APFNet

Asia-Pacific Network for Sustainable Forest Management

And Rehabilitation

COMPLETION REPORT

[MONITORING FOREST COVER CHANGE IN MONGOLIA WITH
PARTICIPATORY APPROACH PROJECT [2015P5-MN]]

[Project Duration: 16 March 2016 to 30 March 2017]

[Supervisory Agency: Ministry of Environment and Tourism (MET) of Mongolia]
[Executing Agency: ERISC NGO, Mongolia]

[Ulaanbaatar, Mongolia]

ACRONYMS

MET   -   Ministry of Environment and Tourism
NUM   -   National University of Mongolia
MUST   -   Mongolian University Science and Technology
MSUA   -   Mongolian State University of Agriculture
SEAS   -   School of Engineering and Applied Sciences
ERISC   -   Environmental Research, Information and Study Center
MULS   -   Mongolia University of Life Science

BASIC INFORMATION

Project Title(ID)	Monitoring forest cover change in Mongolia with participatory approach (2015P5-MN)		
Supervisory Agency	Ministry of Environment, Green Development and Tourism (MEGDT) of Mongolia		
Executing Agency	Environmental Research, Information and Study Center (ERISC)		
Implementing Agency	"NUM-ITC-UNESCO" Space Science/Remote Sensing International Laboratory, National University of Mongolia (NUM)		
Duration of implementation: [03/2016-03/2017], 12 months			
Total project budget (in USD)	108,772	APFNet assured Grant (in USD)	83,372
Disbursement Status		Date of disbursement	Amount (in USD)
Initial disbursement		[03/2016]	65,000
Balance to be disbursed			18,372

List of Project Steering Committee

№	Name	Title	Expertise	Responsibility	Contact Information
1.	Prof Baatarbileg.N	Chairman of the PSC	Director of Life Science University of NUM and Focal point of APFNet in Mongolia	Lead the project and contact with other organizations	Phone-976-9 1995686 E-mail: baatarbileg@num.edu.mn
2.	Dr. Ariunzul.Ya	Project director from ERISC (Secretary)		Lead the project implementation	Phone-976-9 9175014 E-mail: ya_ariunzul @yahoo.com
3.	Dr. Z.Tsogt	Project Board member	Forest scientist of Science Academy of Mongolia	Consult and comment from science side for the project	Phone-976-9 9735622 E-mail:
4.	Mr. Otgonsuren.B	Project Board member	Senior expert of Forest inventory in Department of Forest Policy and Regulation of MEGDT.	Central Government, MEGDT supports the project at policy implication level, facilitates extension of the project methods to the national level application, and advises, and keeps in line with the APFNet strategy Ministry of Environment, Green Development and Tourism of Mongolia (hereinafter referred to as the "Supervisory Agency"), shall be responsible for establishment of PSC in consultation with the project, and Project Coordination at policy implication level, supervise and provide all necessary assistance to ensure effective and successful implementation of the Project in collaboration with the	Phone-976-9 9125806 E-mail: otgonsuren1962@.yahoo.com

				Executing Agency, and consider the long-term sustainability of the Project in terms of policy promotion at Ministry of Environment, Green Development and Tourism of Mongolia.	
5.	Mr. Gantumur.A	Project Board member	Head of Department Environmental and Tourism of Bulgan provence	Local Government shall support the project at local level, and support extension of the developed methods at the local level.	Phone-976-9 9993155 E-mail:

List of Project Team

№	Name	Title	Expertise	Responsibility	Contact Information
1.	Dr. Ariunzul.Ya	Project director from ERISC (Secretary)	Forest engineer and Doctor of Remote sensing, 17 years working experience in law and policy and regulation.	Project director, PIU leader, overall planning, Management and coordination of the project Development of project documents, will be responsible for project implementation, print and publish guidelines, and responsible for financial management of the project and financial reporting in accordance with APFNet rules, consequently for Communication with APFNet. -Be responsible for project implementation on day to day basis, project operational management, administration, image processing, conduct training, reporting, and Informing stakeholders with relevant info.	Phone-976-9917 5014 E-mail: ya_ariunzul@yahoo.com
2.	Undram.G	Project Coordinator	5 years' experience with Environmental and Remote sensing.	Coordinate daily work of the project and communicate parties.	Phone-976-9066 5000 E-mail: lilo_aamay@yahoo.com
3.	Bayanmunkh.N	Project Researcher	Doctorate of the NUM	Involved in the project implementation process, become trainers for further trainings on formulation of the management plans at the community level under the overall supervision of ERISC.	Phone-976-8889 9333 E-mail: bayan1225@yahoo.com
4.	Narangerel.Kh	Project Researcher	Master student of Life Science University	Project Staff, financial responsibility; image processing, data collection	Phone-976-9904 4633 E-mail: narangerel_x@yahoo.com
5.	Erdenechimeg.E	Project Researcher	Master student of Defense University of Mongolia	Involved in the project implementation process, become trainers for further trainings on formulation of the management	Phone-976-9958 1078 E-mail: erka_9100@yahoo.com
6.	Gunjargal.B	Project Researcher	Master of APFNet	plans at the community level under the overall	Phone-976-9997 7599

				supervision of ERISC.	E-mail: gungee09@yahoo.com
7.	Batchimeg.B	Project Researcher	Master of APFNet		Phone-976-8877 5935 E-mail: bachkakiss@yahoo.com
8.	Ganbandi Sh	Director of Khanbuyn forest community	Leading Khanbuyn community since 2011.	community stakeholder representative, shall be strengthened in human capacity by learning utilization of advanced data and technology for development of the management plans at the Community level.	Phone-976- E-mail:
9.	Erdenebileg. G	Director of Buuraldomuu forest community	Leading Buuraldomu community since 2011.	commune stakeholder representative , shall be strengthened in human capacity by learning utilization of advanced data and technology for development of the management plans at the Community level. facilitate project implementation at community level, and provide support in extension of the project outputs at local communities	Phone-976- E-mail:
10.	Prof. Ts.Batchuluun and D.Narantuya	Consultant	Teacher at School of Life Science of NUM, He was a Focal point of APFNet in Mongolia.	Consultants. Be recruited at the project start, and will be accountable for monitoring and evaluation of the project progress to assist Project Director to ensure qualitative outputs of the project, and provide required advice and guidance in forest management planning looking at the strategic Scenario development with use of 3S technology.	Phone-976- E-mail:

Executive Summary

Project has achieved effective results with following work accomplished during about one-year period:

1. Mongolian forest cover change from 2010 to 2015 mapped using high-resolution Landsat satellite data for the first time in forest sector of Mongolia.
2. Methodology created on defining and monitoring forest cover change year by year at state, province and forest unit level, which was later on introduced to students, forest specialists, environmental officers and pilot communities members.
3. Improved forest management plan produced using satellite data to define forest cover area and forest type in two pilot communities on the basis of project results, which could be applied to thousand other pilot communities in Mongolia.
4. Training workshops completed on using GIS and RS, where 106 people got elementary level knowledge of applying GIS and RS technology.
5. A project result book, guidelines and on line courses on monitoring forest cover change in Mongolia as well as a 32 minute's propoganda program are produced. Additionally, project interviews are broadcasted by TV and papers.
6. Two doctorate students, two master students, and two bachelor students made thesis work based on the project result. Bachelor student won the 2nd place from the student research conference.

Based on the above project achievements, it's impending that a deepening cooperation with APFNet on the following aspects upon the completion of this project:

1. Continuously monitor Mongolian forest cover change.
2. Spread the project approach by teaching other pilot communities.
3. Define biomass change and carbon cycle in Mongolia using the pre-collected satellite database.

CONTENTS

1. BACKGROUND AND INTRODUCTION

1.1. Project context

Forest cover accounts 9.2 percent of total territory of Mongolia, out of which 70 percent is intensively deteriorated by ageing fire and insect infestation. Generally, forestry in Mongolia is highly disturbed with increased illegal logging, mining activities and fires by nut and fruit collectors. Climate warming in Mongolia is relatively remarkable; with extreme dry climate, and low precipitation, the inputs to forest resources for ecosystem functioning is relatively higher than those in humid area. To safeguard ecological intact in Mongolia, appropriate planning and management is ungently necessary for forests. However due to lack of resources and capacity, the inventory nationwide for forests ,has yet to be launched, thus resulting in incorrect and inconsistent figures about the forest cover in Mongolia, putting a major obstacle in the front of forest resources planning, use and protection.

This project is aimed to make a validated quantitative assessment of forest cover in Mongolia to assist the Government of Mongolia in development and strengthening of the strategic documents at two levels: national forest resource management plan with production of 30 m resolution Landsat data covering entire territory, and local forest community level strategic documents to adequately manage forest resources, specifically by:
a. Monitoring of forest cover change 2000 through 2015;
b. Determining the current (2014) forest cover of Mongolia, and assessing the accuracy of the result;
c. Making Forest cover mapping of 2015 of selected two forest communities;
d. Assisting in strengthening of strategic management plans for pilot forest communities.

1.2. Project goal(s) and objectives

In order to facilitate Mongolian decision makers of environmental field to make educated decisions on forest management based on scientifically proven reliable products, the project

aims at producing forest cover map for entire economy with use of 30m Landsat data, and resolve existing discrepancies on forest cover estimate of Mongolia; it also aims at development of a comprehensive approach of how high accuracy outputs can be utilized in strengthening the national level forest management plan; as well use developing local forest management plans for the two selected communities. Provided with a single accurate figure planners at all levels, the competent authorities will be enabled to compare alternative management scenarios and to more effectively address the forest policy of Mongolia. Forest type maps and forest change detection maps will inform environmental and forest related organizations of the current status of forest resources, and further study the drives of the forest change that will help decision makers in the policy and decision making process.

Main goal of the project is to assist in development of the strengthened strategic documents at the national and local levels to manage forest resources by making a quantitative assessment of forest cover in Mongolia.

The following objectives are set forth to achieve the project goal that include:

- Monitoring forest cover change from 2000 to 2014;
- Determining forest cover of Mongolia of 2014, and assessing the accuracy of the result;
- Forest cover/type mapping of selected two forest communities based on data of 2015; and
- Strengthening strategic forest management plans for pilot communities.

1.3. Project expected outputs and outcomes

Output 1. Quantified forest cover of Mongolia

Deliverables:

- Landsat and Modis data are downloaded and corrected
- Forest cover change of 2000-2014 is detected
- Forest cover is checked for accuracy

Output 2. Mapped forest types of pilot community forests

Deliverables:

- IKONOS data procured and corrected

- Forest type mapping of 2015 or 2016 completed

- Accuracy of the forest type map is done

- Two third of PhD students thesis is completed

- A paper is prepared for publishing

Output 3. Extension and Application of the new method

Deliverables:

- One In Class training is completed

- Total 2 OJTs are carried out in two communities

- A guideline for forest community group use

- Manual for use of maps for management plan development

Output 4. Increased public awareness

Deliverables

- A TV program

- One or more articles published in scientific forest resources related journal

- A Promotion workshop

- TV talk

2. PROJECT IMPLEMENTATION

2.1. Project schedule and implementation arrangements

The projected implemented on time completely. The biggest result of this one-year project funded by APFNet organization is methodology for calculate the forest cover change which is most important performance of the forest fund. This work had not been completed in forest sector of Mongolia. The project team is concluding this project is one-step onward for science of the Remote Sensing in the Mongolian forestry sector by creating basis of the forest management plan and forest inventory. From the project process trend of the Mongolian forest steppe forest was defined. For the next step of this project is for forest sector specialists to test this approach on their own area and use and update the methodology. By this project completed 4 outputs and 16 activity. The result of the project as digital values and maps and approach should have possible to use in following way:

1. Mongolian forest cover change of the 15 years forest mapping from 2000 to 2015 uses satellite data. The average of the Mongolian forest cover of the forest steppe is 9,480,923.23 hectare. This covers 6.06% of Mongolian landscape. Mongolian forest cover of the forest steppe is decreasing in the last 15 years. The northern permafrost may increases in forest area due to global warming. The forest reforestation may not cause nursing tree work, may be of more importance to do with work by assisting natural reforestation process in an economic and ecological way. Whereas, Dornod and Khentii province's steppe forest decreasing so fast means that further work is needed to improve reforestation and slow down desertification. The result shows a forested area of the infrastructure-developed place is continuously decreasing in all provinces. Which means those areas needs to improve inspection. Increased area of the forest is usually on the boundary of the forest and decreased area of the forest is deepest part. The most suitable period for forest research is the pinnacle of the tree growth. However, summer which means pinnacle of the tree growth and cropland growth. Therefore, we downloaded data

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between 15th June to 15th September. Further researcher of the forest should pick up that period is most suitable for the forest research.

2. The possible to calculate forest type from the high-resolution satellite data. It has importance with more advance forest management plan and create base data for the forest application and forest plan. "Khanbuyan" forest pilot community has 8931-hectare natural forest from that 7691-hectare forest of the larix with 923590 cubic meter of reserves, 1240-hectare *forest of the betula* with 64320 cubic meter of reserves. We classified 2520.45-hectare forest of the *larix,* 798.21-hectare forest of the *betula,* 2311-hectare shrubs from the KOMPSAT high-resolution satellite data. Buuraldomuu pilot community area is 2328 hectare. From that 1922-hectare forest of the larix, 283 hectare forest of the betula. We classified 2020.83-hectare forest of the *larix,* 1046.65-hectare forest of the *betula* from the SPOT high-resolution satellite data. We produced an improved forest management plan for those two communities. Those two pilot communities' have possible to measure forest change in the community area with GPS during go to the herd. Specifically, it can be note wildfire burned area with fire and destroyed forest by insect and reforested area. That is the short term live monitoring that we can put in the vast landscape of Mongolia. Currently, we have not possible to define permanent forest monitoring for the Mongolian forest cover in every year. Only require a substantial amount of the time to teach ability and practice for herders about the mapping and picking up the sample points.

3. During the project, we trained 106 people. The project team trained in high-level methodology for determining forests using satellite data for 16 research students who worked long and short term. Also, gave a knowledge with elementary level of GIS and RS and usage of GPS for 90 local people by repetitive numbers. We published one manual book "Methodology to detect forest cover change from the satellite data" and one project result book. Based on this result book, three books, including the book one: a fifteen year change of Mongolian forest cover area, book two: "Approach to define forest cover area from the satellite data" manual book, and book three: "Application of satellite data in the

Forest management plan""" will be published upon the receiving the last installment. All those published books we sent to Bulgan province's forest specialists and environmental officers and community members who attended our training. Also those books handout for the promotion workshop participators such as , Academy of Science, , , , Inspection Agency, Environmental and Tourism Department of the Bulgan and Tuv province.

4. Project output published as a book. 32 minute's television program passes across the Mongolian via ROYAL TV broadcast in four times. Project director gave a speech to Mongolian National broadcasting and four other TV news and "Daily paper" and "National Post".

5. Project completed 100% in time.

2.2. Project resources and costs

The total budget of the Project is USD 108,772 (US Dollars One Hundred and Eight Thousand Seven Hundred And Seventy Two Only), among which up to USD 83,372 (US Dollars Eighty Three Thousand Three Hundred and Seventy Two Only) shall be granted by APFNet, and USD 25,400 (US Dollars Twenty Five Thousand Four Hundred Only) as counterpart contribution from the Executing Agency. ERISC received USD 65000 (US Dollars Sixty Five Thousand Only) of the APFNet Grant after signed Agreement. ERISC is responsible for office expenses and salaries for workgroups by 25400$. ERISC expensed one-year period's office and labor costs total 25400$ funds. APFNet's first grant 65000$ expensed for the project activity completely. All planned activity completed by planned expenses.

2.3. Procurement and consultant recruitment

We bought the six personal computers for the project by 10800$. Currently 4 personal computers using by ERISC and 2 computers using by communities. Other equipment supplied

from the ERISC. Project taken six consulting service from the National consultants.

1. First time we taken consultant service from the professor Batchuluun.Ts /Teacher of the Life Science School of the NUM/ about the forest science's focus point for the project on 23rd of March 2016. In addition consultancy was about planned activity and how many students would be used and timeframe of the project plan.

2. We taken consultant service from the Narantuya.D about the geographic information system and remote sensing for the project on 8th of April 2016. In addition, consultancy was about which satellite data would be used and about software and correction.

3. The second time we taken consultant service from the professor Batchuluun.Ts /Teacher of the Life Science School of the NUM/ about the field trip of the project on 20th of June 2016. In addition consultancy was about how to measure field trip location's forest which produced on the Landsat data.

4. The third time we taken consultant service from the professor Batchuluun.Ts /Teacher of the Life Science School of the NUM/ about the on job training for the project on 4th of July 2016.

5. The fourth time we taken consultant service from the professor Batchuluun.Ts /Teacher of the Life Science School of the NUM/ about the in class training on 10th of September 2016. In addition consultancy was about lecture for the local forest specialists and forest community members.

6. The fifth time we taken consultant service from the professor Batchuluun.Ts /Teacher of the Life Science School of the NUM/ about how to use result of the field trip for the project on 26th of September 2016. In addition consultancy was about how to unit and analyze field trip sample points result. Project is successfully completed because of Consultants had been giving valuable advice. Specially Professor Batchuluun.Ts was always helping to decision making for challenging time.

2.4. Monitoring & evaluation and reporting

Project monitored in two times. Project leader Ariunzul.Ya monitored pending works after a progress report sent to APFNet, which means six months later from the project starts on fourth of March. Before the project completion, the project was re-monitored to guarantee that all project documents and activities are completed.

Project audit report was sent to APFNet by "Atlanta Balance Audit", which has the right to audit for international projects in Mongolia. External and independent Audit firm "Atlanta balance Audit" has official summary defined as ERISC's activity completed all planned activities within project budget.

2.5. Dissemination and knowledge sharing

The project result was presented to twelve organizations such as Ministry of Environment and Tourism, National University of Mongolia, Mongolian State University of Agriculture, Mongolian University of Science and Technology, Academy of Science, Department of Environment and Tourism of Bulgan and Tuv province and Ulaanbaatar, Forest Research and Development Centre, Inspection Agency and two pilot communities. Interview on project progress and result was broadcasted 18 times by TV and 2 times by FM radio and papers. 32 -minute television program passes across the Mongolian via ROYAL TV broadcast four times. When last fund transferred form the APFNet, then 2 times interview will be contracted with ETV.

During the project 106 people studied in three training workshops. In class training for the 16 people who working in the project was convened every week. The students without any knowledge of the RS GIS, practiced and grasped knowledge about GIS/RS software. They have the possibility to become trainer of the GIS/RS for forest to the forest community members and local people.

3. PROJECT PARTNERS' PERFORMANCE

3.1. Performance of Supervisory Agency

Supervisory Agency that MET provides full policy support. MET connected our project with other foreign projects and invited ERISC members to the same purpose project workshops and let them participate in our project workshops. MET will be responsible for applying our project result of the monitoring of forest cover change in Mongolia connecting our project to UNREDD Mongolia National Program. UNREDD National Program donated 30TB server to our project. Ms Tungalag.M Head of the Department of the Forest Policy and Regulation of the MET noticed during the promotion workshop that the project result is important for the forest sector of Mongolia. The project team perceived that Supervised Agency fulfilled its obligations with great efficiency.

3.2. Performance of Executing Agency

ERISC implemented all project activities and fulfilled project objectives as defined in the Project Document and Project Agreement. Each researcher and student studied about GIS and RS during the project. All the participants of the promotion workshop emphasized Executing Agency has accomplished all the scheduled activities, including downloading, checking, correcting and processing the vast database of forest cover change. The change detection and calculation of forest cover change are very professional. The UNREDD National Program experts worried about the time, but project team finished all the process in time and published results as a book. Project result represented as three books and one TV program. MET summarized it's important for the project to publish books such as methodology as one manual book, project result as a tool book and application of the project result as one recommendation book. People are interested in the published result placard. Project team summarizes that application of the project result may affect Mongolian forest policy. The important output of the project is Mongolian forest cover change by hectare in the past fifteen years, which was never been produced before.

3.3. Performance of Implementing Agency (if any), consultants (technical assistants), contractors, and suppliers

Project Implementing Agency "NUM-ITC-UNESCO" Space Science/Remote Sensing International Laboratory, National University of Mongolia attended as the doctorate of that laboratory works full hour in the project, got the result and methodology of the doctorate thesis. Enkhjargal.N assistant of the laboratory organized Remote Sensing and GIS lecture on Inclass training in Bulgan province.

3.4. Performance of APFNet

The project team satisfied APFNet activity connected with the project in the following aspects

1. Plan and advice and comments were clear to understand. APFNet labors leading the project team by email very effective and quick comments during the project implementation. Mongolians have a feature of tradition not telling so much, but getting result on time. We fear perhaps foreign organization do not understand this feature, but thanks APFNet organizations had a patient contacting.

2. First grant of the project transferred with no delay as a project agreement.

3. The organization established mutual understanding cooperation between MET, NUM and ERISC. There was not any delay or any misunderstood during the project. APFNet was create good communication and good supervising.

4. PROJECT PERFORMANCE

4.1. Project achievements

Project produced the following results in an effective way:

1. Mongolian fifteen years forest cover change from Landsat satellite data year by year from 2000 to 2015 for the first time in forest sector of Mongolia. Most probability data of the Mongolian forest cover by each year.

2. Produced Mongolian forest cover change map, it has not been produced before.

3. In Mongolia, we could not calculate forest cover change of the forest fund declared in the community and enterprise owning forest and soum, province and state's forest

management plan. Before this project, this part of forest management plan was empty except state forest management. The project result has importance with those data produced on the free data from internet and it distributed to every units of the forest as a book.

4. Project produced improved forest management plan and other communities should follow that model.

5. Important output of the project is base database for the decision makers for forest policy in each provinces because change map is produced by province.

6. Two-doctorate student and two master student and two-bachelor student made their study by project result.

4.2. Project Impacts

The project is currently just finished. If the MET takes a policy for the each province instead of the state level for the forest then that is the importance of this project implemented. In particular, the provinces that increasing forest because of climate change should be support natural reforestation. Whereas, steppe forest which is converting into the steppe quickly needs to take a policy of nursing reforestation. Project enhanced for the ability to do short-term monitoring in forest cover changes at the community and soum, province level. In Mongolia has five level forest management plan such as forest community, enterprises owning forest, soum's, provinces and state level. Those forest management plan may improve because of the project result.

4.3. Sustainability

MET suggested to use project result for monitoring Mongolian forest cover in the Promotion workshop. The project has the ability to continue. In Mongolia, only certified forest organization can do forest management plan and only 750 forest communities' management plan are processed from the 1281 forest pilot communities. Even approved forest management plan has not determined forest cover change. As the project methodology can be imparted to

the forest community members and ERISC has the possibility to work for the forest management plan if we are certified.

5. CONCLUSION, LESSONS LEARNED AND RECOMMENDATIONS

5.1. Conclusion

The "Monitoring forest cover change with participatory approach" project funded by APFNet and ERISC short-term project successfully implemented in Mongolia. ERISC as Executing Agency of this project and as a Non-Government Organization of Mongolia implemented 16 activities and received the outputs as follows in one year with funding of USD 108,772.

1. Mongolian forest cover change mapped on MODIS and Landsat satellite data from 2000 to 2015.

2. Compared forest cover change-detection map 2000 with 2015.

3. Forest type of the Buurladomuu and Khanbuyan forest communities identified using KOMPSAT, Pleiades, and SPOT high-resolution satellite data.

4. Improved forest management plan developed in the two pilot communities.

5. Based on the project result, a 32 minute's TV program, books and placard are produced. Additionally, project interviews are broadcasted by TV and papers.

6. Two doctorate students, two master students, and two bachelor students made thesis work based on the project result. Bachelor student won the 2nd place from the student research conference.

7. Three trainings completed by the project and 106 people attending those trainings got elementary level knowledge of using the GIS and RS technology.

Project team deems that the most important part of the project result is an empty chapter of defining forest fund change of the forest management plan at all levels of Mongolia can be bridged by the project result. The second important output is defining forest increased area and forest decreased area of Mongolia by the most probable methodology using free online data. We hope this can affect the forestry policy makers of forest sector of Mongolia. The third

important output is defining forest type in the two pilot communities used high-resolution satellite data for the first time in Mongolia.

The project team concludes we reached enough results within very short-term period and with effective cost. Besides, many organizations attending in promotion workshop also thought highly of the project.

Although some activities takes more time than planned , this project fully accomplished exact on time. Some activities such as downloading, processing, and correcting are a bit lag behind schedule because of internet speed, but other activities has compressed time. Additionally, the project team organized project activities in a very financially efficient manner. Field Trip, OJT, Class Training completed by once time, thus saved the time. Apart from this, MET, NUM, and Department of the Environment and Tourism of the Bulgan province provided strong support for the project activities.

5.2. Lessons learned and recommendations

This project is first project funded by APFNet in Mongolia. Also it's the first time for ERISC to implement international project. Therefore, we are sure that both organizations have a mutual learning and understanding process. All project results and related recommendations are inserted into a result book; therefore, only the appropriate recommendations for further work are presented herein:

1. Promote the project result. ERISC members attend the international conference and workshops sponsored by APFNet.

2. ERISC in collaboration with MET continues the training forest communities and forest specialists on how to define forest cover change.

3. Continues to provide consultancy service and necessary help to the two pilot communities to improve forest management plan and disseminate the project achievements to other communities of Mongolia.

4. ERISC continues the promotion work through giving an interview on project result via TV and papers.

5. Consult the forest enterprises for choosing suitable reforesting area and apply the project results and the forest management plan to the forest unit's activities in the coming 5 to 10 years .

6. Let two bachelor and master students graduate based on the project result and publish two papers by two doctorate students. In addition, assist Mongolia to improve forest definition.

Annexes

A. Project Implementation status
B. Financial statement
C. Photos, media cliffs and other materials used/available for project outreach

Annex A Implementation status

Project Objective/Outputs/Activities *(in line with PD/AWPs)*	Indicators *(in line with PD/AWPs)*	Baseline of activities	Progress made *(% completion of activities and degree of output/objective achievement)*	Appraisal time	Actual time
Project Management Activities	-Minutes of every meetings/workshop -Progress Report, Completion Report with financial statements -External Audit Report -Output Documents -Minutes of Project output promotion workshop -External Terminal Evaluation Report	• 2017.03.24-First PSC meeting organized, on 24th - inception workshop organized, 2017.01.20-Progress PSC meeting and progress workshop. • 2016.09.16-32 sheet progress report sent to APFNet. • 2017.2.17 - Atlanta Balance Audit firm completed audit report and 8 sheet audit report sent to APFNet • 2017.03.30 – Promotion workshop • 2017.04.15 – Closure report sent to APFNet.	Project Management activities 100% completed. All activities documented.	03.04.2016-03.04.2017	04.03.2016-04.03.2017
Objective 1:	-Updated and accurate forest cover of Mongolia -Monitored forest cover change 2000 - 2014 -Demo pilot area forest cover assessed, and	-Available updated and verified for accuracy forest cover map of Mongolia; -An estimate of forest cover change detection is used for research and policy works; -High resolution data utilized in pilot sites to create up to species level forest map and used for	– 100% accomplished in time. – Made Mongolian forest cover map. – Made Mongolian forest cover-change	03.04.2016-03.04.2017	04.03.2016-04.03.2017

			map – Forest type map for the two community areas – Made improved forest management plan for two communities. – One In class training for local people – Two OJT completed for the community people – All people who attended in training are received a three books.		
utilized in strengthening of the strategic plan of the community	management plan development; -Strengthened human capacity of communities and students				
Output 1: *Quantitative assessment of forest cover of Mongolia:*	Change detection of forest cover of Mongolia is quantified Quantified and validated forest cover of Mongolia Landsat and Modis data are downloaded and corrected Forest cover change is detected from 2000 to 2014 Forest cover	– Mongolian forest cover change mapped on MODIS and Landsat satellite data from 2000 to 2015. All year's shape file produced. – Forest cover change-detection map compared with 2000 and 2015.	100% fulfilled.	04.03.2016-04.03.2017	04.03.2016-04.03.2017

	for 2014 is quantified and validated for accuracy MSc students research on change detection is prepared				
Activity 1.1 Data retrieval		Total 1965 scenes which covers full Mongolia /forested and non-forested/ from 2000 to 2015 downloaded from http://glovis.usgs.gov. From that, 165 scenes subtracted because of the quality check. 2012 data has most of them has gap and cloud. Therefore, we did not include 2012 on the database. - Total forested 765 scenes - Total saxual forested 465 scenes The period covers from 15he to June to 15th to September. If that period data could not found we used the data from 5th June to 20th September. For MODIS satellite data used 15 scenes of 15 years, EVI data of the 16th August every year. Downloaded from the http://glovis.usgs.gov.	100% fulfilled. We spent so much time for those data. It also depends on the internet speed.	04.03.2016- 04.06.2016	04.03.2016- 04.09.2016
Activity 1.2 Data correction		1800 scenes of Landsat geometrically, radio metrically and atmospherically corrected by the ERISC. We spent 40 minutes to correct completely for the each scene.	100% fulfilled. We spent so much time for those data. Downloading process passed planned period then correction process also had been late.	04.03.2016- 04.06.2016	04.03.2016- 04.10.2016

Activity 1.3 Forest cover change detection		Forest change detection map produced in Landsat and MODIS data compared with 2000 and 2015. 17 province's forest cover-change detection map produced in Mongolia.	100% fulfilled in time.	04.03.2016-04.03.2017	04.03.2016-04.03.2017
Activity 1.4 Forest cover mapping – DIP		Fifteen-forest cover map produced except 2012's map in Landsat data and MODIS forest cover map produced by every year. 17 province's forest cover map produced in Mongolia.	100% fulfilled in time.	04.03.2016-04.12.2016	04.03.2016-04.12.2016
Activity 1.5 Forest inventory data collection, compilation, validation		Control points created in Taxation data and topographic map and Google pro map also Bing map. There was error to identify forest in cloud shadow, cropland, and meadow of the steppe forest.	100% fulfilled in time.	04.09.2016-04.03.2017	04.09.2016-04.03.2017
Output 2 Mapped forest type of pilot community forests	Forest type map produced and validated	The project had been plan to buy IKONOS data from the 2015 to 2016 for the forest type map. But that satellite has inactive in Mongolia during the project implement duration. Project team decided to buy SPOT, Pleiades and KOMPSAT high-resolution satellite data instead of the IKONOS data. Because of the data quality of the community area, we picked up three different satellite data. Forest type map completed on Buuraldomuu Khanbuyan community areas.	100% fulfilled. Because of the time that we spent for the Mongolian forest cover-change map, this map produced not in time.	04.03.2016-04.06.2016	04.12.2016-04.03.2017
Activity 2.1 Data retrieval/	IKONOS data for pilot sites are procured and corrected	– In Buuraldomuu community area, we bought 100sq.km SPOT6 high-resolution satellite data	100% fulfilled. Because of the time that	04.03.2016-04.06.2016	04.12.2016-04.03.2017

procurement	Forest type (for 2015) mapping is completed Validated forest type map Sufficient number of field data 2/3 of a PhD student' research is completed Draft paper is available	with 1.5m resolution and date of 27th August 2016 data form http://www.intelligence-airbusds.com/. – In Khanbuyan community area we bought Pleiades, KOMPSAT high-resolution satellite data. – 50.83sq.km Pleiades high-resolution satellite data with 2m resolution and date of 26th July 2015 data form http://www.intelligence-airbusds.com/. – 125.29sq.km KOMPSAT high-resolution satellite data with 2.8m resolution and date of 19th August 2015 data form http://www.si-imaging.com.	we spent for the Mongolian forest cover-change map, this map produced not in time.		
Activity 2.2 Data correction, processing		SPOT, PLEIADES, KOMPSAT high-resolution satellite data geometrically, radiometrically and atmospherically corrected by the ERISC. Each scenes processed and classified by larix, betula, fired and affected by insect and shrubs.	100% fulfilled. Because of the time that we spent for the Mongolian forest cover-change map, this map produced not in time.	04.03.2016-04.12.2016	04.12.2016-04.03.2017

Activity 2.3 Field data collection		Field trip completed by a week in the July and September of the 2016 in Khanbuyan of Khangal soum and Buuraldomuu of the Bugat soum community areas of the Bulgan province. The purpose of the field trip was define classified lad type of the community which came from grid-sample method, measure tree properties in the forest, meet the community members, define the forest management plan idea. Field trip completed by two type. Random sampling method was purpose of check the land class type. Special points measured in July and September. Sampling method was measure in the 30x30=900sq.m area parallel with equator. From the Khanbuyan community we measured 37 samples in July and 38 samples in September. From the Buuraldomuu community we measured 10 samples in July and 17 samples in September.	100% fulfilled in time.	04.09.2016-04.03.2017	04.09.2016-04.03.2017
Activity 2.4 Validation		Validated by three steps. - First validation was the "Error confusion matrix" using the computer. 100-meter grid control points created and checked with Forest index data, taxation map and Google Earth pro ma.	100% fulfilled in time.	04.09.2016-04.03.2017	04.09.2016-04.03.2017

		- Confused points checked by the July field trip. - Last validation was random sample method of the Sydney University Geo-informatics laboratory created in September.			
Output 3. Extension and application of new method	Strengthened forest management plan with RS produced forest type map Developed method to strengthen and develop forest management plan based on forest type map Upgraded forest management plan of the pilot community forest	• 106 people trained • Improved two forest management plan • 3 times trainings • Bought 6 personal computers • Gave personal computers to the pilot communities • Published 3 books • Published 2 placards	100% fulfilled in time.	04.09.2016-04.03.2017	04.09.2016-04.03.2017
Activity 3.1 Human capacity strengthening	Training program minutes available. On the job training report is available	• During the project implementation 90local people and 16 students studied elementary and advanced level. Two doctorate students, two master students, and two bachelor students made thesis work by the project result. Bachelor student token 2nd place from the student research conference. • Team of the ERISC includes eight people organized 5days OJT from 16th of July to 20th of July, attended 33 people.	100% fulfilled in time. First OJT couldn't organize in time because of the preparation of the manual and other materials. Second OJT organized in time.	04.03.2016-04.06.2016	2016.07.16-07.20

		- Team of the ERISC and NUM includes ten people organized 3days OJT from 19th of September to 21st of September, attended 44 people		04.09.2016-04.12.2016	2016.09.19-09.21
Activity 3.2 Technical capacity strengthening	Procured and installed computer and software at the target destinations in pilot communities	• Bought six personal computers and gave two of them to the two pilot communities with all software and data. • GPS did not buy.	100% fulfilled in time. 2 personal computers gave communities in Promotion workshop.	04.09.2016-04.12.2016	04.09.2016-30.03.2017
Activity 3.3 Review and improvement of the forest management plans of the pilot communities		Developed two improved forest management plan for the Buuraldomuu and Khanbuyan communities. Project result maps included in the forest management plan.	100% fulfilled in time.	04.03.2016-04.06.2016	04.09.2016-04.03.2017
Activity 3.4 Guideline preparation, publishing	Guideline is prepared Draft manual for use of user friendly maps for management plan development	Published total 127 pages Guideline, 87 pages manual, 2 placards of the Forest cover change detection. All published books handout participants of the promotion workshop such as MET, NUM, MUST, MSUA, Academy of Science, UNREDD Mongolia National Program and community members and forest specialists of the Bulgan province who attended in the training.	100% fulfilled in time.	04.09.2016-04.03.2017	04.09.2016-04.03.2017

Output 4 *Increased public awareness*		• Completed 1TV program. • Published three books. • Gave interview to TV and two papers. • Published a result on two papers.	99% fulfilled in time.	04.09.2016-04.03.2017	04.09.2016-04.03.2017
Activity 4.1 Preparation of TV program	TV footage Publications TV program is available and broadcasted Article published; a TV talk on the project outputs broadcaster	32 minute's television program passes across the Mongolian via ROYAL TV broadcast in four times	100% fulfilled in time.	04.09.2016-04.03.2017	04.09.2016-04.03.2017
Activity 4.2 Deliverable publishing		Total 296 pages project result book published.	100% fulfilled in time.	04.06.2016-04.03.2017	04.09.2016-04.03.2017
Activity 4.3 Project output promotion		4 news agency and papers broadcasted results. Such as MNTV, Mongol HD, ETV, ROYAL TV. Preparing interview by project result.	100% fulfilled in time.	04.12.2016-04.03.2017	04.12.2016-04.03.2017

Annex B Details of project cost by category

Outputs/Activities (based on approved AWP)	Projected Completion Date	Actual Completion Date	Delivery Rate (%)	Projected budget (USD) (based on approved AWP)		Actual cumulative expenditure (USD)		Balance (USD)		Delivery Rate (%)
				APFNet	ERISC	APFNet	ERISC	APFNet	ERISC	
Project Management activities										
Activity 1.1 Stakeholder workshops				10,620$						
Inception workshop	First quarter буюу 2016.03.04-2016.06.04	2016.03.24	100%	3,654$	-	3,654$	-	-	-	100%
Progress workshop	Second quarter буюу 2016.06.04-2016.09.04	2016.01.20	100%	3,426$	-	3426$	-	-	-	100%
Completion workshop	Fourth quarter буюу 2016.12.04-2017.03.04	2017.03.04	100%	3,540$	-	3540$	-	-	-	100%
Activity 1.2 Monitoring, and Auditing	Project year	2017.03.04	100%	4,000$	-	4000$	-	-	-	100%
Activity 3. Reporting and management	Project year	2017.03.04	100%	1,050$	10,000$	1050$	10000$	-	-	100%
Sub total			100%	15670$	10,000$	15670$	10,000$	-	-	100%
Output 1. Quantified forest cover of Mongolia										
Activity 1.1 Data retrieval	First quarter 2016.03.01-2016.06.01	2016.07.01	100%	-	-	-	-	-	-	-
Activity 1.2 Data correction	First quarter 2016.03.01-2016.06.01	2016.07.01	100%	-	700$	-	700$	-	-	100%
Activity 1.3 Forest cover change detection	Project year	2017.03.04	100%	-	4,200$	-	4,200$	-	-	100%
Activity 1.4 Forest cover mapping DIP	Project year	2017.03.04	100%	4,000$	4,200$	4000$	4,200$	-	-	100%
Activity 1.5 Forest inventory data collection, compilation, Accuracy assessment	2016.09.04-2017.03.04	2017.03.04	100%	10,302$	1,400$	10,302$	1,400$	-	-	100%
Sub total			100%	14302$	10500$	14302$	10500$	-	-	100%
Output 2. Mapped forest type of pilot communities										
Activity 2.1 Data retrieval/ procurement	First quarter 2016.03.04-2016.06.04	2017.03.04	100%	5,600$	-	4160$	-	-	-	100%
Activity 2.2		2017.03.04	100%	4,000$	2,800$	4,000$	2,800$	-	-	100%

Data correction, processing	2016.03.04-2016.12.04									
Activity 2.3 Field data collection	2016.09.04-2017.03.04	2016.09.04-2017.03.04	100%	8,460$	1,400$	8,460$	1,400$	-	-	100%
Activity 2.4 Validation	2016.09.04-2017.03.04	2016.09.04-2017.03.04	100%	2,000$	700$	2,000$	700$	-	-	100%
Sub total			100%	20060$	4900$	18620$	4900$	1440$	-	100%
Output 3. Extension and application of new method										
Activity 3.1 Human capacity strengthening	First quarter 2016.03.04-2016.06.04 Third quarter 2016.06.04-2016.09.04	OJT-1 2016.07.19-2016.07.21 OJT-2 2016.09.09-2016.09.11	100%	6,040$	-	6,040$	-	-	-	100%
		In Class Training 2016.09.19-2016.09.21	100%	2,760$	-	2,760$	-	-	-	100%
Activity 3.2 Technical device strengthening	Third quarter 2016.06.04-2016.09.04	2016.03	6 PC-100%	10,800$	-	10,800$	-	-	-	100%
		-	4 JPS 100%	240$	-	1680$	-	-1440$	-	100%
Activity 3.3 Review and upgrade of the forest management plan	First quarter 2016.03.04-2016.06.04 2016.09.04-2017.03.04	2017.03.04	100%	4,000$	-	4,000$	-	-	-	100%
Activity 3.4 Guideline preparation, publishing	2016.09.04-2017.03.04	2017.03.04	100%	3,500$	-	3,500$	-	-	-	100%
Subtotal			100%	27340$	-	28780$	-	-	-	100%
Output 4. Increased Public Awareness										
Activity 4.1 Preparation of TV program	2016.09.04-2017.03.04	2017.03.04	100%	3,500$	-	3,500$	-	-	-	0
Activity 4.2 Deliverable publishing	2016.06.01-2017.03.01	2017.03.04	100%	2,000$	-	2,000$	-	-	-	0
Activity 4.3 Project output promotion	2017.03.04 2016.12.01-2017.03.01	2017.03.04	100%	500$	-	500$	-	-	-	0
Subtotal			100%	6000$		6000$	-	-	-	
Total			100%	83,372$	25,400$	83372$	25400$	0	8,500.00	

Appendix C. Photos, media cliffs and other materials for project outreach

Meeting of project board
Director of SEAS, professor N.Baatarbileg
Teacher of SEAS, professor Ts.Batchuluun
Senior of Forest Policy Coordination Department B.Otgonsuren
Leader of ERISC, PhD Ya.Ariunzul
Executive Director of ERISC G.Undram
Researcher of ERISC, master student of MULS H.Narangerel
Consultant D.Narantuya

INCEPTION WORKSHOP

Participated 73 people from 28 organizations in Mongolian National University, Ulaanbaatar, Mongolia on March 23, 2016.

Starting attendees

Director of forest class of Bulgan province B.Altansukh

Attended the seminar came by their own request
/Coordinator of UN-REDD in Mongolia Chris Dickinson, O.Bilguun and B.Khishigjargal/

PROGRESS WORKSHOP

Participated 56 people from 22 organizations in The Freshwater Resources and Nature Conservation Center, Ulaanbaatar, Mongolia on January 20, 2017.

Workshop participants

Process of meeting

Presenter: Executive Director of *ERISC* G.Undram

Presenter: Researcher of *ERISC* E.Erdenechimeg

Presenter: Researcher of ERISC B.Batchimeg

Presenter: Researcher of *ERISC* B.Gunjargal

Presenter: Researcher of ERISC N.Bayanmunkh

Researchers have answered the question.

Ph.D., Associate Professor says comments A.Buyanbaatar.

National Forest participated in a presentation meeting.

PROMOTION WORKSHOP

Participated 73 people from 24 organizations in Mongolian National University, Ulaanbaatar, Mongolia on March 30, 2017.

Closing the meeting participants

Director of Forest Policy and Regulation Department of MET M.Tungalag

Presenting the results of projects by Leader of ERISC, PhD Ya.Ariunzul

Activity of conferencing

Team of project

To giving results of the project posters, computers, books, forest managments plan and gives on the MET and forests communtities
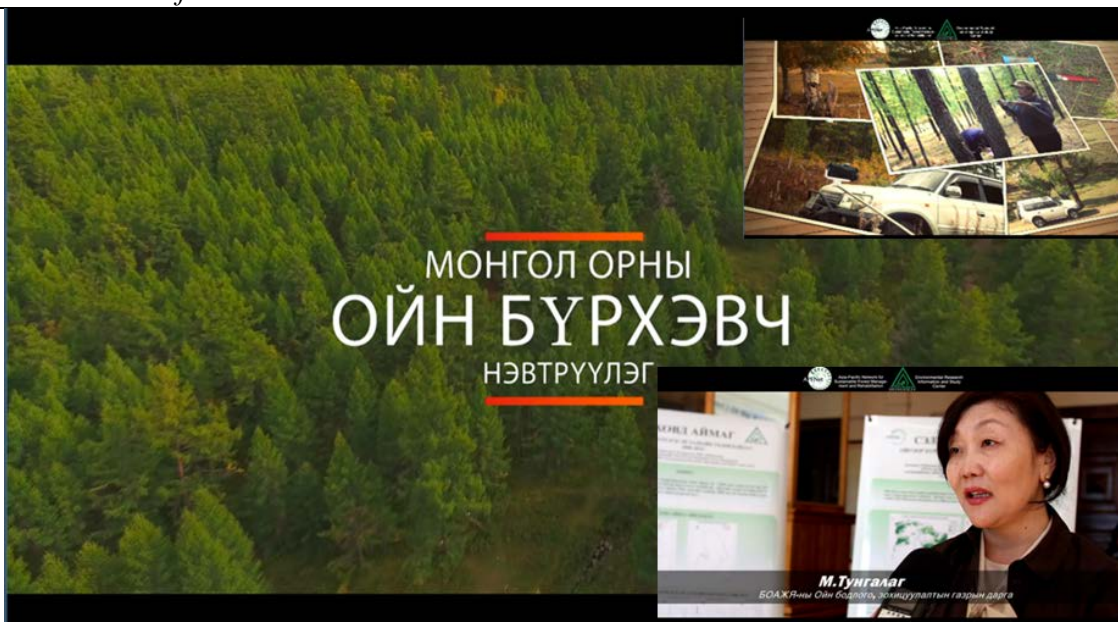
Podcast of TV

During the meeting

ОЙН БҮРХЭВЧИЙН ӨӨРЧЛӨЛТ АЙМГААР

АРХАНГАЙ БАЯНХОНГОР БАЯН-ӨЛГИЙ БУЛГАН ДАРХАН-УУЛ ДОРНОД ГОВЬ-АЛТАЙ

ХЭНТИЙ ХОВД ХӨВСГӨЛ ОРХОН ӨВӨРХАНГАЙ

СЭЛЭНГЭ ТӨВ УЛААНБААТАР УВС ЗАВХАН

Ойн бууралт 2000-2015
Ойн өсөлт 2000-2015

МОНГОЛ ОРНЫ ОЙН БҮРХЭВЧИЙН ӨӨРЧЛӨЛТ
2000 / 2015

Ойн бууралт 2000-2015
Ойн өсөлт 2000-2015
Ойн талбай 2015 он

Forest cover change of Mongolia /2000-2015/
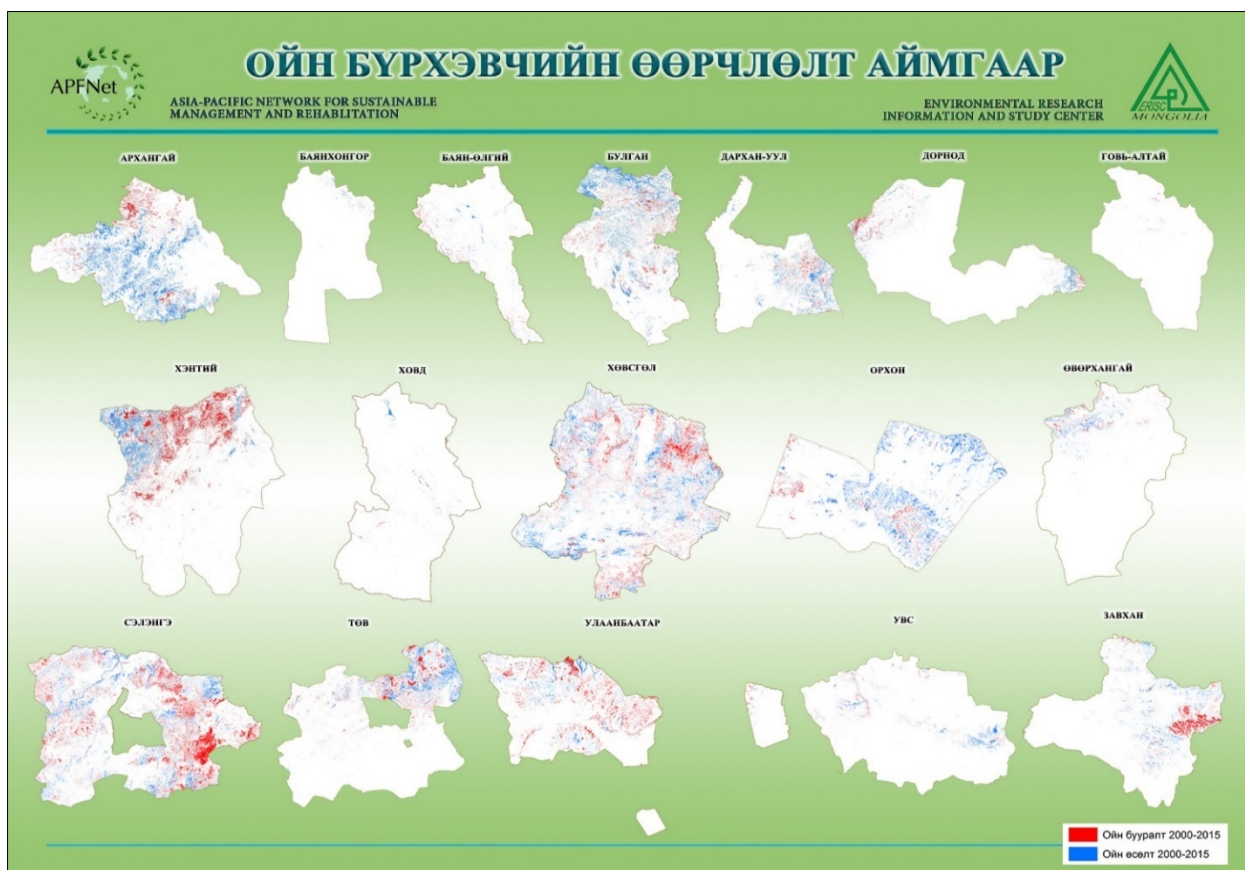
The project result book

Manuals for forest management plan

Class training:

"Participatory assessment of forest cover change in Mongolia" project by ERISC with APFNet implementing to the induction process
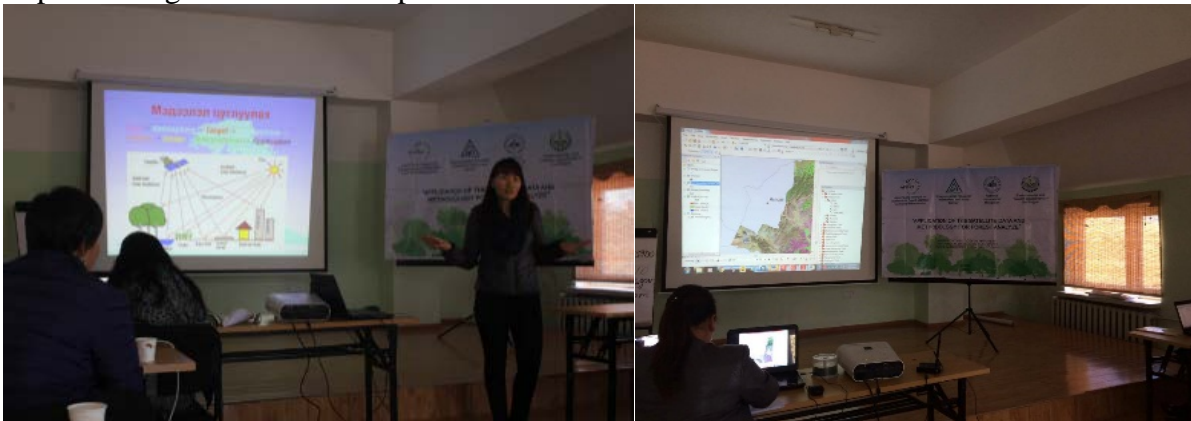
Basic concepts of geographic information systems enable the use of environmental sectors, the potential use of geographic information systems
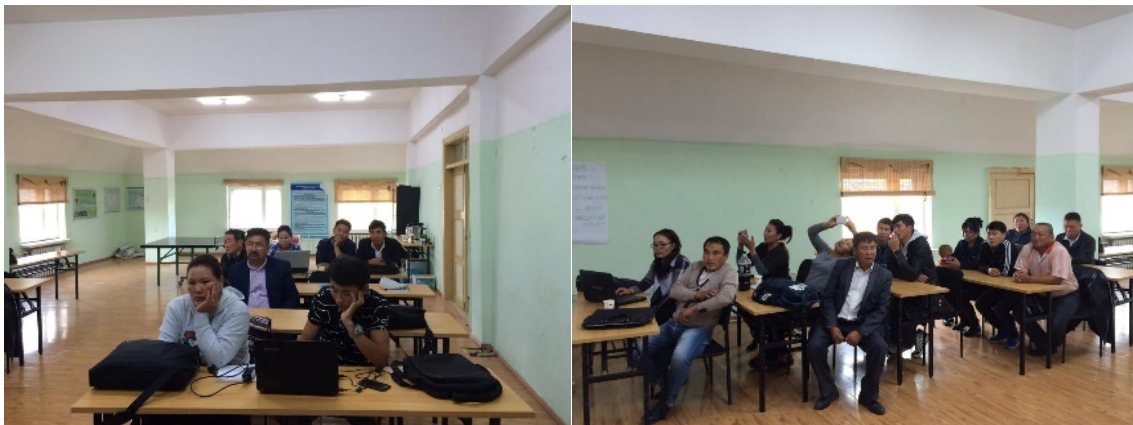
Have included a view of remote sensing and initial training

The awarding of the trainees

Environment and Tourism Forest Officer of Bulgan province B.Altansukh, Leader of ERISC, PhD Ya.Ariunzul	*"Certificate" ceremony.Forestry ingeneer of Erdenet G.Chinzorig, Executive Director of ERISC G.Undram*
"Certificate" ceremony. Officer of Environmental in Bugat Soum SH. Enh-Amgalan, Executive Director of ERISC G.Undram	*"Certificate" ceremony. Ranger of Orkhon soum D.Buynkhishig, Executive Director of ERISC G.Undram*

Field measurements-2   /2016.09.16/

Tree height measured by member of Khanbuyn community Unurtsetseg and Researcher of ERISC N.Bayanmunkh

The tree crown and a height measurement by member of Khanbuyn community Unurtsetseg and researcher of ERISC E.Erdenechimeg

Taking the soil samples on the community forest area
/Researcher of ERISC N.Bayanmunkh/

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Taking the points on burnt area
/Researcher of ERISC G.Undram and E.Erdenechimeg/

Measurement on burnt area of forest
/Researcher of ERISC N.Bayanmunkh/

Measurement the crown of tree on community of forest. Researcher of ERISC H.Narangerel
Logged area on community of forest area
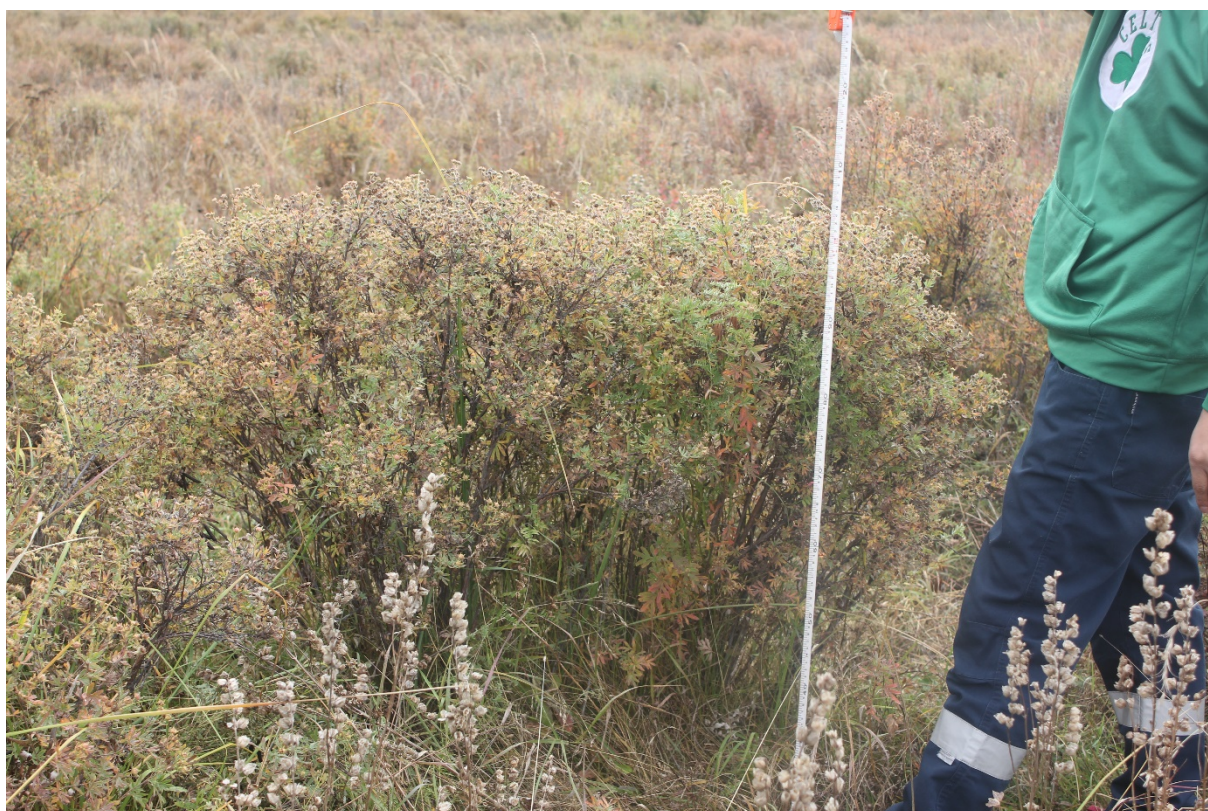
Retinal elevation measurement

24th of March 2016   Round Hall, 1st

Building of National University of Mongolia

Environmental Research and Information Study Center (ERISC) NGO organized an Inception Seminar of Monitoring Forest Cover Change in Mongolia with Participatory Approach [Project ID:2015P5-MN] granted by APFNet and ERISC on 24th of March 2016 at Round Hall, 1st Building of National University of Mongolia.

Total of 73 people of 28 organizations attended the seminar. As we planned 50 people from 24 organizations, attended people are 45 persons of 22 organizations and expected attendance of 90%. Local organizations full attendance with 16 people from 7 organizations from Zuunmod and Batsumber soum of Tuv province and Bugat and Khangal soum of Bulgan province. Public organizations attended 75%, which is 9 people attended from 12 people of 6 organizations as Ministry of Environment, Green Development and Tourism of Mongolia, General Agency for Specialized Investigation, The Administration of Land Affairs, Geodesy and Cartography, Forest Exploration Research Center and Agency for Specialized Investigation of Tuv province, Environmental Center of Bulgan province etc. None of the participants of Ministry of Environment, Green Development and Tourism of Mongolia haven't attended the seminar the reason of the director's seminar of the Department of Environment and Tourism at the same date.

Scientific, Academic organizations attended 90%, which is 9 of 10 people from 3 organizations as Mongolian Academy of Science Institute of Botany, Institute for Meteorology and Environmental Monitoring, Universities. Private and Non-Governmental organizations attended 75%, which is 9of 12 people from 9 organizations.

Not invited, but attended people have an interest with the project are 6 people from rural area and 11 people of relevant organizations from Ulaanbaatar. The GIZ REDD+ project of "National Forest Inventory of Mongolia" team leader and Senior Advisor of Forest Monitoring and Analysis Dan O Altrell attended by own request. Mongolian National Broadcasting, Parlament TV, ETV, Televisions reported about the seminar.

18 recommendations and questions commented at the seminar.

Project leader Ya. Ariunzul PhD put a detailed report about the project implementation approach and implementation plan.

Local representative of the Bulgan province forestry experts B.Altansukh puts presentation about Forest Community, Forest Resource and this project how relates with Forest Organizations of Bulgan province. Chairman of "Khanbuyan" Forest Community of Khangal soum of Bulgan Province Sh.Ganbandi introduced about Forest community. Chairman of

"Buural Domuu" Forest Community of Bugat soum of Bulgan Province B.Erdenebilegt couldn't arrive because to deliver offspring's but sent Member of community O.Azdelgerekh to introduce their community.

Environmental Department of Bulgan province established 189 forest community at 11 soum in 2015. Thereof the Unit completed taxation of 122 forest community, then confirmed and monitor forest management plan performed by local budget in 2014.

In the Implement of Participatory Forest Management established with a membership of 16 people of 8 families in 2012 at Bugat soum of Bulgan province.

"Buural Domuu" Forrest community owned 2410-hectare forest area numbered as 260-623, 282(1-8; 10-12; 14; 18), 283 from the present soum's forest area by contract through the 15/04 Resolution of approved by Citizens Representative Congress on the 16th of July 2012 at Bugat soum. The Community Management plans documented on Taxation plan of "Grand Forest" LLC in 2015, at the forest area of "Buural Domuu" Community planned during three years from 2016 to 2018.

18 people reviewed efficient recommendation and advice from all seminar participators. Workshop participants valued the importance of the work planned by the project, and highlighted ambitious volume of work to be covered within a relatively short time. All expressed their willingness to collaborate. Some early appointments are made with some other donor projects.

We planned to meet discuss about the possibilities of cooperation with international consulting Richard Metcalphe of UN-REDD and GIZ REDD+ project of "National Forest Inventory of Mongolia" team leader and Senior Advisor of Forest Monitoring and Analysis Dan O'Altrell on April of 2016.

Academician Ch.Dorjsüren who is director of Forestry Research industry of Mongolian Academy of Science emphasized about the correlation between the result of forest inventory and result of the Mongolian Forestry area, suggest cooperate for a unique result for the Mongolian Forestry area. Also discussed about the exchange project outcome.

Researcher of Mongolian Academy of Science Dr Z.Tsogt highlighted about taxation and in situ measurement has to be exact and also variety of forest types need to be very focused on selected items.

Remote Sensing teacher of Mongolian Agricultural University B.Batbileg advised that need attention such as species composition and spectral analysis of the forest, spectral curve and classification analysis, display parameter values and analysis (INDEX), to connect natural

conditions related to maintenance and in-situ data with GIS. National consultant of UN-REDD Project Ts.Khongor mentioned about efficiency of use open software for the project.

Following decision made by the seminar:

1. Project Implement as planned
2. Schedule meeting with UN REDD+, GIZ projects
3. Re-schedule meeting about the approach.
4. Meeting with two communities for improve introduction.
5. Use Forest Inventory results
6. Use Open source software
7. Make better in-situ study for taxation.

Picture 1. Inception seminar participants

UNREDD International consultant with governor expert and translator

Local environmental officer of Bulgan province

Project Steering Committee Meeting Minutes
March 23, 2016, 2:00 - 3:00 pm
Room №217 3rd Building of National University of Mongolia, Ulaanbaatar, Mongolia
Attendance:
Steering Committee Members
1.   Baatarbileg.N, *Head of School of Engineering and Applied Science National University of Mongolia*, *and Steering Committee Chair*
2.   Otgonsuren.B, *Ministry of Environmental Green Development and Tourism Representative*
3.   Ariunzul.Ya, *Environmental Research Information and Study Center Representative, Project Leader*
Steering Committee Members - Involved by written document
4.   Tsogt,Z *Science Academy Representative*
Regional Staff - Involved by written document
1.   Gantumur.A, *Department of Environmental and Tourism of Bulgan province Representative*
Guests
1.   Batchuluun.Ts, *PhD and Teacher of School of Engineering and Applied Science National University of Mongolia*, *Consultant*
2.   Narantuya.D, *ERISC Researcher, Consultant*
3.   Undram.G, *Project Coordinator*
4.   Narangerel.Kh, *ERISC Researcher*
   1) Welcome, Introductions and Agenda Review [Ariunzul.Ya]
Ariunzul.Ya opened the meeting with introductions and a review of the agenda.
2) Review of Minutes
•   PSC meeting bylaw. Minutes accepted by Steering Committee
•   Steering Committee Chair selection
•   Project activity plan
•   Project Inception Seminar
3) PSC meeting Proposals unanimous
   • The Steering Committee reviewed PSC meeting shall be appointed as project plan if attendance is more than 60 percent. Also forestry workers have approved written suggestions that you can vote, because of a lot of work in the countryside in summer.
   • Baatarbileg.N selected PSC Chair by election. Ariunzul.Ya selected by the Secretariat. Tsogt.Z, Gantumur.A are encouraged to give a written vote. Steering Committee will be verified by ERISC Director decree.
   • The work plan for the project will follow the work plan approved by the APFNet. But the team decided that they need to work out a detailed plan.
   • Project Inception Seminar should proceed at due date (24th March, 2016)
4) PSC meeting Suggestions
   • B.Otgonsuren suggested that the main role of MEGDT responsible for the project is non-concurrency. One more thing is forest inventory results should be compared.
   • Baatarbileg.N expressed he will fully support the project and project team.
   5) Meeting ended at 3:07 pm.

From left hand: Ariunzul.Ya Project leader, Otgonsuren.B MEDT expert, Baatarbileg.N Director of School of Engineering and Applied science of NUM, Undram.G Project coordinator

From Left hand: Narantuya.D National consultant of project, Batchuluun.Ts National consultant of project, Narangerel.Kh researcher of ERISC

From bottom left hand: Ariunzul.Ya Project leader, Baatarbileg.N Director of School of Engineering and Applied science of NUM, Otgonsuren.B MEDT expert; From upper left hand: Undram.G Project coordinator, Narangerel.Kh researcher of ERISC, Batchuluun.Ts National consultant of project, Narantuya.D National consultant of project

First On Job Training for two communities' members in July

We continued OJT about mapping forest map and work with Landsat data for the community members and environmental officers and forest unit experts for total 33 people on center of the Bulgan province from

Registration of the training

№	Name	Organization	Position
1.	Erdenebileg.G	Community	Director of Buural Domuu forest community
2.	Onortsetseg.D	Community	Member of Khanbuyan community
3.	Oyunbaigali.E	Community	Member of Khanbuyan community
4.	Ganbandi.Sh	Community	Director of Khanbuyan community
5.	Buyankhishig.D	Orkhon soum	Environmental officer
6.	Azdelger.O	Community	Member of Buural Domuu community
7.	Chinzorig.G	Community	Member of Buural Domuu community
8.	Anhtor.Kh	Community	Member of Tugul community
9.	Ganbyamba.J	Community	Director of Tugul community
10.	Nyamdavaa.J	Community	Member of Nogoon Tugul community
11.	Tsengelmaa.M	Community	Member of Berkh Gol community
12.	Radnaabazar.E	Community	Member of Suudriin Gol community
13.	Oyunchimeg.M	Community	Member of Buural Domuu community
14.	Gantumur.A	Bulgan province	Head of the Environmental and Tourism Department
15.	Altansukh.B	Bulgan province	Forest specialist of Bulgan province
16.	Badam.D	Inter-forestry unit	Head of Teshig soum forest unit
17.	Ganzaya.E	Inter-forestry unit	Forest specialist of Teshig soum forest unit
18.	Erdenebayar.G	Inter-forestry unit	Forest specialist of Erdenet city forest unit
19.	Munkhsaikhan.S	Inter-forestry unit	Head of Bulgan soum forest unit
20.	Javkhlan.D	Inter-forestry unit	Forest specialist of Bulgan soum forest unit
21.	Mandakhsan.D	Inter-forestry unit	Head of Khutag-Undur soum forest unit
22.	Davaakhuu.Sh	Inter-forestry unit	Forest specialist of Khutag-Undur soum forest unit
23.	Zoljargal.O	Inter-forestry unit	Forest specialist of Khyalganat soum forest unit
24.	Ariunkhishig.Sh	Inter-forestry unit	Forest specialist of Khyalganat soum forest unit
25.	Uugan-Erdene.E	Orkhon soum	Environmental officer
26.	Oyunbadrakh.S	Orkhon soum	Environmental officer

Some of training applicants and project researchers.
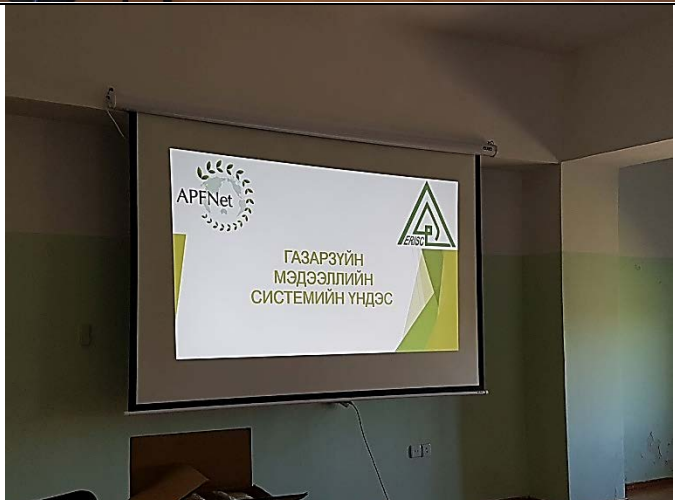
Process of training: Gave basic knowledge of GPS and spatial analyzing software /ArcMap, Google Earth, ENVI/, taught how to download free Landsat data from USGS, work with forest measuring equipment and made themselves own forested area of their soum and printed out their maps.
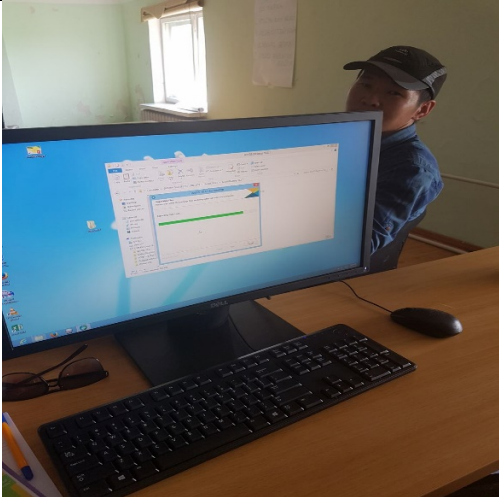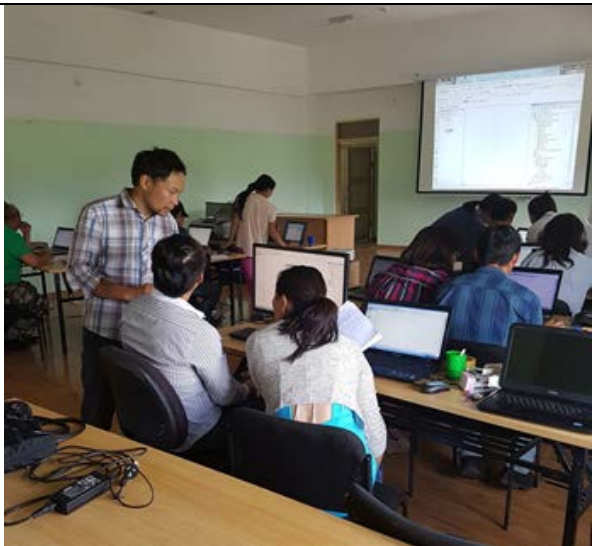
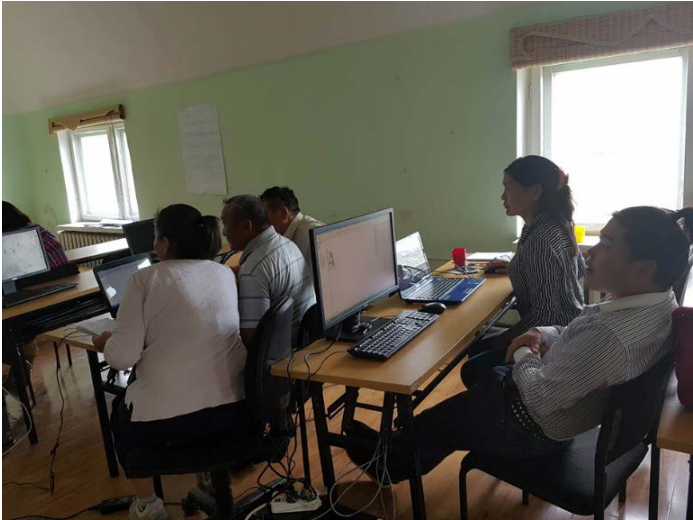Following table attached in-class trainings name:

№	Date	Topic	Responsible with
1.	2016.07.16	"Monitoring Forest Cover Change in Mongolia With Participatory Approach" Project introduction	CEO of the ERISC Undram.G
2.		"Install ArcGIS"	Researcher of ERISC Bayanmunkh.N, Narangerel.Kh, Lhagvasuren.I
3.		"Install ENVI"	CEO of the ERISC Undram.G, Researcher Ermuun.B
4.		"Install Google Earth Pro"	CEO of the ERISC Undram.G, Researcher Ermuun.B
5.	2016.07.17	"Base of the Geographic Information system"	Researcher of ERISC Narangerel.Kh
6.		"Base of the Remote Sensing"	CEO of the ERISC Undram.G
7.		"Work with GPS"	Researcher of ERISC Narangerel.Kh
8.	2016.07.18	"Start with ArcGIS"	Researcher of ERISC Bayanmunkh.N, NUM student Lhagvasuren.I
9.		"Start with ENVI"	Researcher of ERISC Bayanmunkh.N, NUM student Lhagvasuren.I, Ermuun.B
10.		"Practice"	Students
11.	2016.07.19	"Download Landsat data"	Researcher of ERISC Narangerel.Kh, Erdenechimeg.E, NUM student Lhagvasuren.I, Ermuun.B
12.		"Register for USGS, take ID"	Researcher of ERISC Narangerel.Kh, Erdenechimeg.E, NUM student Lhagvasuren.I, Ermuun.B
13.		"Work with ArcGIS"	CEO of the ERISC Undram.G
14.		"Practice"	Students
15.	2016.07.20	"Work with ENVI""	Researcher of ERISC Bayanmunkh.N, NUM student Lhagvasuren.I
16.		"Install software on participant's computer"	CEO of the ERISC Undram.G, Researcher of ERISC Bayanmunkh.N, NUM student Lhagvasuren.I
17.		"Make measurement by forest equipment"	Researcher of ERISC Bayanmunkh.N, Narangerel.Kh, Ermuun.B
18.		"Print out forest map of soum and community"	CEO of the ERISC Undram.G, Researcher of ERISC Erdenechimeg.E

Purpose achievement of the in-class training for strengthen professional ability of local specialists each and separately:

№	Purpose	Achievement	Picture
1.	Introduction of the APFNet (Asian Pacific Forest Network) activity and projects	*Non-profit International Organization dedicated to advancing sustainable forest management and rehabilitation in the Asia-Pacific region* *31 members, including 26 member economies and 5 international organizations in the Asia-Pacific region* *APFNet was proposed by China and co-sponsored by Australia and the United States at the 15th APEC Economic Leaders Meeting, in Sydney, Australia, in September 2007.* – MISSION – *Help Promote and Improve sustainable forest management and rehabilitation* – PURPOSES – *Expanding forest cover and Improving forest ecosystem quality in Asia and the Pacific* – *Help mitigate and Adapt to climate change* – *Meet the changing socio-economic and environmental needs of the region*	

2.	Introduce role and responsibility for the Project "Monitoring forest cover change in Mongolia by Participatory approach" of the parties which is APFNet and ERISC;	Detect Mongolian forest cover timely change from 2000 to 2014 by 15 years using Landsat data and define forest type and age in Bulgan province area from high resolution satellite data. From this project 1601 scenes downloaded and 492 scenes preprocessed from total forest covered area which is 780 scenes and processed 303 scenes. We introduced about project progression by 10 sheet presentation.	
3.	Improve Geographic information system knowledge and give basic knowledge;	12 sheets presentation shows about connection between specialist and geodatabase and hardware and software and end user.	

4.	Improve Remote sensing knowledge and give basic knowledge;	History of the Remote sensing and basic knowledge and how to use satellite data, what is satellite data and spectral value etc	
5.	Explain about usage hardware and software of GIS and RS	Install GIS software's ArcMap and Google Earth, RS software ENVI on participant's computers.	

6.	Divide two class by basic level of the knowledge of ArcGIS and give two types	We prepared all participants divide into two part of trainings which are intermediate and elementary level of ArcGIS. But intermediate level's participants hadn't enough knowledge of ArcGIS, so we integrate all participants into the one class training.	
7.	Let them prepare own maps of the forest by community area and soum area.	- "Forest map of Teshig soum" by Badam.D, Ganzaya.E, Anhtur.G, Ganbyamba.J - "Forest cover map of Orkhon soum" by Oyunbadrakh.S, Buynkhishig.D, Uugan-Erdene.D, - "Khun chuluunii Bel" forest partition map by Javkhlan.D - "Forest map of Khutag-Undur soum" by Davaakhuu.Sh, Mandahsan.D - "Forest partition map of Khyalganat soum" Zoljargal.O, Ariunkhishig.Sh - "Forest cover map of Berkh forest communication of Khangal soum" Tsengelmaa.M - "Forest cover map of Khangal soum" Onortsetseg.D, Oyunbaigali.E, Ganbandi.B - "Forest socioeconomic map of Erdenet city" by Erdenebayr.G - "Forest map of Buural Domuu" by Erdenebileg.G, Azdelger.O, Chinzorig.G	

8.	Teach to download free satellite data	Taught how to download Landsat satellite data by following sequence: - Open USGS website www.glovis.usgs.gov - Download and install Java - Register ID for USGS website. - Explain functional process of the website - Find your deserved area - Download data - Check the data	
9.	Introduce forest measuring some equipment /Tree diameter, height, canopy and age drill, GPS/ and give the initial knowledge of them.	We take an in situ class on forested area using measuring approaches of the tree as measure diameter, height, canopy, slope etc. Practicing on the garden of the Environmental Tourist Center.	

Remote sensing fundamental lecture

Training of ArcGIS

Three. Result

Project team taken survey with 9 questions from OJT participants for analyze result of the training.

Example of survey sheet

　　47.4 % of the participants evaluate our OJT's achievement of the goal as very good and 47.4 % as good and 5.2% as medium. 94.7% of the participants could take a deserved result from the training and 5.3% is couldn't reach enough. Participants have 100% satisfied with teacher Undram.G's /CEO of the ERISC/ lecture and 57.9% has having good mark on Narangerel.Kh /Researcher of the ERISC/ and other teachers as Bayanmunkh.N, Erdenechimeg.E, Ermuun.B.

　　100% of the participants wanted to take next training on their province.

Assessment of the training from the participants attached on following table:

№	Question	Could	Couldn't	I don't know
1.	Could you taken fundamental knowledge of the Remote Sensing?	100%	-	-
2.	Could you taken fundamental knowledge of the GIS?	94,7%	-	5,3%
3.	Have you taken forest map of your province?	89,5%	10,5%	-
4.	Did you have Landsat data which include your area? And did you have registered USGS website?	89,5%	10,5%	-
5.	Total average	**93.4%**	**10.5%**	**5.3%**

About training

APFNet and ERISC contributed and organized the training named as "Satellite data for forest and methodology to process the data" in Bulgan province from 19th to 21st of September 2016 by human capacity strengthen progress under the "Monitoring forest cover change with participatory approach in Mongolia" project.

The training has 36 participants which includes experts of Environment and Tourism Department of Bulgan province and Inspection agency and environmental officers of Bulgan and Khangal soum and community members.

Name of participants

№	Сургалтад хамрагдсан хүний нэр	Харьяалагдах байгууллага	Албан тушаал
27.	Gantomor.A	Bulgan province	Head of Environment and tourism Department
28.	Altansukh.B	Bulgan province	Specialist of forest of Bulgan
29.	Bayarjargal.G	Bulgan province	Specialist of ArcGIS of Bulgan
30.	Mart.B	Bulgan province	Specialist of environmental assessment
31.	Mendsaikhan.P	Bulgan province Inspection agency	State officer of environment
32.	Enkhbayar.Kh	Bulgan province Inspection agency	State officer of environment
33.	Enkh-Amgalan.Sh	Bugat soum	State officer of environment
34.	Badam.D	Forest unit of soum	Head of forest unit at Teshig soum
35.	Ganzaya.E	Forest unit of soum	Specialist of forest unit at Teshig soum
36.	Chinzorig.G	Forest unit of soum	Forest engineer of Erdenet soum
37.	Erdenebayar.G	Forest unit of soum	Forest technician of Erdenet soum
38.	Munkhsaikhan.S	Forest unit of soum	Head of forest unit at Bulgan soum
39.	Javhlan.D	Forest unit of soum	Forest engineer of Bulgan soum
40.	Mandahsan.D	Forest unit of soum	Head of forest unit at Khutag-Undur soum
41.	Davaakhuu.Sh	Forest unit of soum	Forest engineer of Khutag-Undur soum
42.	Zoljargal.O	Forest unit of soum	Forest engineer of Hyalganat soum
43.	Ariunkhishig.Sh	Forest unit of soum	Forest technician of Hyalganat soum
44.	Uuganerdene.E	Bulgan soum	Environmental officer
45.	Oyunbadrakh.Sh	Orkhon soum	Environmental officer
46.	Buyankhishig.D	Orkhon soum	Environmental officer
47.	Erdenebat	Bugat soum	Environmental officer
48.	Onortsetseg.D	Khanbuyan community	Member
49.	Oyunbaigali.E	Khanbuyan community	Member
50.	Azdelger.O	Buuraldomuu community	Member
51.	Nyamdavaa.J	Nogoon tunshlel community	Member
52.	Radnaabazar.E	Nogoon tunshlel community	Member
53.	Amgalanbaatar.E	Bukht community	Member
54.	Otgonbayar.B	Boogiin sondol community	Member
55.	Dashmaa.T	Gun Chuluut community	Member
56.	Amgalan.M	Bulgan	Forest engineer
57.	Tsolmon.R	NUM	Doctor, Teacher of NUM-ITC-UNESCO
58.	Enkhjargal.N	NUM	Teacher of NUM-ITC-UNESCO
59.	Ariunzul.Ya	ERISC	Consultant, teacher
60.	Undram.G	ERISC	Teacher
61.	Bayanmunkh.N	ERISC	Teacher
62.	Narangerel.Kh	ERISC	Teacher
63.	Erdenechimeg.E	ERISC	Teacher

The training taken three days and Professor Tsolmon.R, Doctorate Enkhjargal.N, Doctor Ariunzul.Ya, Undram.G ERISC director, Researcher Bayanmunkh.N, Narangerel.Kh, Erdenechimeg.E taught following lectures for participants.

- Introduce progress process of the APFNet and ERISC contributed project named as "Monitoring forest cover change with participatory approach in Mongolia"
- Fundamental of remote sensing and GIS
- GIS fundamental for environmental
- About satellite data and satellite data for the forest
- Characteristic of satellite data.

Following practice work completed:

- Gave knowledge about ArcGIS, ArcMAP, Google Earth, ENVI software
- Usage of ArcGIS software.
- Usage of GPS and find picked points in the personal computer, follow track and find area
- Pick point uses GPS and insert ArcGIS software.

- Make georeferenced
- Define digital number of satellite data; About NDVI and FI
- Methodology of classification in satellite data. About supervised and unsupervised classification.
- Make own forest map of own soum and province by GIS
- Download free satellite data from the internet.

Training result

Project team taken survey with 13 questions from Inclass training participants for analyze result of the training.

№	Question	I have	I haven't	I don't know
6.	Have you studied methodology for download satellite data?	100%	-	-
7.	Do you think the training has effect for forest community activity?	100%	-	-
8.	Did you produce forest map of your province and soum and community?	89,5%	10,5%	-
9.	Do you want to study again in our training?	100%		-
10.	Average	**93.4%**	**10.5%**	**-**

Participants of second OJT

Participants of Inclass training

Progress workshop

We attached progress workshop power point file named with ERISC project progression.

Participants of Progress workshop

Participants of Progress workshop

Form left hand: Ariunzul.Ya Project leader, Dorjsuren.Ch Academician of forest in Science Academy, Batchuluun. Ts National Consultant

Form left hand: Gunjargal.B APFNet master and ERISC researcher, Batchimeg.B APFNet master and ERISC researcher, Erdenchimeg.E ERISC researcher, Undram.G Director of ERISC

Minutes of Promotion workshop.

Name of the Organization: Environmental Research Information and Study Center /ERISC/ NGO

Title of the Document: "Monitoring forest cover change with participatory approach" project promotion workshop

Date of workshop: 13:00 30th March 2017

Location: Round hall of NUM in Ulaanbaatar

Undram, Batchimeg: Registration 12:00 to 13:00 PM

Lunch: 12:00 to 13:00 PM

Participants of workshop: 70 people

Start time of workshop: 13:30 PM

Tungalag.M */Head of Policy and Regulation of the Forest Department of MET/*: Opening

Ariunzul */Doctor, Project director/*: Opening

Ariunzul */Doctor, Project director/*: Introducing project output / 2 hour/

Question, Answer, Discussion and Recommendation

Tungalag.M: - The result is very important and we invited them forest community conference in 14th April. The methodology is basic for forest management plan of forest community. The project result shows 6.6 percent of Mongolian landscape is the forest. It has not include saxual forest. Mongolian government aimed for forest is reach 9% of landscape. But from that result we saw that is impossible aim. Also the project gave an idea we should support natural growth more. That is the one important idea for forest policy in Mongolia. The project also published very important three books. I am working as focal point of APFNet in Mongolia and I will write to that organization about this project. I am very glad that project successfully implemented in the forest sector.

№		Organization	Names of Participants	Position	Phone number	e-mail &facebook
1	1.	Ministry of Environment and Tourism	Batbayar.Ts	Deputy Prime Minister	266286	
	2.		Tungalag.M	Director of Forest Policy Coordination Department	267548	
	3.		Otgonsuren.B	Senior Specialist of Forest Policy Coordination	261726	
2	4.	Institute of General and Experimental Biology, Mongolian Academy of Sciences	Dorjsuren.Ch	Head of Forest sector, Academician	99178887	
	5.		Tsogt.Z	Scientist, PhD	99735622	
3	6.	Ministry of Environment and Tourism, "Forest Research and Development Center"		Director	11301072	
	7.		Michid.Kh	Head of Forest Stock Research and Utilization Office	96049441	Michid.kh@forestry.gov.mn
	8.		Khosbayar.B	Specialist	88124157	azazll_2@yahoo.com
4	9.	State Inspection Agency	Tserendash.D	Director of Environmental monitoring department	99055225	www.facebook.com. TserendashDavaa
	10.		Nyamdavaa.Ch	Forest inspector of Mongolia	99112751	nyam_ds@yahoo.com
5	11.	District Inspection Department	Bat.G	Forest inspector of Bayangol district	88084743	www.facebook.com.Gombosuren Bat
6	12.	Agency Land Affairs and Cartography Geodesy	Munkhtsetseg.D	Specialist	96676761	naara8797@yahoo.com
7	13.	Department of Environment and Tourism of Bulgan province	Gantumur.A	Director of Department of environment and Tourism	99993155	www.facebook.com. AltangerelGantumur
	14.		Altansukh.B	Director of forestry	99012754	boldaltansukh@yahoo.com
8	15.	Forest community of Bulgan province	Azdelger.O	Community Member "Buuraldomuu"	99668776	anguush_18@yahoo.com
	16.		Oyunbaigali.E	Community Member "Khan buyan"	99356135	oyunbaigalbaigal@yahoo.com
9	17.	Department of Environment and Tourism ofTuv province	Otgonbuyan.J	Director of forestry	99077808	ja_otgoo@yahoo.com
	18.		Tumentur.P	Specialist	99132160	

1 0	19.	Forestry of Batsumbersoum ofTuv province	Davaanyam.T	Specialist of land	99960093	daku_public@yahoo.com
1 1	20.	Bayantsogtsoum of Tuv province	Davaadorj.A	Governors	88010402	davka1212@yahoo.com
	21.		Munkhbayar.N	Environmental inspector	88409692	moogii_8296@yahoo.com
1 2	22.	National University of Mongolia	Baatarbileg.N	Director of School of Applied Sciences and Engineering, Professor	91995686	Baatarbileg@num.edu.mn
	23.		Batkhuu.N	Teacher of School of Applied Sciences and Engineering, Professor	91923933	Batkhuu@seas.num.edu.mn
	24.		Batchuluun.Ts	Teacher of School of Applied Sciences and Engineering, Professor	99066182	Batchuluun@num.edu.mn
	25.		Gerelbaatar.S	Teacher of School of Applied Sciences and Engineering, Professor		Gerelbaatar@num.edu.mn
	26.		Tsolmon.R	Head of "NUM-ITC-UNESCO" laboratory, Professor	88013715	tsolmonren@gmail.com
1 3	27.	University of Life Science	Buyanbaatar.A	Teacher of soil, Professor	99014702	buyanbaatar_avirmed@yahoo.com
	28.		Bat-Erdene.J	Teacher of forest ingeneer, Professor	99239654	
	29.		Khishigjargal.M	Teacher of forest ingeneer, PhD	99159152	
	30.		Batbileg.B	Teacher of Remote Sensing	99277708	
1 4	31.	UN-REDD Mongolia National programme	Chris Dickinson			
	32.		Bilguun.O	UN-REDD Үндэснийхөтөлбөр	88112132	bilguuno@unredd.mn
	33.		Khishigjargal.B	Manager, UN-REDD Mongolia		khishigjargal.batjantsan@undp.org
	34.		Khongor.Ts	National Consultant	99280129	khongor@unredd.mn
1 6	35.	Information and Research Institute of Meteorology, Hydrology and Environment	Nandin-Erdene.G	RS specialist, National Remote Sensing Center		nandia_n2@yahoo.com
1 7	36.		Narangerel.Z	Forest database specialist, Environmental Information Center		znarangerel@yahoo.com
1 8	37.	Climate change project implementation unit	Sanaa.E	AFOLU sector specialist of CCPIU		ezsanaa@gmail.com
1 9	38.	Environmental Professionals Association	Ulziibayar.D	Executive Director	99058659	ulziibayar2002@gmail.com
2 0	39.	"Ascard city" Co.Ltd	Bolortuya.Kh	Journalist	99039343	Bolortuya9343@gmail.com
	40.		Enkhjavkhlan.E	Journalist	88169699	

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"MONITORING FOREST COVER CHANGE IN MONGOLIA WITH PARTICIPATORY APPROACH"

Project title (ID)-(2015P5-MN)

Undram Galbadrakh. CEO of ERISC

erisc.mn@gmail.com

Ulaanbaatar, September 2016.

Project information

- **Supervisory agency**

  -Ministry of Environment, Green Development and Tourism (MEGDT) of Mongolia

- **Executing agency**

  -Environmental Research, Information and Study Center (ERISC)

- **Implementing agency(ies)**

  - Forest communities of Khan Buyan and Buural Domuu, of Bulgan province Mongolia,

- **Project Director:**

  - Yangiv Ariunzul, Director ERISC, ya_ariunzul@yahoo.com; Tel:976 99175014;

  - Undram Galbadrakh, Executive Director of ERISC,Tel:976 90665000; Email: erisc.mn@gmail.com; lilo_amay@yahoo.com

- **Project implementation duration:** [03/2016 to 03/2017, 12 months]

Main stakeholders:

- Asia-Pacific Network for Sustainable Forest Management and Development (APFNet);

- Ministry of Environment and Green Development of Mongolia (MEGD);

- Environmental protection agency of Bulgan Province;

- Forest inventory companies/ organizations (FIC);

- Forest communities such as "Eco Khan Buyan" and "Buural Domuu";

- Forest departments at the higher educational institutes;

- Scientists and researchers working in the forest field

Introduction

1. Project progress
2. Forest definition.
3. Download Landsat data
4. Checking
5. Find useful data
6. Index study /choose which Index are we use/
7. Define methodology of the correction and processing
8. Preprocessing
   a. Correction
9. Forest Index
10. Accuracy assessment
    a. Taxation Data
    b. Google Earth
    c. On the field
11. Classification analyze

Main goal of the project is to assist in development of the strengthened strategic documents at the national and local levels to manage forest resources by making a quantitative assessment of forest cover in Mongolia.

The following objectives are set forth to achieve the project goal that include:

- Monitoring of forest cover change from 2000 to 2014;

- Determine forest cover of Mongolia of 2014, and assess the accuracy of the result;

- Forest cover/type mapping of selected two forest communities based on data of 2015;

- Strengthening of strategic forest management plans for pilot communities.

Currently project progress going with at least 55%.

- First PSC meeting completed
- First Inception Seminar completed
- Downloaded 1601 scenes of the Landsat satellite data by Mongolia from 2000 to 2014.
- Checked cloud cover, gap and quality and especially period of the all scenes .
- Defined all methodology of the pre-processing and processing.
- Define forest definition
- Pre-processing – 91.5% accomplished
- Processing- 90.9% accomplished
- Accuracy Assessment completed on 2 forest communities
  - Buural Domuu (4900 check points)
  - Khanbuyan (33600 check points)
    - Taxation data
    - Landsat data
    - Google earth pro
    - *Collect Earth*
- First field trip done in Bulgan province
- First On Job training completed with 2 communities and Environmental officers and forest unit of the Bulgan province

Landsat Data

DOWNLOADING PROGRESS FOR WHOLE MONGOLIA BY 15 YEARS FROM LANDSAT

Name of staff	Row №	Path count	Total number of Scene	Date	Number of downloaded scene	Precentage for Row Precentage	Unit	Precentage for whole data Precentage	Unit	
Narangerel	24	4	60	V/16	48	80.00	%	3.00	%	8.18
Bayanmunkh	25	20	300	V/16	252	84.00	%	15.74	%	30.29
Undram	26	21	315	V/16	274	86.98	%	17.11	%	33.73
Erdenechimeg and Ermuun	27	21	315	V/16	291	92.38	%	18.18	%	27.80
Undram	28	19	285	V/16	266	93.33	%	16.61	%	
Bayanmunkh	29	17	255	V/16	233	91.37	%	14.55	%	
Erdenechimeg	30	11	165	V/16	154	93.33	%	9.62	%	
Narangerel	31	6	90	V/16	83	92.22	%	5.18	%	
Total		119	1785		1601	89.69	%	100.00	%	

Requirments of Data		
Total 15 years from 2000 to 2014	Priority Season of Scene	
Path 123-144	August	1
Row 24-31	September	2
CC<10%	July	3
glovis.usgs.gov	October	4
java.com	June	5
Folder location to save	May	6
APFNet - Landsat Data - Row№ - Path № - Year		
N	Not Include	
M	Most data completed	
Y	Yes	
Number	Completed year	
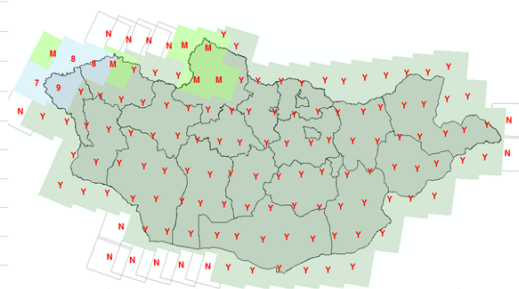
- Data period from 15th of June to 15th of September

- Cloud cover less than 10%

- With No gap

- Path from 124 to 144

- Row from 24 to 31

- Period from 2000 until 2014 (Except 2012)

With Gap

With cloud

With snow
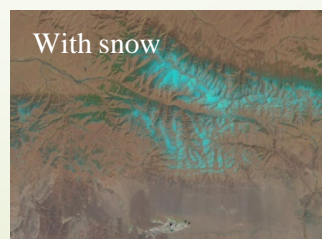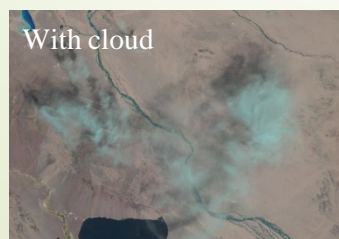
Data Correction
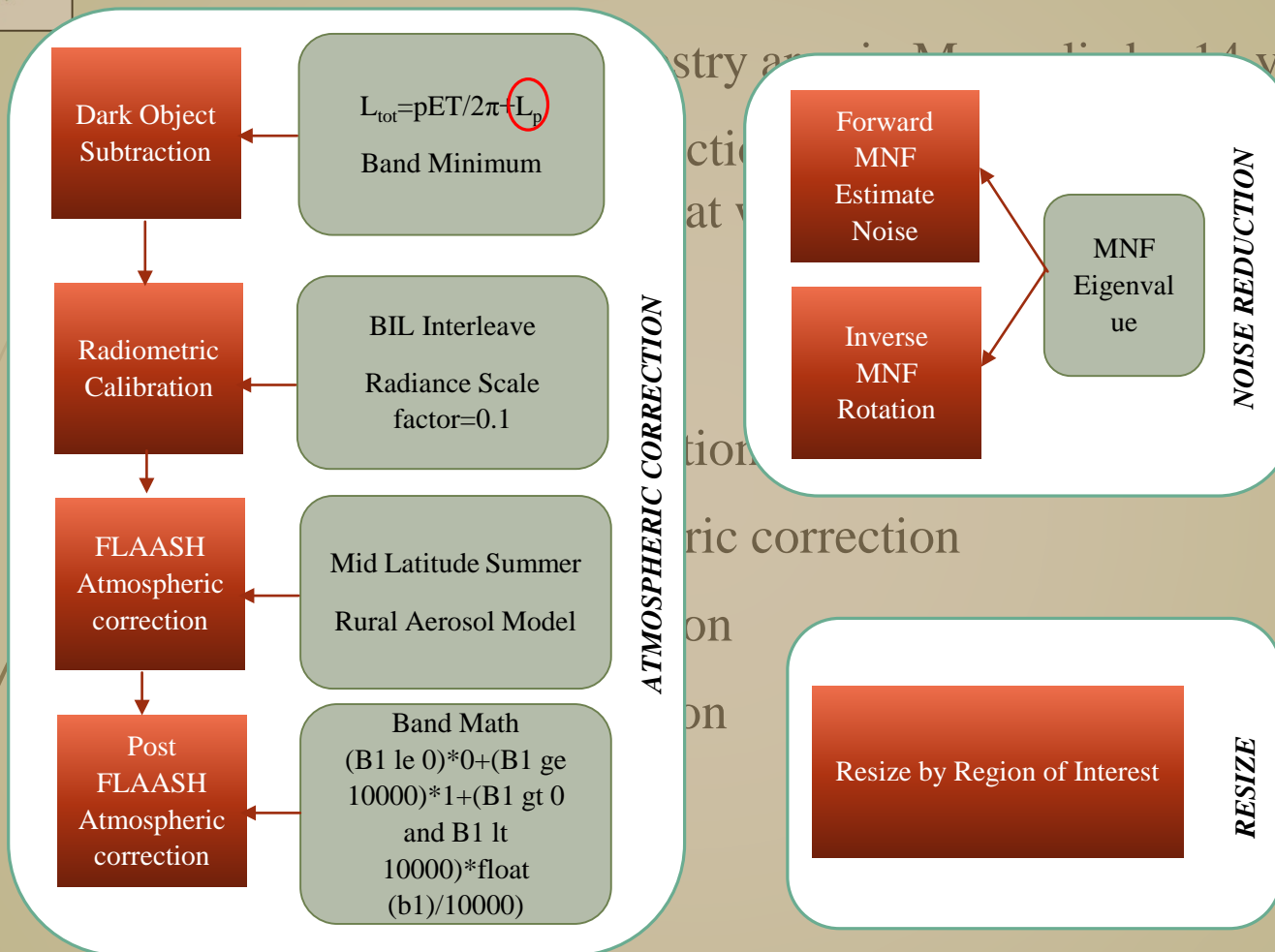
Vegetation index

What is the INDEX?

➤ There is different types of indexes for the vegetation and forest based on the green biomass and water absorption of the vegetation, photosynthetic process etc.

   Vegetation Index is:

➤ Increase biophysical characteristic of the vegetation, then increase spectral sensitivity.

Vegetation index

- Simple ratio $[SR=(\rho_{red}/\rho_{nir})]$

- Normalized difference vegetation index $[NDVI=(\rho_{nir}-\rho_{red})/(\rho_{nir}+\rho_{red})]$

- Triangular vegetation index

  $[TVI=0.5*(120*(\rho_{nir}-\rho_{green}))-200*(\rho_{nir}-\rho_{green})]$

- Soil adjusted vegetation index

  $[SAVI=((1+L)*(\rho_{nir}-\rho_{red}))/(\rho_{nir}+\rho_{red}+L)]$

- Atmospherically resistant vegetation index

  $[ARVI=(\rho_{nir}^*-\rho_{rb}^*)/(\rho_{nir}^*+\rho_{rb}^*)]$

- Soil and Atmospherically resistant vegetation index

  $[SARVI=(\rho_{nir}^*-\rho_{rb}^*)/(\rho_{nir}^*+\rho_{rb}^* + L)]$

- MODIS Enhanced vegetation index

  $[EVI=(\rho_{nir}^*-\rho_{red}^*)/(\rho_{nir}^*+c_1\rho_{red}^* - c_2\rho_{blue}^* + L) * (1 + L)]$

- Forest Index

  $[FI=((\rho_{nir}-\rho_{red} - L)/(\rho_{nir}+\rho_{red})) * ((c_1 - \rho_{nir})/(c_2 + \rho_{green}))]$

Forest Index

- State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan university introduced FOREST INDEX by paper named as "A Spectral index for highlighting forest cover from Remote sensing imagery" The International Society For Optical Engineering Conference – November 2014

- To make the process of forest cover mapping simple and rapid a simple spectral index called forest index (FI) was proposed to highlight forest land cover in Landsat scenes.

- The FI is derived from three bands, green, red and near-infrared (NIR) bands and an FI image can be classified into forest/non-forest map with a threshold.

- The overall accuracies of classification maps in the two study areas were 97.8% and 96.2%, respectively, which indicates that the FI is efficient at highlighting forest cover.

Forest Index

- As forest is a kind of vegetation, it is generally easy to discriminate forest from non-vegetation with the help of a kind of vegetation index (VI). So the key problem is how to distinguish forest from non-forest vegetation (NFV). To identify forest in remote sensing images, non-vegetation can first be eliminated by a kind of VI and then NFV can be discriminated according to the spectral difference between forest and NFV

- Reflectance of forest is usually lower than other vegetation in the visible and shortwave infrared (SWIR) bands

- L=0.01, c1=1, c2=0.1

$$MNDVI = \frac{\rho_{NIR} - \rho_{red} - L}{\rho_{NIR} + \rho_{red}}$$

$$\left(\frac{c_1 - \rho_{NIR}}{c_2 + \rho_{green}} \right)$$

Forest Index

Original map
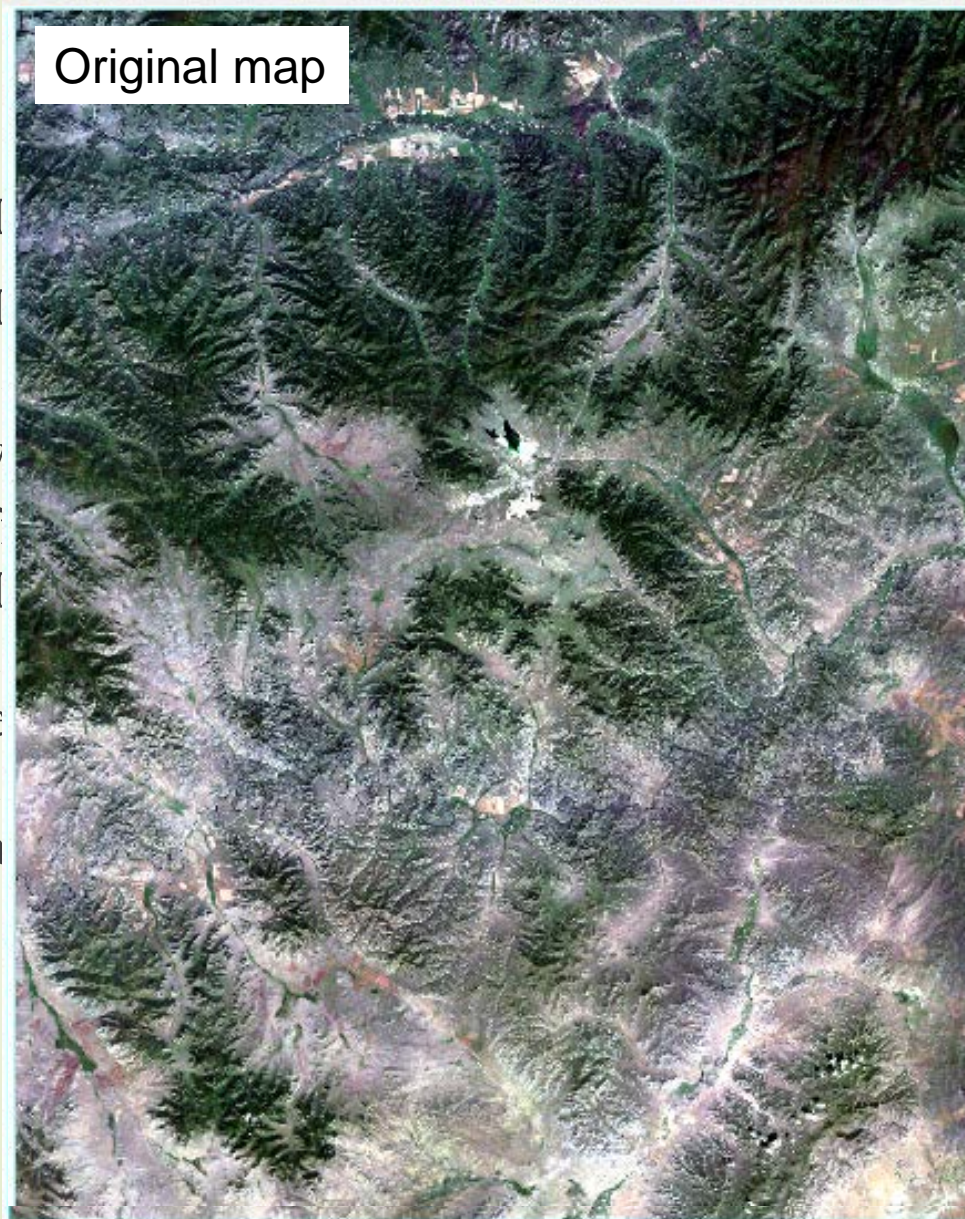
- FI
- FI ... forest, while a pi ... non-forest
- W ... ed by atmospheric ef... re calculating the FI... the green band and th... h (AOD) and will be... In this situation, th... and the pixel ca... shold.

Comparison on Google earth
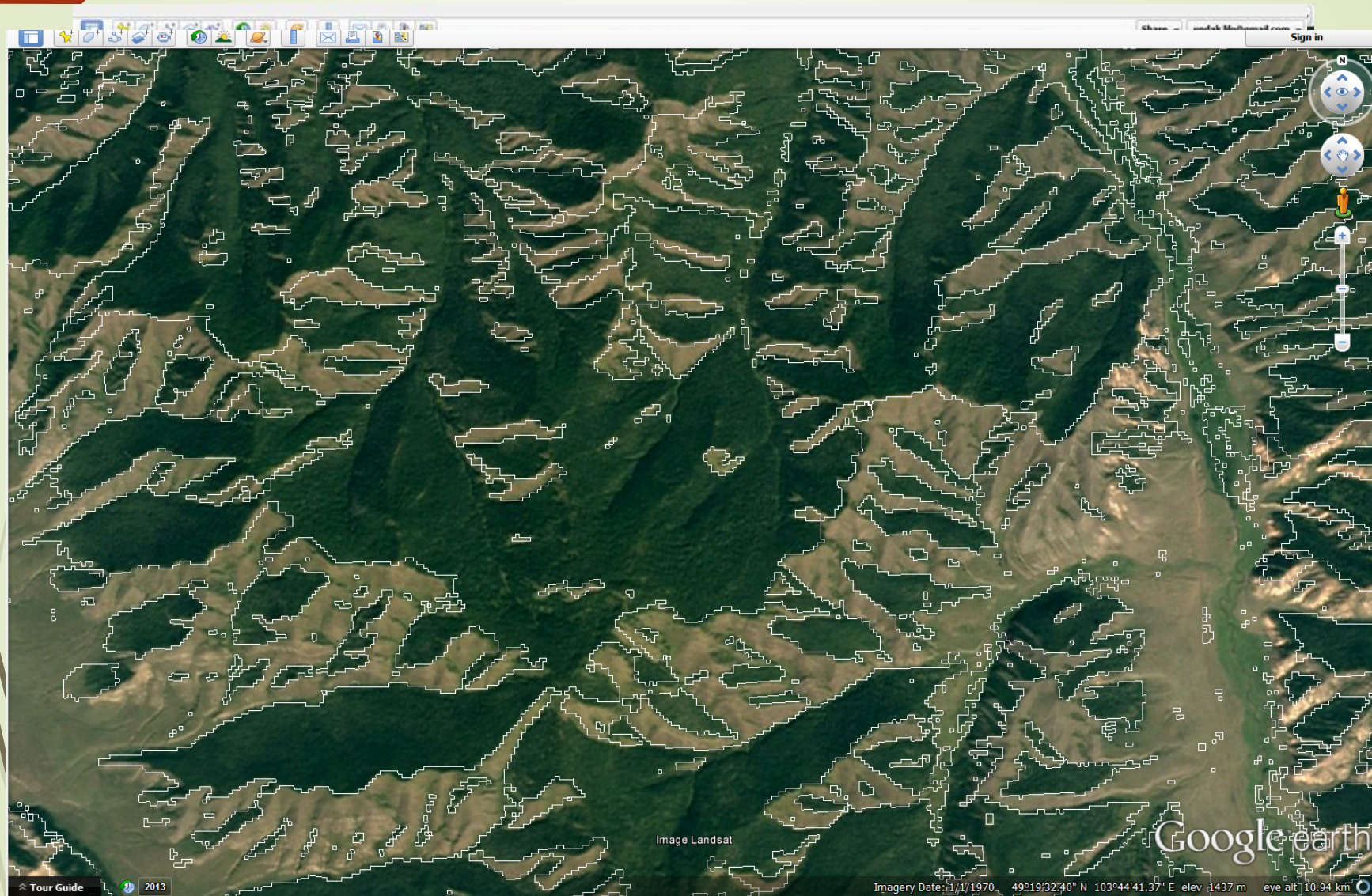
Processing

- 682 scenes completed by Processing from 765 scenes

- Resize – on Each scene

- Forest Index calculation

- Forest class /3.5-7/

- Export vector file

- Mosaic

- 2000-2014 for Bulgan province completed

- Area calculated for each year in Bulgan province

Union the vector file
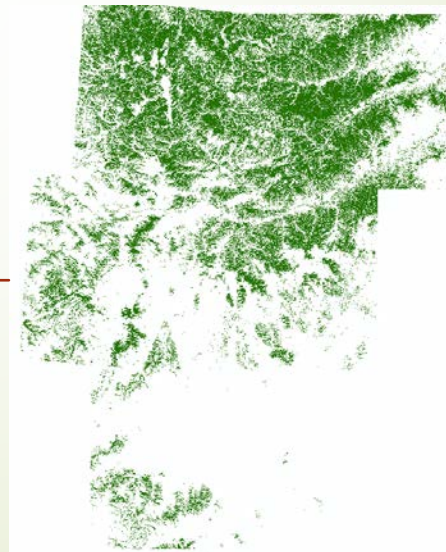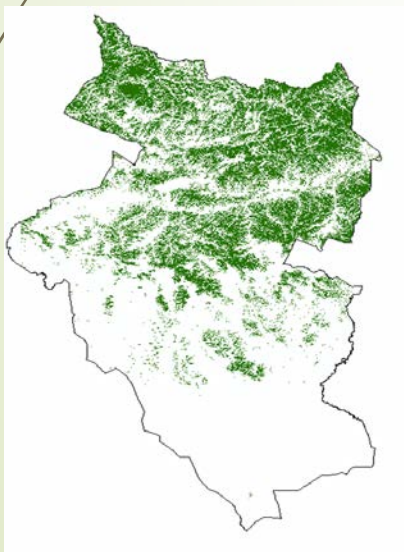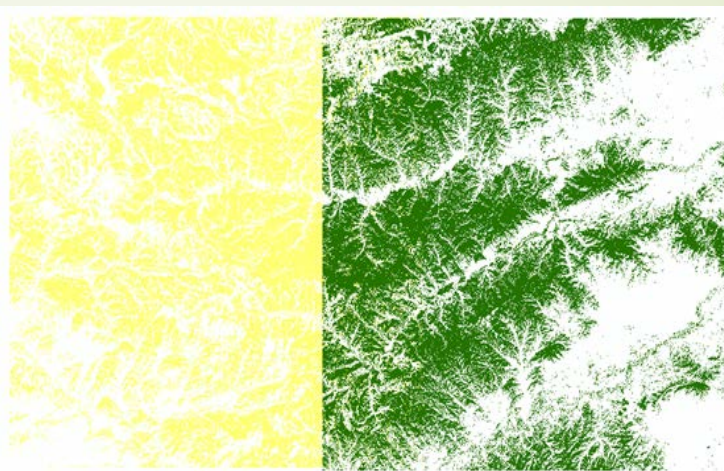
Calculate area of Bulgan Province

Year	Forest covered area (ha)	Bush	Shrub	Forested area
2000	1290079.88	16857.31	5488.95	1267733.62
2001	1296779.78	28585.90	5812.57	1262381.31
2002	1215751.58	32755.48	3958.06	1179038.04
2003	1100924.43	32384.40	3960.03	1064580.00
2004	1244045.20	20331.40	4270.12	1219443.68
2005	1172664.24	26266.94	4651.89	1141745.41
2006	1252245.38	11612.00	4479.88	1236153.50
2007	1139776.59	30708.46	3336.54	1105731.59
2008	1258187.93	20016.02	3800.09	1234371.82
2009	1171182.83	13865.02	2706.63	1154611.18
2010	1286162.45	9714.73	4493.52	1271954.20
2011	1425120.97	15907.86	8655.87	1400557.24
2013	1248467.51	19879.28	5985.35	1222602.88
2014	1361405.78	17206.63	6087.67	1338111.48

Forest cover change by 14 years

= 7377.1x + 1E+06
R^2 = 0.1291

Forest area

Bulgan Forest cover 2014

Total Area Calculated from Forest Index 2014: 1338111.48

Sponsorod by   APFNet

Completed by   ERISC
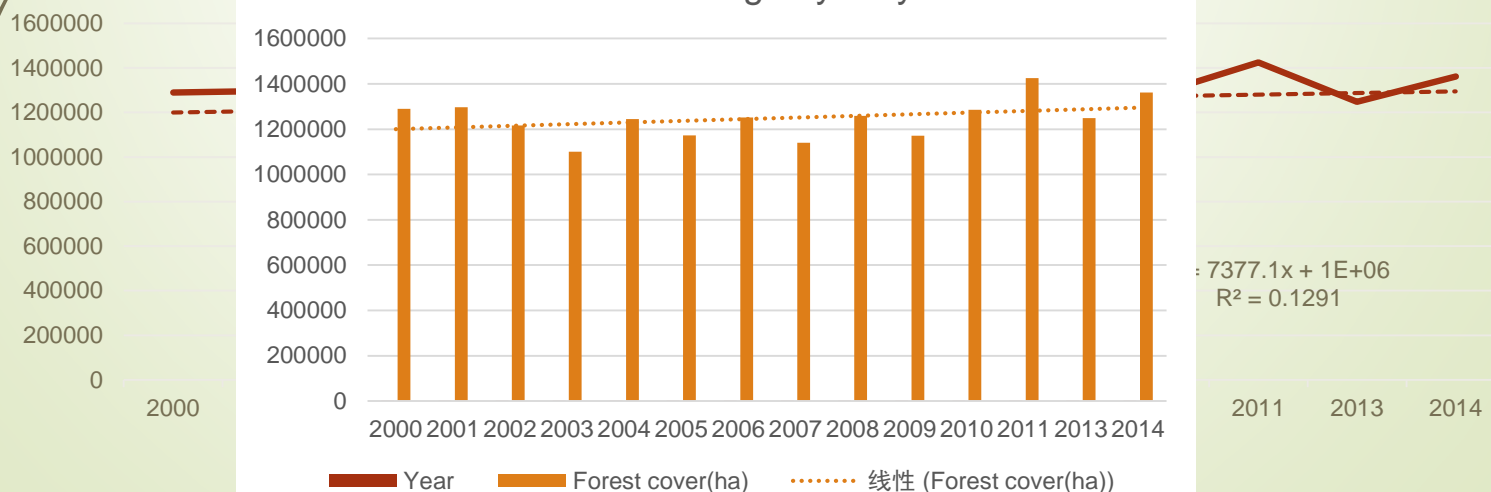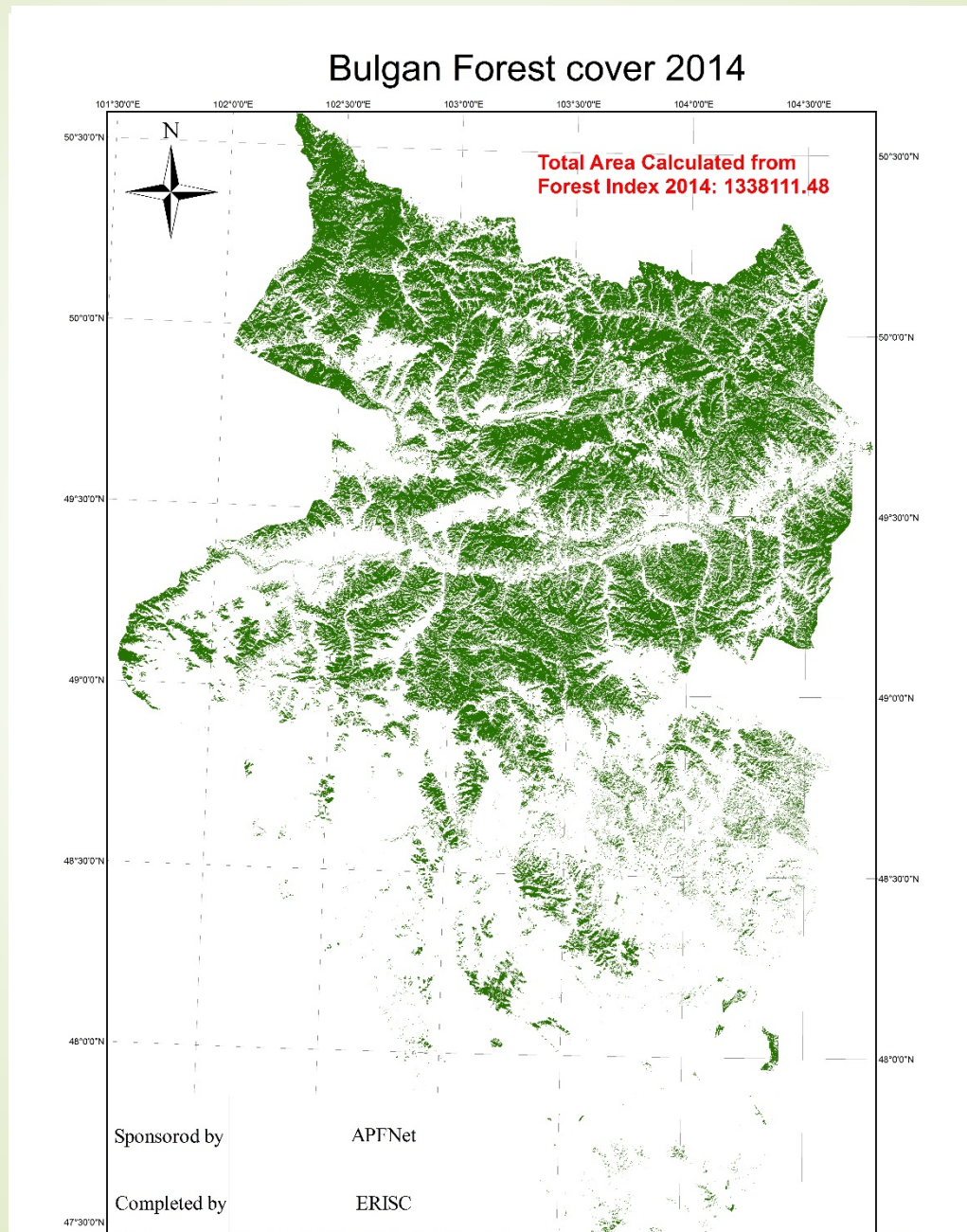
Accuracy assessment Buural Domuu

Accuracy Assessment for Buural Domuu forest community forest by Forest Index data

Total 1925 samples with forest
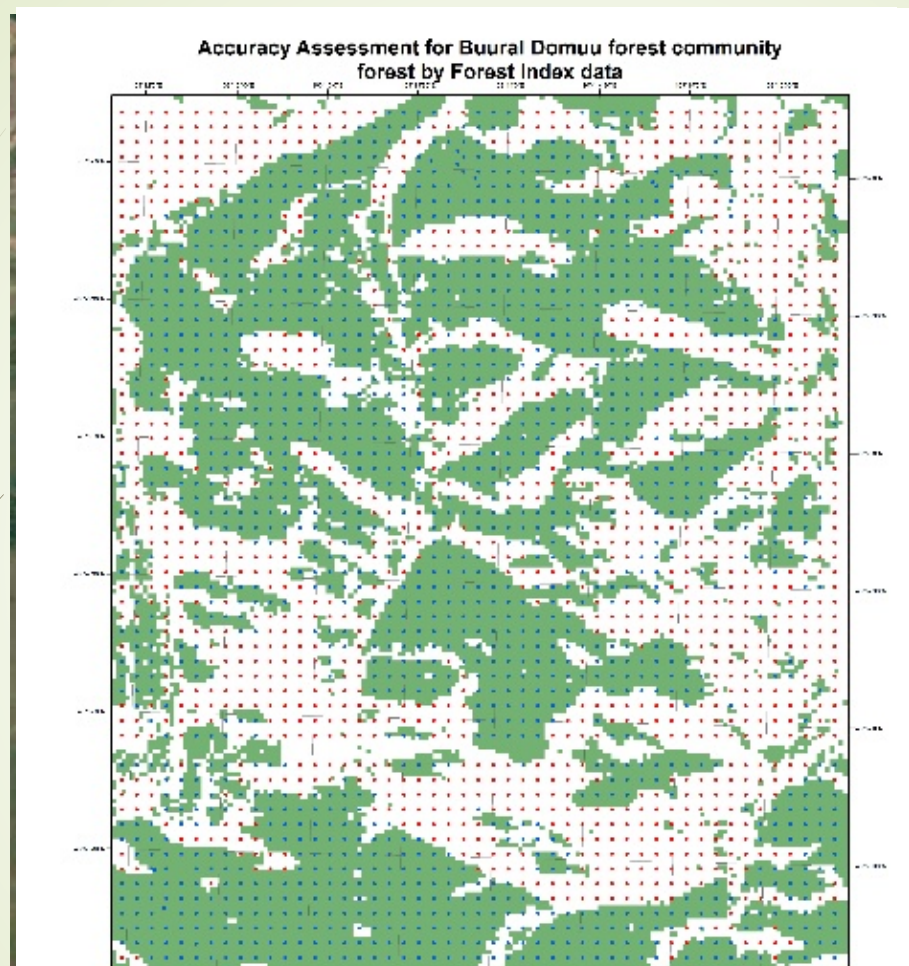
	In situ FOREST	In situ NONFOREST	Total	Percentage
Landsat FOREST	1664	317	1981	83.99798
Landsat NONFOREST	261	2373	2634	90.09112
Total	1925	2690	4615	41.71181
			87.4756	

Different classification method
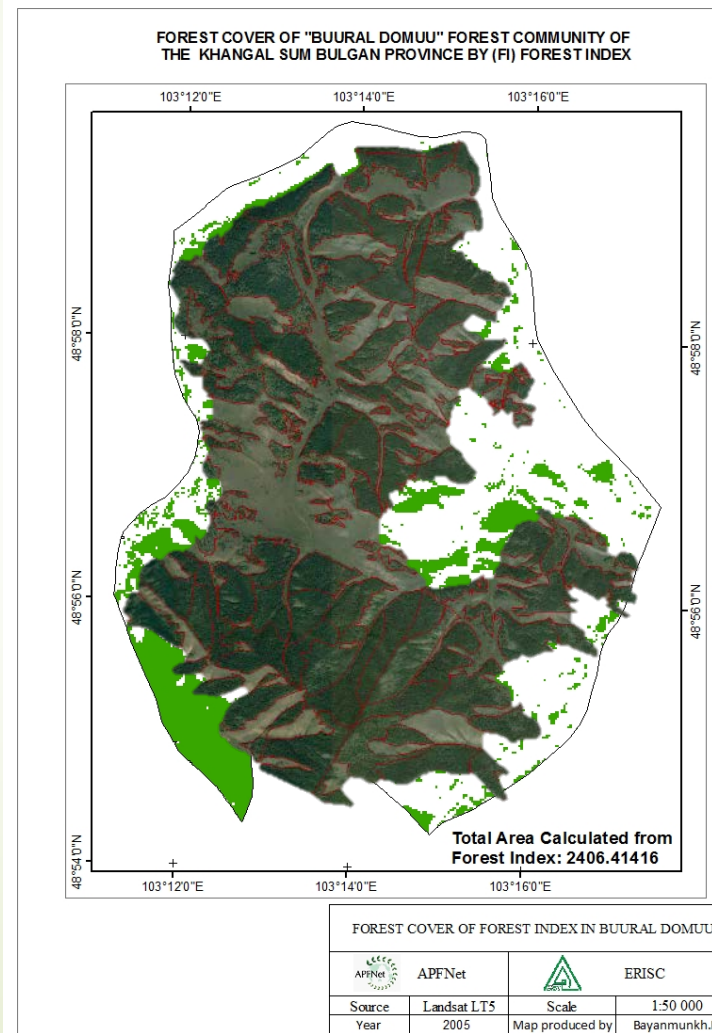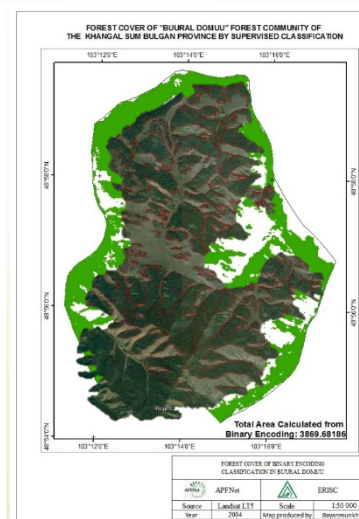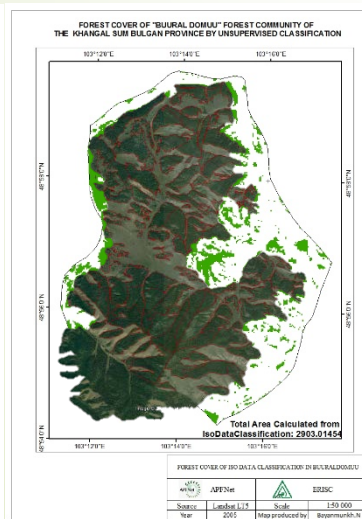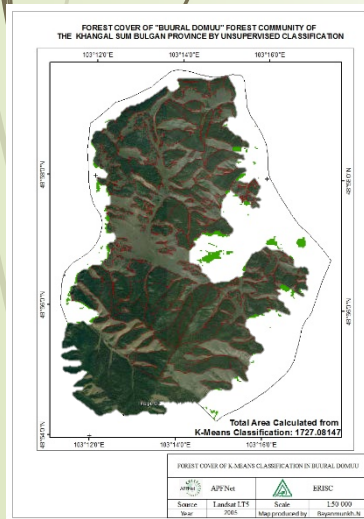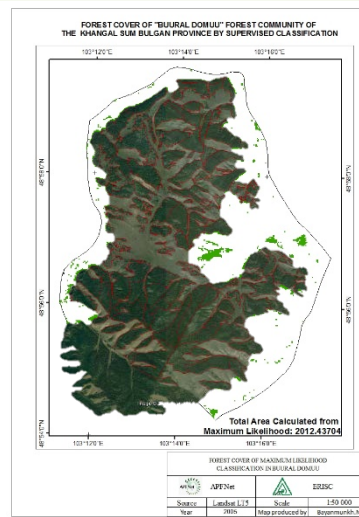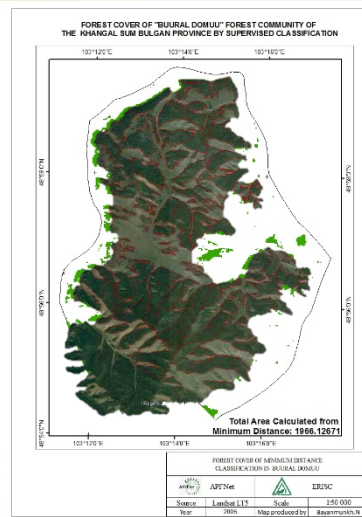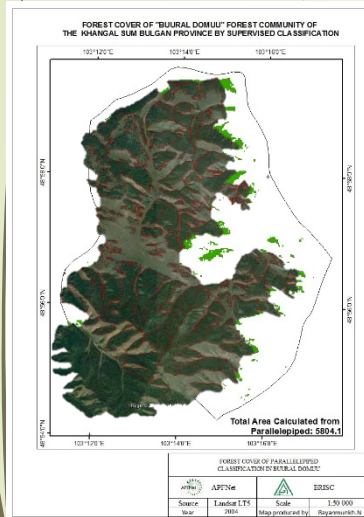
SAMPLE POINT FROM FIELD TRIP ON "BUURAL DOMUU"

Legend

Sample point

Buural Domuu border
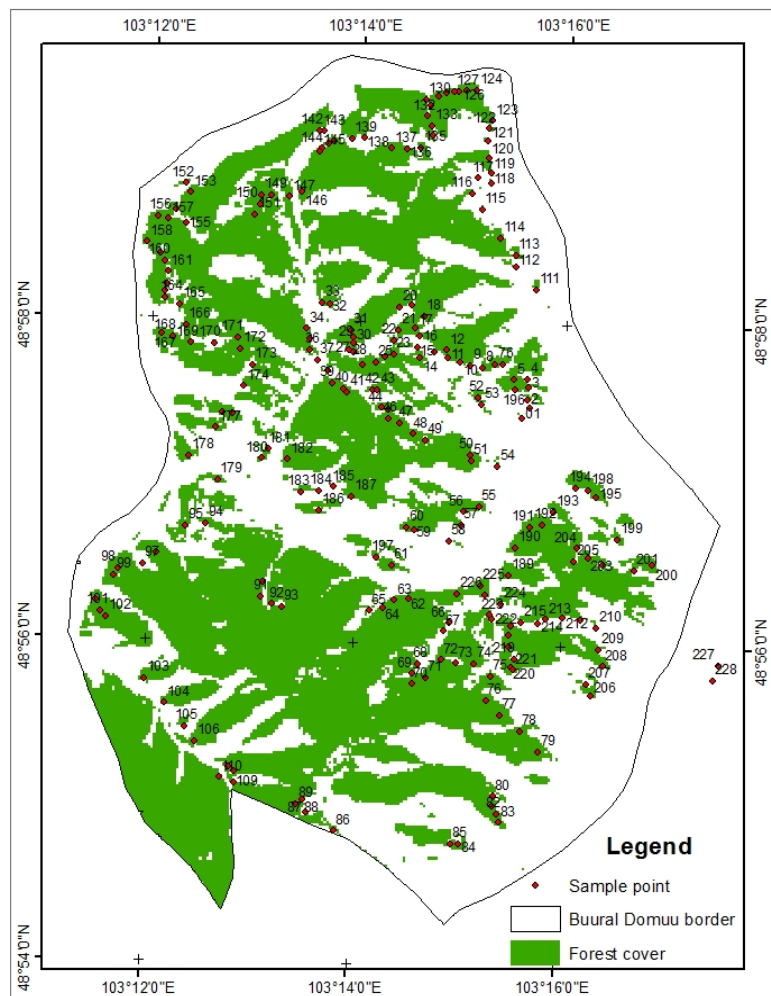
Forest cover

FOREST COVER OF FOREST INDEX IN BUURAL DOMUU

APFNet		ERISC	
Source	Landsat LT5	Scale	1:50 000
Year	2015	Map produced by	Bayanmunkh.N

SAMPLE POINT FROM FIELD TRIP ON "KHANBUYN"
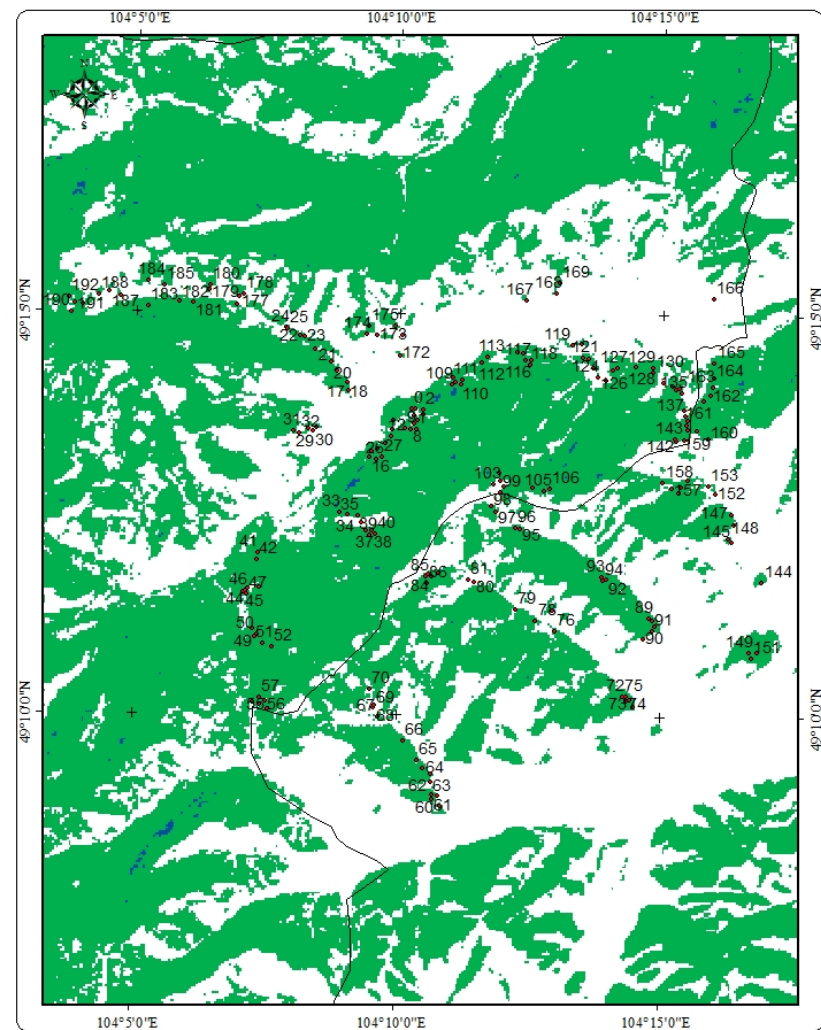
Legend

Sample point

Khanbuyn border

Forest cover

FOREST COVER OF FOREST INDEX IN KHAN BUYN

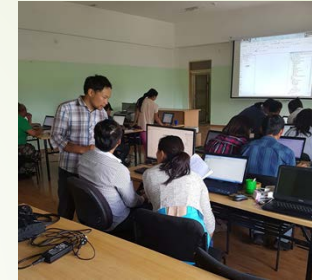| APFNet		ERISC	
Source	Landsat LT5	Scale	1:100 000
Year	2015	Map produced by	Bayanmunkh.N

First On Job training

- First On Job training completed (In class and survey class) – Including 35 people

Thank you for your attention