Dear Ladies and Gentlemen,

National University of Mongolia (NUM) developed first Mongolian satellite “MAZAALAI” in 2017. Following this “MAZAALAI” launch, we have now the 3rd BIRDS International workshop and the 8th International Workshop for application of satellite data for Mongolian environment which will be held at NUM E-Library conference Hall between 16-19 August, 2018 in Ulaanbaatar, Mongolia. The National University of Mongolia is the local co-organizer of the workshop.

The workshop will provide space engineering technology, development of Cubesats, small satellites based on application of commercial-off-the-shelf (COTS) microelectronics, universities to develop, launch and operate and an opportunity to discover cutting-edge remote sensing technology and applications. While at the same time exchanging ideas, research results, professional experiences, and future visions in the fields of environmental innovation, remote sensing applications for environmental studies.

The BIRDS workshop will cover all the aspects of Nano/pico-satellites including architecture, component technologies, navigation, control system, infrastructure such as ground station systems and launch opportunity, applications and regulatory issues and education.

The workshop will focus on various aspects of space engineering in Mongolia and environmental problems, and it is believed to provide an opportunity to discuss how to respond effectively to the regional environmental changes while strengthening international cooperation and advanced use of satellite data. Through the International workshop, we hope to build an international cooperation on space science and engineering, earth observation, environmental innovation, and efficient scientific exchange and collaboration.

I, Tumurbaatar director of NUM, looking forward for our “BIRDS” project partner enhancement/expansion and deepening successfully.

Dr. Ya.Tumurbaatar
President of National University of Mongolia
ORGANIZING COMMITTEE MEMBERS

Chairmen:
  Ochirkhuyag Baldorj, National University of Mongolia, Mongolia
  Mengu Cho, Kyushu Institute of Technology, Japan

Members:
  Tsolmon Renchin
  George Maeda
  Chimgee Dari
  Mendbayar Shuurai
  Erdenebaatar Dashdondog
  Enkhjargal Natsagdorj
  Altansukh Mainbayar
The 3rd BIRDS International Workshop and The 8th International Workshop for application of satellite data for Mongolian Environment

All sessions:

KEYNOTE SESSION:

1 - Prof. R. Tsolmon
MONGOLIA’S SPACE ENGINEERING EDUCATIONAL ACTIVITIES AND ITS FUTURE VISION

2 - Prof. Mengu Cho
OVERVIEW OF BIRDS PROGRAM

Session 1: BIRDS-1  Chair: Dr. G. Maeda
*Purpose: To discuss about achievements, lessons learned from BIRDS-1 project and further international collaborations.*

Session 2: REMOTE SENSING APPLICATION FOR FORESTRY  Chair: D. Narantuya

Session 3A: BIRDS-2  Chair: S. Adrian
*Purpose: To discuss about current process, lessons learned from BIRDS-2 project related activities in home countries.*

Session 3B: RS TECHNOLOGY  Chair: Prof. Philippe De Maeyer

Session 4A: BIRDS-3  Chair: Dr. G. Maeda
*Purpose: To discuss about current development process of BIRDS-3 project and improvement on related activities in home countries.*

Session 4B: RS APPLICATION FOR LAND COVER CHANGE  Chair: Prof. R. Tsolmon

Session 5A: GENERAL  Chair: Dr. G. Maeda
*Purpose: To discuss about space technology development situation in some countries*

Session 5B: WATER RESOURCE AND SOIL MOISTURE  Chair: Dr. D. Chimgee

Session 6: GROUND STATION  Chair: J. Apiwat
*Purpose: To discuss about international ground station network and its challenges.*
Session 7: REMOTE DATA COLLECTION  
Chair: S. Adrian

Purpose: To discuss about challenges and development on Remote Data Collection technology.

Session 8: MONGOLIAN SPACE ENGINEERING AND APPLICATION  
Chair: Dr. D.Erdenebaatar

Purpose: To discuss about current status of the space technology development and capacity building of Mongolia.

SESSION 1: BIRDS-1  
Chair: Dr. G.Maeda

Prof. Mengu Cho, Japan
LESSONS LEARNED FROM BIRDS-1 PROJECT  
(S1A-01)

Mr. Benjamin Bonsu, Ghana
PROGRESS AND FUTURE PERSPECTIVE ON ALL NATIONS UNIVERSITY SPACE ACTIVITIES  
(S1A-02)

Dr. Dahunsi Akintunde, Nigeria
LOCAL CAPACITY BUILDING FOR SPACE ENGINEERING AMONG FUTA STUDENTS  
(S1A-03)

Ms. Raihana Shams Islam Antara, Bangladesh
PAYLOAD SHARING PLATFORM FOR BIRDS SATELLITE PROJECT  
(S1A-04)

SESSION 2: REMOTE SENSING APPLICATION FOR FORESTRY  
Chair: D.Narantuya

Dr. S.Gerelbaatar
CHANGE DETECTION OF THE FOREST COVER IN THE KHUSTAI NATIONAL PARK  
(S2A-01)

M. Bilguunmaa
DIGITAL SURFACE MODEL GENERATION METHOD IN MIXED FORESTED AREA FROM DENSE UNMANNED AERIAL VEHICLE LIDAR DATA  
(S2A-02)

N. Bayanmunkh
ESTIMATION FOR FOREST BIOMASS USING SENTINEL DATA IN BULGAN PROVINCE MONGOLIA  
(S2A-03)
Dr. D. Davaadorj
TO USE NDVI METHOD TO ASSESS THE LAND COVER CHANGE IN MONGOLIA
(S2A-04)

SESSION 3A: BIRDS-2

Chair: S. Adrian

Dr. Joel Marciano, Philippines
THE STAMINA FOR SPACE PROGRAM: SUSTAINED SUPPORT FOR SPACE TECHNOLOGY AND APPLICATIONS MASTERY, INNOVATION AND ADVANCEMENT IN THE PHILIPPINES (S3A-01)

Dr. Mohammed Huzaimy Jusoh, Malaysia
SPACE-BASED INTERNET OF THINGS (IOT) FOR NANOSATELLITE APPLICATION (S3A-02)

Dr. Cheki Dorji, Bhutan
GROUND STATION AND FUTURE SPACE ACTIVITIES IN BHUTAN (S3A-03)

Mr. Adrian Salces, Philippines
STUDENTS’ EXPERIENCES FROM THE BIRDS-2 PROJECT, INITIAL OPERATION RESULTS AND NEXT STEPS (S3A-04)

SESSION 3B: RS TECHNOLOGY

Chair: Prof. Philippe De Maeyer

N. Lkhagvadorj
NDVI ANOMALIES DETECTED BY TIME-SERIES MODIS (S3B-01)

Lazina Shopanbyek
STATISTICAL ANALYSIS OF MEASUREMENT OF THE OMI INSTRUMENTS OVER MONGOLIAN AREA (S3B-02)

D. Narantuya
SPATIAL TOOLS IN ISSUES OF ENVIRONMENTAL HEALTH AND PUBLIC HEALTH (S3B-03)

Prof D. Chimgee
INTEGRATING GIS INTO BUSINESS SCHOOL CURRICULA (S3B-04)
SESSION 4A: BIRDS-3

Chair: Dr. G. Maeda

Prof. Mengu Cho, Japan
OVERVIEW OF BIRDS-3 PROJECT  (S4A-01)

Dr. Rabindra Prasad Dhakal, Nepal
PIONEERING INITIATIVES ON SPACE TECHNOLOGY FOR NATIONAL CAPACITY AND CONFIDENCE BUILDING IN NEPAL  (S4A-02)

Ms. Kamani Ediriweera, Sri Lanka
NATIONAL CAPACITY DEVELOPMENT IN SPACE TECHNOLOGIES – SRI LANKA  (S4A-03)

Dr. George Maeda, Japan
A VIDEO WILL BE SHOWN: PRODUCED BY THE BIRDS-3 TEAM. EACH MEMBER EXPLAINS HIS OR HER WORK  (S4A-04)

SESSION 4B: RS APPLICATION FOR LAND COVER CHANGE

Chair: Prof. R. Tsolmon

A. Tsolmon
ESTIMATION OF FOREST BIOMASS IN NORTHERN PART OF MONGOLIA USING REMOTELY SENSED DATA  (S4B-01)

M. Zaya
MAPPING FOREST FIRE RISK USING REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM IN SELenge PROVINCE  (S4B-02)

S. Enkhbaatar
COMPARISON STUDY OF MODERN TECHNOLOGY APPLICATION FOR PAVEMENT REHABILITATION IN THE GOBI REGION OF MONGOLIA  (S4B-03)

E. Munkhnaran
MONITORING FOR PASTURE DEGRADATION USING REMOTE SENSING AND GIS IN SERGELen SOUM, DORNOD PROVINCE  (S4B-04)

SESSION 5A: GENERAL

Chair: Dr. G. Maeda

Dr. Jyh-Ching Juang, Taiwan
A CUBESAT MISSION FOR INTELLIGENT REMOTE SENSING AND IOT SERVICE  (S5A-01)
Mr. Adolfo Chaves Jimenez, Costa Rica
SETEC LAB SPECIALIZATION RESEARCH AND DEVELOPMENT PLAN (S5A-02)

Dr. Moutaman, Sudan
NEW TRENDS TO IMPROVE PERFORMANCE OF DATA LINK OF CUBE SATELLITES (S5A-03)

Dr. Delele Worku Ayele, Ethiopia
SPACE SCIENCE AND TECHNOLOGY RELATED ACTIVITIES IN BAHIR DAR UNIVERSITY ETHIOPIA (S5A-04)

Mr. J. Apiwat, Thailand
SPACE SCIENCE AND TECHNOLOGY DEVELOPMENT IN KMUTNB; KNACKSAT SATELLITE PROJECT (S5A-05)

SESSION 5B: WATER RESOURCE AND SOIL MOISTURE Chair: Dr. S.Tuya

Ts. Burenjargal
MONITORING ULAAN NUUR LAKE AREA USING REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM IN UMNUGOVI PROVINCE, MONGOLIA (S5B-01)

N. Enkhjargal
LONG-TERM SOIL MOISTURE ANALYSIS USING REMOTELY SENSED DATA IN MONGOLIA (S5B-02)

Dr. S.Tuya
DETERMINATION OF REGIONAL EVAPOTRANSPIRATION AND SOIL MOISTURE USING SATELLITE DATA (S5B-03)

E. Erdenetogtokh
GLACIER CHANGE AND 3D SURFACE EXTENTS PREDICTION USING LONG TERM LANDSAT IMAGE AND CLIMATE DATA IN NORTHERN MONGOLIA (S5B-04)
SESSION 6: GROUND STATION

Chair: J. Apiwat

Mr. J. Apiwat, Thailand
BIRDS GROUND STATION NETWORK OVERVIEWS AND PROJECT STATUS
(S6A-01)

M. Altansukh
MONGOLIAN GROUND STATION DEVELOPMENT AND CURRENT SITUATION
(S6A-02)

SESSION 7: REMOTE DATA COLLECTION

Chair: S. Adrian

Mr. Adrian Salces, Philippines
CURRENT DEVELOPMENTS ON THE BIRDS-2 STORE-AND-FORWARD (S&F) MISSION AND THE WAY FORWARD FOR AN ADVANCED REMOTE DATA COLLECTION MISSION IN THE BIRDS NETWORK
(S7A-01)

Mr. Adolfo Chaves Jimenez, Costa Rica
ON-ORBIT RESULTS AND LESSONS LEARNED FROM THE IRAZÚ PROJECT'S STORE-AND-FORWARD MISSION
(S7A-02)

SESSION 8: MONGOLIAN SPACE ENGINEERING AND APPLICATION

Chair: Dr. D. Erdenebaatar

Dr. Ts. Davaadorj
SMALL SATELLITES AS APPROPRIATE TOOLS FOR ENSURING NATIONAL SECURITY
(S8A-01)

Prof. K. Ichii, Japan
HISTORICAL CHANGES IN TERRESTRIAL WATER AND CARBON CYCLE IN MONGOLIA: OBSERVATION AND MODELING SYNTHESIS
(S8A-02)

G. Amarsanaa
HOW WE USE COMMUNICATION SATELLITE FOR CONTENT DISTRIBUTION IN MONGOLIA
(S8A-03)

B. Onon
ESTIMATION OF SOLAR ENERGY POTENTIAL OVER MONGOLIA BASED ON SATELLITE DATA
(S8A-04)

Dr. B. Erdenebat
A STRATOSPHERE IS A PART OF SPACE SCIENCE
(S8A-05)
Dr. B. Suvdantsetseg
THE NEEDS OF SATELLITE DATA FOR THE MONGOLIAN SCIENCE AND TECHNOLOGY DEVELOPMENT (S8A-06)

Dr. D. Erdenebaatar
MONGOLIAN SECOND CUBESAT’S MISSIONS AND CONCEPT (S8A-07)
SESSION 9: POSTER

P1-01  S.Enkhbat
DEVELOPING PASTURE CAPACITY MAPS FOR PASTURELAND MANAGEMENT OF MONGOLIA

P1-02  T. Davaagatan
ESTIMATING AREA CHANGES OF LAKE BUUN TSAGAAN USING SATELLITE DATA

P1-03  A.Bolor
GEOSPATIAL ANALYSIS WITH GIS BASED DIGITAL TAXATION

P1-04  A.Enerel
GIS AND SPATIAL STATISTICS SOLUTIONS IN BANKING SECTOR

P1-05  L. Nyamjav
FLOOD PLAIN PLANT COMMUNITY RESPONSE TO THE CLIMATE CHANGE

P1-06  T. Gerelmaa
SATELLITE BASED WATER QUALITY MONITORING OF DELGERMURUN RIVER

P1-07  D.Battulga
WILDLIFE MONITORING IN EASTERN SOUMS OF UMNUGOBI PROVINCE

P1-08  E. Orolmaa
AIR QUALITY AND POLLUTION MONITORING IN DARKHAN-UUL PROVINCE
MONGOLIA’S SPACE ENGINEERING EDUCATIONAL ACTIVITIES AND ITS FUTURE VISION

Tsolmon Renchin

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Since Mongolia becoming member for UNISEC the Universities in Mongolia have benefits from UNISEC–global which is an international nonprofit, nongovernmental organization, consisting of local–chapters across the world. National University of Mongolia (NUM) started space engineering activities since 2010 sending first Mongolian university student for the CanSat Leader Training Program (CLTP). Objective of the CLTP is a training program for professors /instructors to learn how to conduct CanSat training by experience. Participants are expected to teach their students after training. It has contributed to capacity building in basic space engineering and technology in Mongolia. UNISEC – Mongolia chapter was established in 2017 and National University of Mongolia, Mongolian University of Science and Technology, Mongolian National Defense University, Mongolian University of Life Sciences became as members.

UNISEC provide opportunities to collaborate and cooperate among universities in the world and stands for University Space Engineering Consortium. Its primary objective is to help create a world where space science and technology is used by individuals and institutions in every country for the benefit of humankind.

As Kyutech and NUM are members of the UNISEC. Kyutech, Japan allowed to launch “Joint Global Multi-Nation Birds” project in collaboration with universities in Ghana, Mongolia, Nigeria, and Bangladesh in 2015. It is a constellation of five CubeSats. All the satellites are identical with a size of 10cmx10cmx10cm. To have very first MAZAALAI satellite it is great opportunity to enter space related research on international operation of small satellite constellation and ground station network for Mongolian space scientists. International network and collaboration was developed among universities in different countries through the BIRDS project.

MJEED project in Mongolia allowed National University of Mongolia (NUM) to develop space engineering and capacity building. Mongolian Nation and organizations encourage first satellite activities from very first steps by donating and fundraising.

As in the vision of UNISEC-Global there is “By the end of 2020, let’s create a world where university students can participate in practical space projects in more than 100 countries.”
“By the end of 2030, let’s create a world where university students can participate in practical space projects in all countries.”

We UNISEC-Mongolian universities will train and educate students in order to participate in the global projects such as in the Debris Awareness and solutions, Debris mitigation Competition, Mission idea Contest for Micro/Nano satellite Utilization.

For this reason, it is important to strengthen and develop the university Space Engineering program with particular emphasis to satisfy Sustainable Development Goals in Mongolia.
OVERVIEW OF BIRDS PROGRAM

Mengu Cho

Director
Laboratory of Spacecraft Environment Interaction Engineering
Kyushu Institute of Technology, Japan

In this presentation, overview of BIRDS program including its latest update will be given. BIRDS program, originally called Joint Global Multi Nation Birds started in 2015 as a satellite project involving 7 countries to develop five 1U CubeSats. The BIRDS program is not just making a series of satellites. It is an international program to foster cross-border inter-university collaboration on space research and education. Its mission is to make the foremost step toward indigenous space program at each nation by successfully building and operating the first national satellite. In BIRDS-1, Mongolia, Ghana and Bangladesh launched the countries of first satellite. In BIRDS-2, Bhutan launched its first satellites. In BIRDS-3, Nepal and Sri Lank will make debut in the space sector. It this presentation overview of BIRDS program, including its origin, status and future, will be presented.
LESSONS LEARNED FROM BIRDS-1 PROJECT

Mengu Cho

Director
Laboratory of Spacecraft Environment Interaction Engineering
Kyushu Institute of Technology, Japan

BIRDS-1 was the first satellite project of BIRDS program. It was made of five identical 1U CubeSats. It was made by 15 graduate students at Kyushu Institute of Technology. Because it was the first of the program, there were many lessons learned. In this presentation, the lessons and how they were reflected to the succeeding projects, BIRDS-2 and beyond, will be presented.

SESSION 1: BIRDS-1 (S1A-01)
PROGRESS AND FUTURE PERSPECTIVE ON ALL NATIONS UNIVERSITY SPACE ACTIVITIES

Benjamin Bonsu, Samuel Donkor, ANU_SSTL team

Space Systems Technology Laboratory, All Nations University, Ghana

The All Nations University - Space Systems Technology Laboratory (ANU-SSTL) was established in the year 2012. Since its establishment, the lab has been able to engage in successful projects which include CANSAT project, Amateur ground Station project and Aeronet ground station project. In July 2017, the ANU-SSTL team launched the first Ghanaian satellite into Orbit known as GHANASAT-1 under the Birds Project. The ANU-SSTL is part of the Birds Network and hosted the 2nd Birds Network Workshop in Ghana on November 2017, which brought together experts from all over the world. The ANU-SSTL team is working on the next earth observational satellite to monitor weather and disaster management applications and hopefully to be launched in the year 2020.

SESSION 1: BIRDS-1 (S1A-02)
LOCAL CAPACITY BUILDING FOR SPACE ENGINEERING
AMONG FUTA STUDENTS

Dahunsi Olurotimi Akintunde

Department of Mechanical Engineering
Federal University of Technology
P. M. B. 704, Akure
Ondo State, Nigeria

SESSION 1: BIRDS-1 (S1A-03)
PAYLOAD SHARING PLATFORM FOR BIRDS SATELLITE PROJECT

Raihana Shams Islam Antara

BRAC University, Bangladesh

BIRDS program is getting popular day by day for the non-space faring countries. Till date, more than dozens of countries are involved with this project. But it is very difficult to make people understand in developing countries about effort and dedication behind a satellite project. Hence finding a big investor for launching and operating a dedicated satellite is very difficult for these countries. To continue the BIRDS project in the partner countries, a payload sharing platform is proposed in this presentation which will take less time and money. Sharing platform like Airbnb, UBER or Facebook are getting popular in the world and these are the most business profitable platform. All the BIRDS partner is well skilled with system engineering approach which will help to make proper system architecture and interface design of the host satellite. In this presentation, a standard modular architecture will be discussed where payload from any country can be carried with the hosted satellite. This payload sharing platform will build a strong relationship among the partners by participating in hosted payload programs.

SESSION 1: BIRDS-1 (S1A-04)
CHANGE DETECTION OF THE FOREST COVER IN THE KHUSTAI NATIONAL PARK

Sukhbaatar Gerelbaatar, Tseveen Batchuluun, B. Temuujin

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The Khustai National Park (KHNP) Forest is one of the most threatened semi-arid forests in Mongolia. The rapid growth of deforestation has resulted in the loss of one third of its original cover during recent two decades. A number of factors have been made to halt deforestation activities. This study provides the first multi-temporal analyses of the dynamics of the deciduous forests within the KHNP, however the influence factors which accelerating the rapid deforestation in the study region. We used remote sensing data acquired from Landsat images from 1999 to 2016 to measure the extent of the forest cover and deforestation rates over 17 years. Our findings demonstrate a total loss in the forest cover of 565 ha. Deforestation rates in KHNP areas determined by high density of livestock and red deer, which show damaging effect to the tree health and natural regeneration. Therefore, we found the potential existence of soil water deficit which result massive death of trees. The combination of deforestation and remote sensing data demonstrated that forest dynamics at the KHNP is mainly influenced by overgrazing in the forest and rapid growth of population density of red deer and livestocks.

SESSION 2: REMOTE SENSING APPLICATION FOR FORESTRY (S2A-01)
DIGITAL SURFACE MODEL GENERATION METHOD IN MIXED FORESTED AREA FROM DENSE UNMANNED AERIAL VEHICLE LIDAR DATA

Myagmardulam Bilguunmaa¹, Kazuyoshi Takahashi²

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A Digital Canopy Height Model (DCHM) is used for monitoring forest resources and Light Detection and Ranging (LiDAR) data is the key data source used to create it. To create a DCHM, a forested Digital Surface Model (DSM) in a leaf-on situation and a Digital Elevation Model (DEM) are necessary. In Japan, airborne LiDAR observations have often been carried out to obtain ground surface information in seasons when trees lose their leaves (leaf-off), such as late fall or winter. Because of this, it is difficult to generate a DCHM from LiDAR data in those seasons. In this paper, a method to estimate a DSM in summer (leaf-on) from dense LiDAR data in late fall was examined in a mixed-forested area. Grids corresponding to trees in leaf-off were extracted based on a statistical threshold. In extracted grids, a DSM in summer was estimated by a local maximum operation. The estimated DSM was compared to a DSM created by a Structure from Motion (SfM) with low-altitude aerial photos acquired in summer by a DJI Phantom4. In this study, mean absolute difference (MAD) of 1.9 m the original LiDAR DSM was decreased to an estimated summer DSM MAD of 1.1 m. This research shows the possibility of estimating a DSM in summer from dense LiDAR data acquired in a leaf-off season.

Keywords: RIEGL VUX-1, deciduous forest.

SESSION 2: REMOTE SENSING APPLICATION FOR FORESTRY (S2A-02)
ESTIMATION FOR FOREST BIOMASS USING SENTINEL DATA IN BULGAN PROVINCE MONGOLIA

Bayanmunkh Norovsuren1*, Tsolmon Renchin2, Batchuluun Tseveen3,
Zaya Mart4, Ariunzul Yangiv5, Munkhnaran Enkhtumur6

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5 Environmental Research, Information and Study Center /ERISC/

ABSTRACT: This research aims to use recently launched Sentinel-1B Synthetic Aperture Radar (SAR) and optical Sentinel-2B satellite data for estimation of larch and birch forest biomass in the study area. The study area is Eco khanbuyan community, Bulgan province is situated in the Northern part of Mongolia near borders. Boreal and montane forest belts of larch and birch are dominated in this area. Sentinel-1B satellite data was applied for estimation forest biomass while Sentinel-2B used for classification map. Ground truth data collected in July 2016 and September 2016 for biomass measurement and for forest mapping. We applied Sentinel-1B 2016 data VV and VH backscatter coefficients and Sentinel-2B 2016 data four visible bands. Ground measurement for forest biomass data was compared with backscatter coefficients of SAR data. Multispectral data was used for classification forest type and accuracy was 92%. Forest estimation biomass using SAR data shows good agreement with National Measurement for Forestry 2016 data for Mongolia.

Keywords: SAR C-band; Forestry biomass; Classification; Backscatter coefficients; HV and VV polarizations

ACKNOWLEDGEMENTS:
This research was partially supported by Asian Research Center (ARC), Mongolia and Korea Foundation for Advanced studies and “Monitoring forests cover change in Mongolia with participatory approach” (APFNet) project. The authors would like to gratitude the “Forest Research and Development Center” in Mongolia and “Khanbuyan” community for their kind support. Authors are thankful for SENTINEL DATA CENTER for providing data.

SESSION 2: REMOTE SENSING APPLICATION FOR FORESTRY (S2A-03)
TO USE NDVI METHOD TO ASSESS THE LAND COVER CHANGE IN MONGOLIA

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Land degradation and soil erosion becoming very serious problem in Mongolia. There are more than 77% of land cover has been declined soil properties and land degradation. Therefore, to develop the monitoring method for control the soil quality land cover change of pasture management. NDVI is effective tools for land cover change and land degradation in last several decades. There are many studies has been focusing to use NDVI for land monitoring around world.

In this study, we used NDVI for vegetation cover of last five years in three different natural zone of Mongolia. Our purpose is to detect the NDVI (vegetation cover) change in forest, typical steppe and semi-desert area of Mongolia and to compare the vegetation and soil types. Our result has shown the vegetation cover has been decreased 2013 to 2015 years and increased in 2016 and 2017, except the Tuvshinshiree (semi-desert area). In semi-desert area 2013 and 2014 hasn’t detect the vegetation cover change and has been increased last 3 years. Most NDVI value changes are detected in light chestnut and meadowish soils and those soils are dominated by sandy particles in horizontals and low organic matter contents. In vegetation covers are sensitively in semi-desert area. Our study has been continued to improve the field validation measurement in 2018.

Mongolian plateau has indicated that transboundary area between the Siberian Taiga and Central Asian desert area. Soils and vegetation covers are quickly changed to following latitude zonal. In future study will be more focusing the NDVI values in different natural zone of steppe, and semi-desert area of arid ecosystem. Also there are more pointed study of anthropogenic impact, such us off-road driving and overgrazing and water resources.

SESSION 2: REMOTE SENSING APPLICATION FOR FORESTRY (S2A-04)
THE STAMINA FOR SPACE PROGRAM: SUSTAINED SUPPORT FOR SPACE TECHNOLOGY AND APPLICATIONS MASTERY, INNOVATION AND ADVANCEMENT IN THE PHILIPPINES

Joel S. Marciano, Jr.

Acting Director
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Department of Science and Technology (DOST-ASTI)

Professor
Electrical and Electronics Engineering Institute
University of the Philippines Diliman (UPD-EEEI)

Program Leader
PHL-Microsat and STAMINA_for_Space Programs

Under the 2nd Joint Global Multi-Nation Birds Satellite or BIRDS-2 Project, the Philippines sent a 1U CubeSat, Maya-1, to the International Space Station on 29 June 2018. Set for deployment in August, Maya-1 together with identical CubeSats from Bhutan and Malaysia will form a constellation that opens exciting opportunities for environmental sensing and scientific data collection through the Store and Forward (S&F) mission. Among the possible applications of the S&F mission are tracking endangered species and fishing vessels in remote locations in the Philippines.

The Philippines, through the initiatives of the Department of Science and Technology (DOST), is moving into the next phase of local space technology development through small satellites with the new program, “Sustained Support for Space Technology and Applications Mastery, Innovation and Advancement” or the STAMINA_for_Space Program. In this presentation, we will introduce the STAMINA_for_Space program, which is being implemented by the University of the Philippines Diliman (UPD) and the Advanced Science and Technology Institute of the DOST (DOST-ASTI). A component of the program is “Space Technology Proliferation in an Inter-University Partnership” or the STEP-UP project. STEP-UP intends to use the BIRDS-2 CubeSat as a platform for proliferating know-how in space science and engineering among various universities in the country through the lean satellite design and test philosophy. These efforts will be part of the activities of the University Laboratory for Small Satellites and Space Engineering Systems (ULyS³ES) at UPD, which is hoped to be launched within the year.

SESSION 3A: BIRDS-2 (S3A-01)
SPACE-BASED INTERNET OF THINGS (IOT) FOR NANOSATELLITE APPLICATION

Mohamad Huzaimy Jusoh

Director
Center for Satellite Communication
Faculty of Electrical Engineering
Universiti Teknologi MARA, MALAYSIA

Space-based Internet of Things (IoT) application employs space technology such as satellite communication; as in data collection process which can be achieved with Store-and-Forward (S&F) technique and an orbiting satellite. Therefore, a ground terminal is required to communicate with the satellite. Correspondingly, this project aims to develop a Ground Sensor Terminal (GST) system which able to communicate with UiTMSAT-1 nanosatellite (one of BIRDS-2 nanosatellites) for S&F application. The GST consists of 4 subsystems which are data acquisition systems (DAQ), servo motor, Very High Frequency (VHF) antenna and VHF radio transceiver. The DAQ includes m microcontroller which processes input received from sensors. The microcontroller will prepare it into AX.25 packet format, convert it into KISS format and send it to transceiver for transmission. As servo motor aligns the omnidirectional eggbeater antenna based on the tracked nanosatellite’s movement, the uplink and downlink will be operated over amateur radio frequency at 145.825 MHz. To conclude, this project will introduce space-based IoT concept to complement existing communication method.

SESSION 3A: BIRDS-2 (S3A-02)
GROUND STATION AND FUTURE SPACE ACTIVITIES IN BHUTAN

Cheki Dorji

President
College of Science and Technology
Royal University of Bhutan, Bhutan

The Ground Station for Bhutan is installed at Department of Information Technology and Telecom (DITT). The approval to receive data from the CubeSats are accorded and ready for data reception. With the introduction of Bhutan to BIRDS-2 Project by Kyushu Institute of Technology (Kyutech), Bhutan is expected to explore space related activities to collect data on weather, Communication and disasters in future. It is observed the possibility to introduce curriculum and research facilitating students in the university teaching and learning in Bhutan.

SESSION 3A: BIRDS-2 (S3A-03)
STUDENTS’ EXPERIENCES FROM THE BIRDS-2 PROJECT, INITIAL OPERATION 
RESULTS AND NEXT STEPS

Adrian C. Salces

Doctoral Student

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In this presentation, I will share the experiences of BIRDS-2 student members, as they went through satellite development – in terms of technical challenges, team dynamics, cultural and social aspects. While gaining technical skills, we also built strong relationships through activities and socialization inside and outside our workspace. Although team members are diverse in many ways, our shared experiences as a team helped forge our teamwork, which sets a great example of establishing an international human network (an important dimension of space-related activities). Then, I will present some results from initial days of satellite operation and the next steps of the BIRDS-2 Project.

SESSION 3A: BIRDS-2 (S3A-04)
NDVI ANOMALIES DETECTED BY TIME-SERIES MODIS


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Vegetation cover plays an important role in regulating the global climate by serving as the primary carbon pool for atmospheric carbon dioxide. The study of vegetation dynamics and phenologic state, which traditionally relies on systematic field survey, could benefit from the long-term archive and analysis of remote sensed data. Moderate Resolution Imaging Spectroradiometer (MODIS) onboard Aqua and Terra satellites provides a reliable and consistent data source for monitoring of global biosphere. This study used time-series MODIS NDVI as the primary spectral indicator for monitoring detection of vegetation anomaly. Based on nine years’ dataset (2008-2016) and NDVI anomaly is the difference between the average NDVI for particular month of a given year and the average NDVI for the same month over a specified number of years. This approach can be used to characterize the health of vegetation for a particular month and year relative to what is considered normal, which is a good indicator of drought or declining vegetation health.

SESSION 3B: RS TECHNOLOGY (S3B-01)
The ozone layer protects the planet and life from the sun's harmful ultraviolet effects. This work demonstrates the changes in content of ozone and the atmospheric aerosols over the Mongolia area and evaluate the results by statistical analysis. Data from 2013 years to 2017 years are used on our research which are measured by Ozone Monitoring Instrument (OMI). Over the Mongolia, the ozone concentration was the lowest amount during August (280-310 DU) and highest was in February (360-410 DU). Mostly near southwestern area of Mongolia was observed as lower concentration amount of ozone.

Keywords: concentration amount of ozone, atmospheric aerosols

SESSION 3B: RS TECHNOLOGY (S3B-02)
SPATIAL TOOLS IN ISSUES OF ENVIRONMENTAL HEALTH AND PUBLIC HEALTH

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Advancements in spatial tools provide equal opportunity in studies on health of environment and public. Geographic information system can assist in analyzing the trend of disease spread. It can help in developing models to predict the potential of certain health issue distribution over an area. Likewise, remote sensing tools can contribute with data in research analysis of certain public and environmental health issue, in simulating GIS scenario. Examples of application of spatial tools in environmental health and public health will be discussed in the presentation.

SESSION 3B: RS TECHNOLOGY (S3B-03)
INTEGRATING GIS INTO BUSINESS SCHOOL CURRICULA

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Today’s digital era organizations are more in need business graduates who understand geographical information systems (GIS) and emerging technologies. Because most business occurs in geographical locations. Creation and use of geospatial data is increasing very rapidly with increasing number of satellites for communication and earth monitoring, web-enabled sensors. There is substantial use of geospatial data in businesses such as oil, minerals, agriculture commodities, and banking. Business schools are increasingly incorporating GIS into their programs to address this need. This study investigates how business schools can integrate GIS to ensure business graduates have opportunity to develop this knowledge. A number of approaches have studied in this research. Based on the findings several opportunities and challenges are have listed as the future research.

Keywords: GIS; business school; curricula, geospatial data

SESSION 3B: RS TECHNOLOGY (S3B-04)
OVERVIEW OF BIRDS-3 PROJECT

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Director

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BIRDS-3 is the third satellite project of BIRDS program carried out by three countries, Japan, Nepal and Sri Lanka. The satellite design inherits BIRDS-1 and -2 but with modifications. The project kicked-off in October 2017 and is now at EM testing phase. In this presentation overview of BIRDS-3 project will be given including the satellite mission and design.

SESSION 4A: BIRDS-3 (S4A-01)
Nepal has initiated its Geospatial study through National Remote Sensing Center established in 1981 and became a member of Regional Space Application Programme for Asia Pacific in 1989. In 1993, Remote Sensing Section within the Department of Mines and Geology was established for updating Geo-Scientific information. Ministry of Science and Technology formed a task force to identify the outstanding issues on Space technology by 2000, which came up with recommendation for the establishment of A National Space Technology Center (NASTEC). Currently, Application of Space Technology in Nepal are mostly satellite Communication Telecommunications, Television broadcasting, Remote Sensing, Geographical Information System & Global Positioning System, Environmental Surveying, Resource Management, Disaster Monitoring, Weather forecasting & Hydrological studies, Earth Resource Observation and others.

Nepal Academy of Science and Technology, a national apex body of Science and Technology of the country, which is organizing the event in periodic basis for the sensitization, motivation and capacity buildings in the area of Space and Astronomy. It has been working on GPS monitoring of the land on collaboration with California Institute of Technology and UNEP together with ICTP. But from now onward, will have network on space through Nano Satellite for capacity and confidence building through collaborating with Kyutech. Government of Nepal has accepted the offer by Kyutech and would like to have ground station established by the end of 2018, as NAST has already approved its program for. Nepal Academy of Science and Technology and would like to organize several round of brainstorming sessions among the stakeholders to identify the national need, which can be incorporated into the Nano Satellite as a load. It is believed that Nepal will enter into the satellite age through BIRDS-3 Initiative taken by Kyutech.

Ref:

SESSION 4A: BIRDS-3 (S4A-02)
NATIONAL CAPACITY DEVELOPMENT IN SPACE TECHNOLOGIES – SRI LANKA

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Space technology has been identified as a vital area of advanced technology contributing to building of Sri Lanka’s overall national technological capabilities. Arthur C Clarke institute for Modern Technologies, Sri Lanka’s national focal agency for space technologies and applications and mandated for acceleration of introduction of space technologies into the country, among other disciplines of modern technologies, is driving a threefold strategic road map for the same. The main strategic initiative is to develop Sri Lanka’s national capacity in space technologies, commencing with the design, development, construction, testing and launching of a nano-satellite.

SESSION 4A: BIRDS-3 (S4A-03)
ESTIMATION OF FOREST BIOMASS IN NORTHERN PART OF MONGOLIA USING REMOTELY SENSED DATA

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Information on forest volume, forest coverage and biomass is important for developing global perspectives about CO2 concentration changes. Forest biomass cannot be directly measured from space yet, but remotely sensed greenness can be used to estimate biomass on decadal and long-time scales in regions of distinct seasonality, as in the north. Of Mongolia the objective of this study is to estimate forest biomass and forest change using remotely sensed technique. Landsat were used to validate forest coverage. This study suggests that the estimation of biomass based on remotely sensed data could be detected over a range of land cover change processes for global biomass change studies.

SESSION 4B: RS APPLICATION FOR LAND COVER CHANGE (S4B-01)
MAPPING FOREST FIRE RISK USING REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM IN SELENGE PROVINCE

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Abstract: The purpose of this research is to map the forest fire risk in the Selenge province using Remote Sensing data and Geographic Information Systems. Selenge province is located in the North part of Mongolia, where 42 percent of broad-leaved and coniferous forest. These are: pines prevailing, trees include poplars, larches, birches, Siberian cedars, willows, picea wins. We used Landsat, MODIS, Climate and Digital Elevation Data for mapping of forest fire risk. Enhanced Vegetation Index (EVI) from Landsat and land surface temperature (LST) from MODIS data were applied in this research. Digital Elevation Model (DEM) was used to determine Slope and Aspect. For mapping forest fire risk, we developed a Forest Fire Risk model using Historic Fire Regime map. There is a good relationship (54.1%) between output fire risk map and ground measurement in the study region. Forest Fire Risk model can be used for any forested area.

Keywords: Forest fire, Digital Elevation Model (DEM), risk, precipitation, surface temperature, Landsat, MODIS.

SESSION 4B: RS APPLICATION FOR LAND COVER CHANGE (S4B-02)
COMPARISON STUDY OF MODERN TECHNOLOGY APPLICATION FOR PAVEMENT REHABILITATION IN THE GOBI REGION OF MONGOLIA

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The Mongolian road network has consisted mainly “natural” tracks. The registered network includes national roads (11210km), which connect the aimag centers and local roads (38030km), i.e. urban roads and rural roads. Last five years’ Mongolian government mainly supported for construction and rehabilitation of the roads. The objective of this study, to compare two methods of pavement rehabilitation and its impact on environment in Gobi region of Mongolia. The study area is located in Umnugobi province which selected in national roads (239km) from Gashuun sukhait port to Tavan tolgoi mining factory. In this study, we used statistical data, economic data, laboratories measurement and satellite images between April to August, 2015-2017. Two pavement rehabilitation methodologies which are traditional method and cold recycling technology. Cold recycling is the term used for recovering and re-using material from an existing pavement, without the addition of heat. We use materials which as existing pavement and additionally cement and lime. This new technology is very important for road construction and rehabilitation in Mongolia. Old method highly damaged environment. The advantage of this study, we used statistical, economic, laboratory data and high resolution satellites images for monitoring the road rehabilitation. Statistical and economic analysis and satellite images show that new method is friendly for environment.

Keywords: pavement rehabilitation, GIS, technology, remote sensing

SESSION 4B: RS APPLICATION FOR LAND COVER CHANGE (S4B-03)
MONITORING FOR PASTURE DEGRADATION USING REMOTE SENSING AND GIS IN SERGELEN SOUM, DORNOD PROVINCE

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This study monitors land degradation processes in the study area of the Sergelen soum which located in the northern steppe part of the Dornod province. (N 48 -49, E 113-114). Landsat 8 satellite data from June-August 2013-2017 and MODIS EVI (Enhanced Vegetation Index) data for 2013-2017 data were applied in this research. Precipitation, temperature, EVI, pasture capacity, number of livestock, population, steppe fire was selected as the indicators of the land cover change. The GIS conditional functions used for modeling and analyzing socio economic factors which affect land degradation in the study area. Results show that temperature and precipitation and livestock impact pasture degradation in the study area.

Key words: Degradation, Authors, Conference, Guidelines,

SESSION 4B: RS APPLICATION FOR LAND COVER CHANGE (S4B-04)
A CUBESAT MISSION FOR INTELLIGENT REMOTE SENSING AND IoT SERVICE

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Many universities, research organizations, and companies have adopted Cube satellites (CubeSats) for technology development and commercial applications to take advantage of CubeSats in terms of the use of miniaturized components and the standardized process in satellite development. The paper discusses the IRIS (Intelligent Remote-sensing and Internet Satellite) CubeSat in an attempt to develop enabling CubeSat bus and payload technologies for remote sensing and space-based IoT (Internet of Things) applications. Key technologies that are under development in this IRIS project includes the use of deep leaning for remote sensing, the development of internet of thing payload for space applications, and intelligent fault detection and fault tolerant control. It is anticipated that the payload that is developed in this project can pave the way for future collaboration through a program such as the BIRDS to make progress in space-based imaging and internet services.

SESSION 5A: GENERAL (S5A-01)
SETEC LAB SPECIALIZATION RESEARCH AND DEVELOPMENT PLAN

Adolfo Chaves-Jiménez

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The Costa Rica Institute of Technology (TEC), in cooperation with the Central American Association for Aeronautics and Space (ACAE), developed the first Central America Satellite: Project Irazú. This satellite is a one-unit (1U) CubeSat that works as a store-and-forward (S&F) system, transmitting the information of ground sensors measuring tree growing in a remote location in Costa Rica. This satellite is currently in operation. TEC was in charge the technological development of both the space and ground segments of this project and operates the device.

In the context of Project Irazú, TEC invested in both personnel and equipment, leading to the implementation of its own ground station and space engineering specialized staff. To take advantage these resources, and create a space engineering development program, the Electronic Engineering School of TEC founded in July 2017 the Space Systems Engineering Laboratory (SETEC Lab).

SETEC Lab is the first laboratory of its kind in Central America. Its mission is to take advantage of the capabilities of TEC to use space engineering as a tool of development in Costa Rica, and its vision is to lead the space research and development in the country.

It is the objective of the researches of SETEC Lab to become a world-class laboratory. To achieve this goal using the available resources efficiently, after a careful definition, the research and development focus of SETEC Lab have been defined.

Costa Rica is known worldwide as a “green country”: 20% of its territory is covered by protected zones and 50% of its territory is covered by forests. Currently, there are systematic efforts from its government to promote the country as a “natural laboratory” for environmental conservation research. In this context, the development of innovative environmental monitoring systems constitutes both a necessity and an opportunity. Due to this fact, the environmental monitoring methods enabled by satellite technology from SETEC Lab have potential to provide automatically daily data to natural resources researchers. This capability was proven with the tree growing monitoring system of Project Irazú. For these reasons, the development efforts of the laboratory are focused in environmental monitoring.

SETEC Lab research focus area is spacecraft navigation, because its staff is specialized in this field of study, and at the same time, the development of navigation systems contributes to the improvement of satellite environmental monitoring performance. This capability is
seen as complementary to the capabilities of other international partners with whom the laboratory is currently cooperating. Currently, SETEC Lab is developing a second mission with George Washington University (GWSat), where TEC develops the navigation system and the environmental monitoring communication system. Also, a joint mission with partners from Guatemala and Mexico for forest monitoring is under design. Finally, SETEC Lab is part of the BIRDS efforts lead by the Kyushu Institute of Technology, with focus on S&F systems for environmental monitoring. In this presentation, the past, current and future work of SETEC Lab is presented, in the context of its research and development areas.

SESSION 5A: GENERAL (S5A-02)
NEW TRENDS TO IMPROVE PERFORMANCE OF DATA LINK OF CUBE SATELLITES

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Director

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A cube satellite as the smaller size Nano-satellite of limited size and power is expected to have limited data link of low speed data throughput. Such low data rate is acceptable to conduct information like telemetry data for housekeeping purposes and data of a humble sensor, such as low-resolution camera. However, along with the progress and spread of using cube satellites, higher data rate communication systems are experiencing extremely fast evolution. Developers of cube satellites data links have started to come out with improvements to accommodate the data throughput required for advanced missions. One of those trends is to apply linear transponders or packet repeaters that are simple to implement and enable cube satellites to play as communication satellites. Higher resolution imager of small weight and power can be utilized for remote sensing, making benefit of high data rate provided. Instead of using a basic, low efficiency, radio-amateur based, 1200 bps AFSK link, missions started to consider more advanced modulation schemes, such as BPSK and QPSK that offer better spectrum efficiency. Moreover, channel coding or Forward Error Correction (FEC) help improving the data throughput. It can be clearly seen that channel coding can improve the link budget and it will start playing a significant role as soon as missions will need to go beyond a conventional low speed link. In order to achieve better performance and reliable link, digital signal processing is carried to increase the signal-to-noise ratio, and hence reducing the data bit error rate (BER). Regarding data link layer or network protocols, still the most common is AX.25, used over amateur bands. The main reasons for using it is the possibility to reuse radio amateur hardware (like TNCs). Since AX.25 is a quite simple and robust protocol but it does not allow FEC to be used, some alternatives are proposed such as FX.25 though their usage is still limited. For antennas, the main development trend has not been primarily in the improvement in the overall performances that is limited by physical size and spacecraft requirements for omni directionality, but rather in the reduction of the volume required to house them. Antenna arrays could also be possible, but their usage is limited to higher frequencies due to the available size of the panels. This forces the antennas to be generally omni-directional, such as monopoles or dipoles. Finally, Software Defined Radio (SDR) is proposed to increase the flexibility of radio equipment. Complex modulation and coding could be accommodated, which would not be feasible using traditional systems. Software defined systems are based on programmable devices such as FPGAs or DSPs.

SESSION 5A: GENERAL (S5A-03)
Nowadays space science and technology is getting strong attention as it has considerable socio-economic impact. However, this field of study and related technologies are the best known in the developing countries, for example in Africa continent. Some initiatives like IHY (International Heliophysical Year) and ISWI (International Space Weather Initiative) are doing excellent job in promoting space science and technology to the developed countries such as Ethiopia. Ethiopia has got benefits from these and similar initiatives and advancing this science. In this presentation, space science activities that have been carried out in Bahir Dar University (Ethiopia) since 2007 are presented and future directions are also introduced.

SESSION 5A: GENERAL (S5A-04)
KMUTNB Satellite System Laboratory (KSSL) has started a CubeSat: “KNACKSAT” (KmutNb Academic Challenge of Knowledge SATellite) design project in October 2015. The primary goal of the project is to verify the basic functions necessary for satellite systems and to acquire important knowledge of space technology. The secondary goal is to provide students the opportunity to develop complete satellite system and experience a space mission at low cost. Furthermore, the project will promote space technology in educational institutions in Thailand. This presentation will describe space educational program, future development plan and status of KNACKSAT project.

SESSION 5A: GENERAL (S5A-05)
MONITORING ULAAN NUUR LAKE AREA USING REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM IN UMNUGOVI PROVINCE, MONGOLIA

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To study variation of lake area and volume of water is key concept to investigate its hydrological regime and to mitigate adverse impact on water volume of the lake. There is an ungauged lake, Ulaan nuur has been dried recent years because of climate change and mining activities near the lake. There are several intermittent rivers flow into the Ulaan nuur lake. The land use change of the mining activity may change inflow channels of the intermittent rivers which flow into the lake. Moreover the climate change impact may affect the lake water regime. This research aims to identify variations of lake water area and climate change and anthropogenic impacts on lake water reservoir in the Gobi region of Mongolia in period of 1986-2016. We used Landsat-5,8 data for estimation lake area and classified by Normalized Difference Water Index (NDWI). The Landsat data was validated to observational data and Landsat data shows reasonable to compare with observational data. As a result, lake has water in 1993, 1994, 1995, 1996, 1998, 2003, 2006, 2007, 2008, 2010, 2015, 2016 and dried in other years. Moreover, we used correlation analysis between lake water volume and precipitation and land use change of mining. The correlation was high between lake water volume and precipitation and weak for mining area.

SESSION 5B: WATER RESOURCE AND SOIL MOISTURE (S5B-01)
LONG-TERM SOIL MOISTURE ANALYSIS USING REMOTELY SENSED DATA IN MONGOLIA

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Soil moisture (SM) content is one of the most important environmental variables in relation to land surface climatology, hydrology and ecology. Climate is changing in the global spotlight and Mongolia is a hotspot of climate change especially temperature rises and drought frequencies. Long term moisture data sets on a regional scale could provide reasonable information about climate change and global warming specific regions. Moisture is most important variable in climate change especially drought. The annual evaporation is 150~250 mm in the steppe zone and over 150 mm in desert steppe and deserted zones. The study area is included seven provinces which as agricultural area and situated central part of Mongolia. Its situated between approximately 589 and 2788 meters and there are thirty-eight climate stations in seven provinces. The aim of this research work is to estimate long-term moisture mapping in central part of Mongolia. In the long-term analysis, the satellite-derived products can be providing moisture indices events. We interpolated precipitation data into raster imagery from May to August for the 2000-2013 over Mongolia using 127 climate stations. The potential evapotranspiration (PET) was estimated from MODIS data and Normalized difference vegetation index (NDVI) was calculated two bands which are near infrared (NIR) and visible red (RED) from SPOT data during the growing season from May – August for the 2000-2013 was acquired. The method of Mathew Tybersky (2008) used to derived from precipitation and PET. For the moisture mapping to accurate using NDVI. The results of moisture mapping were compared with NDVI. The relationship between moisture of June and NDVI of July is determined 0.68, moisture of July and NDVI of August is determined 0.80. The amount of moisture (May-July) was compared with NDVI of August correlation coefficient was 0.75 and the relationship between amount of moisture (June-July) and NDVI of August was determined 0.79. According the results that moisture of previous months directly affected to growth of vegetation which as next months. SM monitoring is important for Mongolian agricultural development. There is a regional plan to develop agricultural land in Mongolian mountain forested areas.

Keywords: Soil moisture, satellite, in-situ, moisture index, PET

SESSION 5B: WATER RESOURCE AND SOIL MOISTURE (S5B-02)
DETERMINATION OF REGIONAL EVAPOTRANSPIRATION AND SOIL MOISTURE USING SATELLITE DATA

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The study of evapotranspiration (ET) is significant to physical process controlled by a number of interconnected environmental and eco-hydrological factors in arid and semi-arid region of Mongolia. The main objective of the study is to estimate the spatially distributed actual evapotranspiration, surface soil moisture using satellite data. The Normalized Difference Vegetation Index (NDVI), Land surface temperature (LST) are derived from MODIS data, every 10-day averages period 5 years from 2010 to 2015 only in growing season (May to September). We analyzed relation between results of actual evapotranspiration and surface soil moisture. The identified factors were related to physical processes influencing the evapotranspiration. The results of the study reveal that the variables, air and surface temperature are those with the most influence in the evapotranspiration process in arid and semiarid environment of Mongolian steppe area. Satellite based estimated actual evapotranspiration and surface soil moisture have shown positive correlation in arid and semiarid environment of Mongolian steppe area.

Keywords: Evapotranspiration, Soil moisture, Satellite data, Steppe area

SESSION 5B: WATER RESOURCE AND SOIL MOISTURE (S5B-03)
GLACIER CHANGE AND 3D SURFACE EXTENTS PREDICTION USING LONG TERM LANDSAT IMAGE AND CLIMATE DATA IN NORTHERN MONGOLIA

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The glacier is most important the freshwater resources and indicator of the climate change. The researchers noted that during last decades the glacier is melting due to global warming. The study calculates a spatial distribution of protentional change of glacier coverage in the Ikh Turgen mountain of Western Mongolia, and it integrates long-term climate data and satellite datasets. Therefore, in this experiment has tried to estimation three-dimensional surface area of the glacier. For this purpose, Normalized difference snow index (NDSI) was applied to decision tree approach, using Landsat MSS, TM, ETM+ and LC8 imagery for 1975-2016, a surface and slope for digital elevation model, precipitation and air temperature historical data of meteorological station. The potential volume area significantly changed glacier cover of the Ikh Turgen Mountain, and the area affected by highly variable precipitation and air temperature regimes. Between 1972 and 2016, a potential area of glacier area has been decreased in Ikh Turgen mountain region.

Keyword: Landsat imagery, glacier, 2D, 3D area, Prediction, climate, decision-tree

SESSION 5B: WATER RESOURCE AND SOIL MOISTURE (S5B-04)
BIRDS GROUND STATION NETWORK OVERVIEWS AND PROJECT STATUS

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BIRDS ground station network (GSN) is a part of BIRDS satellite project which is an education program to assist the capacity building in space program for emerging space programs in developing countries at Kyushu Institute of Technology. BIRDS GSN was designed to support the missions of BIRDS CubeSats constellation and other small satellites operating with VHF/UHF frequency band. BIRDS GSN connects twelve ground stations of each member countries by internet to increase the communication time between ground station and satellites. This presentation will present an overview of BIRDS ground station and current status of GSN development.

SESSION 6: GROUND STATION (S6A-01)
MONGOLIAN GROUND STATION DEVELOPMENT AND CURRENT SITUATION

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National University of Mongolia has built amateur satellite ground station regarding BIRDS-1 project in 2017. This is the first satellite ground station for university. Purpose of the ground station is to use for Mazaalai satellite operation and education for students. There were some challenges during ground station development stage due to which was the first time. On the ground station, several satellite’s signal were received including Mazaalai satellite. Also the ground station is the part of BIRDS GSN. In this presentation, current situation of ground station and results so far will be discussed.

SESSION 6: GROUND STATION (S6A-02)
CURRENT DEVELOPMENTS ON THE BIRDS-2 STORE-AND-FORWARD (S&F) MISSION AND THE WAY FORWARD FOR AN ADVANCED REMOTE DATA COLLECTION MISSION IN THE BIRDS NETWORK

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In this presentation, I will talk about the recent developments and challenges on the BIRDS-2 S&F mission – both in terms of the satellite-onboard payload and the ground sensor terminals for Bhutan, Malaysia, and the Philippines. Then, I will present some proposed plans for a more advanced remote data collection mission among the BIRDS network members – with the goal that CubeSats, despite the many technical constraints, will provide practical uses as low-cost data relays that obtain sensor data from remote places on Earth. This presentation also aims to set the tone for the succeeding panel discussion.

SESSION 7: DATA COLLECTION (S7A-01)
ON-ORBIT RESULTS AND LESSONS LEARNED FROM THE IRAZÚ PROJECT’S STORE-AND-FORWARD MISSION

Adolfo Chaves-Jiménez

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Project Irazú, the First Central American Satellite, is a joint project between the Central American Association for Aeronautics and Space (ACAE) and the Costa Rica Institute of Technology (TEC). This last institution is responsible for the technological development of the mission, including both the ground segments and the space segment.

This mission has two objectives. First, to demonstrate that in Costa Rica there exist capabilities to develop a complete space mission. The second objective is to create a “proof of concept” platform for the monitoring of three growing in remote locations. This communication is done using a 1-Unit CubeSat, that performs the communication between the remote station and the central ground station operating as a store-and-forward (S&F) system.

The satellite communication system is done in a UHF band at 136.5 MHz, half-duplex. The satellite transmits a digital beacon that contains its health information, and establishes separately communications with the remote station in San Carlos, Costa Rica, and the central station at TEC.

Project Irazú was launched on April 2th, 2018, and it was released to orbit from the Japanese Kibo Module of the International Space Station on May 11th, 2018. The S&F system of Irazú is currently under operation. In this operation, many possible areas of improvements have been identified, including the development of solutions to deal with challenging environmental conditions and the optimization of hardware on the remote station and the use of different protocols for energy use optimization.

In this presentation, the preliminary on-orbit results of the operation of the satellite are described, including the health data from the device, the results obtained from the date of trees growing, and the lessons learned from the operation of both the ground stations and the space segment.

SESSION 7: DATA COLLECTION (S7A-02)
Mongolia as a developing country, with its huge territory and over 8000km border, needs large amount of geospatial data for its socio-economic development and national security. Rapid development necessitates even rapid response on a traditional and non-traditional risks and challenges. According to the Concept of National Security the approach to security and action-making shall be based on knowledge, information and analysis. Especially in a new era of Big Data, national security shall be assured through the appropriate, comprehensive action, interrelationship among the “security of the existence of Mongolia”, “economic security”, “internal security”, “human security”, “environment security” and “information security”, which requires increased capacity for communication, inspection, collection and processing of security and development related geospatial data.

High resolution imagery monitoring and inspection over the mining activity, infrastructure development and their environment impacts in normal circumstances, and rapid revisits to focused area for emergency situations and disasters. All of these requirements needs additional amount of financial resources, which are nearly insufferable for small, developing country. Small satellites increasingly developed globally for innovative commercial and security applications can be cost effective, and can complement larger satellites’ missions. The area of interest for the national security application unlike that of civilian applications, needs more rapid response and imagery quality. The Earth Observation satellite imagery, which Mongolia partly uses since 30-40 years for meteorology, environment protection and etc, needs to be optimized in terms of cost and coverage of the desired region, revisiting time, especially in time of emergency.

Article 3.5.5.2. of National Security Concepts requires strengthen the disaster management system, take actions at the national level to reduce vulnerabilities, create conditions to encourage participation in the efforts by central and local governments, specialized organizations, private entities and citizens and increase their capacities. Systematically improve capacity, human resources, technology and ensure continuity of a network for monitoring and evaluation of security risk and treats, improve ways and means for prompt delivery of information to national security decision makers and agencies, customers and establish a disaster early-warning system will be realized via improved comprehensive geospatial information system.
Appropriate, optimized and cost effective system of geospatial data collection and processing including GEO, LEO, AERO, UAV imagery, with supporting infrastructure needs to be developed as a unified ‘tailors made’ solution for Mongolian Government, national security agencies, industry and society. A new technology development, new interrelations requires a new legal framework and regulations. In addition to that an international cooperation in small satellite application, research and development, capacity building should be an important parts of new edition of National Space Policy. Small satellite International cooperation in frame of regional security efforts on combating transboundary air and water pollution and increase environment evaluation and monitoring capacity. Improve legislation and upsurge cross border control capacity on transnational crime, trafficking, illegal chemical and toxic agents, biological materials and radioactive minerals.

SESSION 8: MONGOLIAN SPACE ENGINEERING AND APPLICATION (S8A-01)
HISTORICAL CHANGES IN TERRESTRIAL WATER AND CARBON CYCLE IN MONGOLIA: OBSERVATION AND MODELING SYNTHESIS

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I will present our analysis on historical changes in terrestrial water and carbon cycles in Mongolia based on the integration of publicly available datasets. My analysis focus on the period from 1980s to 2015. Publicly available datasets include ground observation (e.g. AsiaFlux data), remote sensing based products (e.g. vegetation index, biomass), data-driven products (e.g. machine-learning based estimations), and process-model based estimations. Gridded climate data shows increases in temperature and slight decreasing trends in precipitation over the past 30 years (e.g. 1982 to 2011). Responding to these changes, satellite-based vegetation index from MODIS and AVHRR sensors showed both increase and decrease trends depending on the region. Furthermore, these changes based on the remote sensing data show consistent interannual variations with data-driven estimates and process-based model estimations. Therefore, we can assume these consistent trends are reasonable, and process-based models can be used to identify the potential causes of these changes. I will also discuss further results on how the estimated changes in terrestrial water and carbon cycle were explained using process-model based analysis.

Keywords: Remote Sensing, AsiaFlux, Ecosystem Models, Carbon, Water, Environmental Changes.

SESSION 8: MONGOLIAN SPACE ENGINEERING AND APPLICATION (S8A-02)
HOW WE USE COMMUNICATION SATELLITE FOR CONTENT DISTRIBUTION IN MONGOLIA

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Year ago, Mongolia does not have its dedicated satellite which has beam steered to Nationwide. Since 2015, DDISH started cooperating with Korean KTSAT, to build KoreaSat-5A satellite called KT-migration. KT-migration project finish at end of 2017. Around 95% of TV subscribers migrated to new KoreaSat-5A satellite. New Satellite can capable of transmit 25% of more data and users use 30% of small antenna. More data and high receiving signal open the possibility of new kind of content service which is called ARVOD (without internet watch the VOD contents) and 4K. We already tested ARVOD service in the world first time. It is going successful now.

SESSION 8: MONGOLIAN SPACE ENGINEERING AND APPLICATION (S8A-03)
ESTIMATION OF SOLAR ENERGY POTENTIAL OVER MONGOLIA BASED ON SATELLITE DATA

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Due to its climatic characteristics, Mongolia has a large potential for solar energy generation. However, due to lack of sufficient instrumentation, this potential is yet to be mapped. Accurate knowledge of PV generation potential is a key requirement for the renewable energy market, as it provides guidance in choosing the most profitable location for PV projects. Further, such information helps quantify the output of the proposed PV system and its uncertainty.

Over the past few decades, a considerable number of studies have assessed PV potential around the world. Although these assessments are readily available, they do not meet the fine spatial and temporal resolution needed to support PV installation projects in Mongolia. In this study, we propose to meet this requirement using fine resolution satellite data and limited ground measurements. We have implemented a semi-physical model (Otani, 1994) to calculate ground albedo (reflectance) from brightness data provided by Japanese geostationary meteorological satellite Himawari 8/9 (successors of the MTSAT series). After retrieving ground albedo, solar irradiance falling on the earth’s surface can be estimated, since higher ground albedo leads to low irradiance and vice versa.

The semi-physical model was validated against observations over Choibalsan City (48.065° N, 114.515° E, 742 m), eastern part of the country, during 2016. We found that the model performed well with mean bias error (MBE) and root mean square error (RMSE) of 109 W/m² and 230 W/m², respectively, and a correlation coefficient of 0.87. In future, we are planning to install 3 sets of weather station in southern and central Mongolia. Therefore, validation of the model performance will be extended across the country.

SESSION 8: MONGOLIAN SPACE ENGINEERING AND APPLICATION (S8A-04)
A STRATOSPHERE IS A PART OF SPACE SCIENCE

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An atmosphere is a layer or a set of layers of gases surrounding a planet or other material body, that is held in place by the gravity of that body. The atmosphere of Earth is composed of nitrogen, oxygen, argon (about 0.9%) with carbon dioxide and other gases in trace amounts. The atmosphere helps to protect living organisms from genetic damage by solar ultraviolet radiation, solar wind and cosmic rays. Keywords: Stratosphere, cosmic dust.

SESSION 8: MONGOLIAN SPACE ENGINEERING AND APPLICATION (S8A-05)
THE NEEDS OF SATELLITE DATA FOR THE MONGOLIAN SCIENCE AND TECHNOLOGY DEVELOPMENT

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As the leading science institution of the country, The Mongolian Academy of Sciences (MAS) plays an integral role in strengthening the foundation of science and technology for the country and in preparing to meet the challenges and future needs of our nation and the global society. Nowadays, leading countries are giving urgent role in space science development because of its huge benefits on countries information technology development, national security, disaster risk reduction, environmental protection and sustainability.

This study aims to describe the trends of space science and Scientific government organizations’ roles in space technology development in Mongolia. The Mongolian Academy of Sciences consisting from 10 institutes, those of six have been actively used a remote sensing and space technology in their all research. We are still using low resolution and free data which is not very useful for the high expectation of research outputs.

Mongolia have some advantages of huge territory, large steppe, no raining season and a serene sky. In this case, we need to establish a microsatellite constellation and its ground station networks in parallel positions of latitude to downlink a remote sensing data from polar orbital earth observation satellites. Here we have to expand our international collaboration with countries to help them a data downloading and get benefits from them.

The one of the requirement to enter this science field, we have to capacity human resources and young space engineers through collaborating with best engineering universities from space science developed countries to work together on Nano and micro satellite real projects and joint research or study program. The Mongolian Academy of Sciences is very much supporting to develop the human capacity on space engineering, enhance basic technology, participate in international constellation satellite projects, to join ground station networks for remote sensing, and launch the communication satellite to improve information technology and national security.

SESSION 8: MONGOLIAN SPACE ENGINEERING AND APPLICATION (S8A-06)
MONGOLIAN SECOND CUBESAT’S MISSIONS AND CONCEPT

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MAZAALAI (NUMSAT-1) satellite of BIRDS-1 constellation was the very first satellite of the Mongolia. In the space engineering point of view, it was entirely new technology and learning process for the engineers of the Mongolia. Furthermore, National University of Mongolia is proposing the next science and technology demonstration oriented cubesat project, named NUMSAT-2, based on concept of the locally developed high technology advancement. In this presentation, main concept of the project and satellite missions will be presented.

SESSION 8: MONGOLIAN SPACE ENGINEERING AND APPLICATION (S8A-07)
DEVELOPING PASTURE CAPACITY MAPS FOR PASTURELAND MANAGEMENT OF MONGOLIA

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Pastoralism is the main means of livelihood in Mongolia in spite of the recent attention and interest on mining industry. However, herders often face great challenge from extreme weather conditions that adversely affect the pasture land and hence the livestock feed. Number and frequency of drought and dzud are increasing in the last couple of decades, causing huge loss of livestocks. It directly impacts the Mongolian economy. Hence, preparing a proper pasture land management policy is one of the most emerging issues of Mongolia.

In this study, we develop the current as well as future forecast of available forage from Mongolian pasture land. We obtain the forage avialablity map by integrating satellite data and ground measurements into Phygrow model. Based on the model output, we develope pasture capicity maps, which are very important in pasture land management. We will report the status of pasture land over Mongolia since 2006, based on the pasture capacity maps.

The forecast forage maps and pasture capacity maps could be used by decision makers and herders to prepare an optimal policy for land usage, and also to prepare strategies for pasture land management. thus improving the livestock productivity and quality, managing livestock population density, etc, so that we could minimize and prevent the risks of natural as well as man-made disasters.

Keywords: phygrow, LEWS, dzud, rangeland, forecast-forage-map,
ESTIMATING AREA CHANGES OF LAKE BUUN TSAGAAN USING SATELLITE DATA

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This study preliminarily presents three decade changes in area of Lake Buun Tsagaan, the largest lake in the Valley of Lakes in the Govi region, southern Mongolia. The area changes are calculated based on Landsat images in 1990 (Landsat 5 TM), 1999 (Landsat 7 ETM) and 2017 (Landsat 8); Normalized Difference Water Index (NDWI) and ArcGIS 10.2 Software. The calculation shows that area of Lake Buun Tsagaan varies as 268 km² in 1990, 281 km² in 1999 and 244 km² in 2017. Increase in lake area by 13 km² between 1990 and 1999 and decrease in lake area by 37 km² between 1999 and 2017 may have related to precipitation and temperature rises, respectively. The result infers that present study to estimate change in lake area is needed to be extended with climatic fluctuations in temperature and precipitation to conclude climate change in southern Mongolia and Central Asia.

Keywords: Landsat satellite, Change in lake area, Lake Buun Tsagaan, Mongolia

POSTER SESSION: P1-02
GEOSPATIAL ANALYSIS WITH GIS BASED DIGITAL TAXATION

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Geographical Information System (GIS) is a technology used to analyze geographic data to look for patterns and trends. Today, GIS is used to solve taxation problems for local governments to maximize the government income. This study thus aims to review literatures focused on geospatial analysis and GIS application in taxation. The study goal was to identify GIS capabilities, limitations, and need for potential improvement in areas of spatial analysis, spatial statistics, and modeling. This study examined spatial data analysis and GIS used mostly in property tax. The research findings revealed that the biggest contribution on GIS used in taxation was the creation of web and GIS based property tax systems for an agency or department. Data collected and used in these systems is shared with another agency or department. In many countries, municipalities use geospatial data analysis and GIS-based tax system, widely for property, to strengthen their revenues. Researches showed that municipal areas that are using geospatial analysis tools and the GIS have major increase in revenues. In addition, we identified a wide range of tools that used to spatial analysis and statistics.

Keywords: spatial analysis, GIS, taxation

POSTER SESSION: P1-03
GIS AND SPATIAL STATISTICS SOLUTIONS IN BANKING SECTOR

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Geographical information systems /GIS/ technology used to analyze geographic data to look for patterns and trends. Today GIS, spatial analysis and statistics used to improve decision making in banking services to maximize banks’ revenues. This study aims to review literature focus on GIS, spatial analysis and statistics solutions in banking service. The study also examines the extent to which banking studies mostly in banking service use GIS and spatial data analysis. The objective of the study was to identify GIS capabilities, limitations, and need for potential improvement in areas of spatial analysis, statistics, and modeling. The research findings revealed that the biggest contribution on GIS in banking sector is the creation of GIS-based banking system for one agency or department that shares collected and used data with one another. In many countries, GIS-based banking systems and special data analysis are used to strengthen their revenues, where the banking areas that are using the GIS have observed major increase. We identified a wide range of tools they used to spatial analysis and statistics.

Keywords: GIS, spatial analysis and statistics, banking sector

POSTER SESSION: P1-04
FLOOD PLAIN PLANT COMMUNITY RESPONSE TO THE CLIMATE CHANGE

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Floodplains are species-rich when compared to surrounding ecosystems and valuable pasture and hay resource for nomadic herders and stated as the most overgrazed pasture type in Mongolia. Since the flow regime determines the successional evolution of floodplain plant communities it is important to monitor them in relation to the flow dynamics. Monthly runoff of high (1978-1995) flow years of Orkhon River and its confluence South Tamir River decreased two and three times compared with low (1996-2008) flow years. Plant community analysis conducted at 7 sites along the Orkhon and South Tamir River floodplains in the summer of 2016 using Braun-Blanquet technique in order to compare with the plant community structure defined in early 1970s. Community structure changed drastically and occurrence and cover of the hydrophytes and mesophytic species decreased while the xerophytes increased. Average NDVI, calculated basing on the satellite images taken 17-19th of August of 1991, 1997, 2003, 2009, 2015, continuously decreased, the low biomass area increased. Flow and livestock affecting NDVI. As a result, floodplain stepping-up intense by the influence of climate change and human activities.

POSTER SESSION: P1-05
WILDLIFE MONITORING IN EASTERN SOUMS OF UMNUGOBI PROVINCE

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The purpose of the” Wildlife monitoring in the eastern soums of the Umnugobi province, Mongolia” is to combat poaching. The project estimated number of animals, monitor ecosystem change for wildlife, water issues and develop awareness for public on how to protect heritage for wildlife in Omnogovi province using Remote Sensing and GIS. Manlai, Hanbogd, Nomgon, Bayan-oboo soums selected as the study areas. To implement the goals of the project we used Smart and GIS softwares. Collection data and observation for wildlife conducted twice for years 2014-2017 in the study area.

We developed habitat map and suitability for wildlife map. Remote Sensing and GIS data is important tool for ecosystem condition for wildlife. Landsat data was used in this research. Application of high resolution data needed for research on wildlife and heritage in Mongolia.

POSTER SESSION: P1-06
AIR QUALITY AND POLLUTION MONITORING IN DARKHAN-UUL PROVINCE

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This research is based on research of 6-18 years (1995-2013) of Darkhan-Uul aimag’s atmosphere containing SO2 NO2 CO and pollen. In winter season, the atmosphere contains maximal SO2 NO2 CO and pollen (NO2-0,04 мг/м³, SO2-0,035 мг/м³, CO-1.12 мг/м³) but in summer, it has lesser fume comparing to other seasons ( NO2- 0,002 мг/м³, SO2- 0,0036 мг/м³, CO- 0,2 мг/м³ ). As result of SO2 NO2 CO and pollen increasing in winter and decreasing in summer shall have direct connection with household, thermal power station’s firing and plus number of car’s has been increased.

POSTER SESSION: P1-07