Food and Agriculture Organization of the United Nations

SUSTAINABLE DEVELOPMENT GOALS

APCAS/24/A2.4

ASIA AND PACIFIC COMMISSION ON AGRICULTURAL STATISTICS

30TH SESSION

19–24 May 2024

Kathmandu (Nepal)

NATIONAL
STATISTICS OFFICE
OF MONGOLIA

MONGOLIAN EXPERIENCES WITH EO DATA

EXPERIENCES USING EO DATA FOR AGRICULTURE STATISTICS

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Agriculture, Environment and Industrial Statistics Division

Economic Statistics Department

EO DATA - BACKGROUND INFORMATION - MONGOLIA

Lead Ministry/Agency	National statistics office of Mongolia
Policy mandate	Ministry of food, Agriculture and Light industry
Legislative mandate (if any)	National statistics office of Mongolia
Stakeholders involved	• World Bank • National statistics office of Mongolia • Ministry of food, Agriculture and Light industry • Agency for Land administration, management geodesy and cartography • Institute of Geography and Geo-ecology
Interagency collaborations	National statistics office of Mongolia and Agency for Land administration, management geodesy and cartography are shares cadastral and agricultural data each other.
Privacy legislation	• Law about transparency of public information • Law about the protection of personal information
Privacy considerations	NSO is working to implement the ISO 27001 standard for information security.

EO DATA - BACKGROUND INFORMATION - MONGOLIA

Satellite imagery source(s)	• Free sources • Sentinel-2
Type of imagery used (optical, SAR, etc.; including satellite system)	Optical imagery (The optical payload it carries has visible, near-infrared, and infrared sensors, which provide a total of 13 spectral bands)
Spatial and Temporal resolution	• Spatial – 10m, 20m, 60m • Temporal – 10 day
Ancillary data	• Cadastral parcel data • Agricultural statistics data
Data processing (infrastructure on-site or cloud-based)	Including infrastructure on-site and cloud-based /GEE/
Area covered by EO data analysis (national/sub-national)	Sub-national (Tarialan, Khutag-Undur, Kharkhorin, Zuunburen, Orkhon, Jargalant, Umnudelger soums)

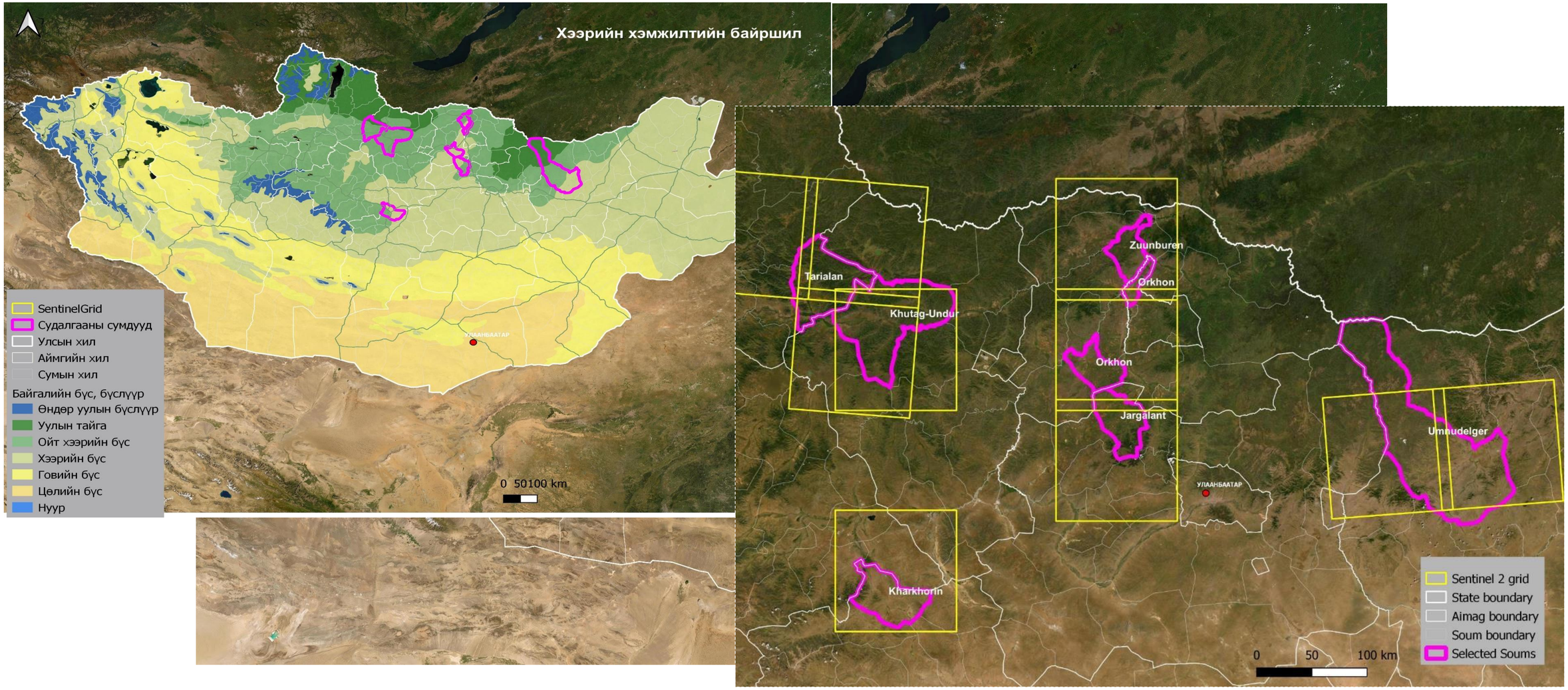
EO DATA - BACKGROUND INFORMATION - MONGOLIA

Crops covered	• Wheat • Rapeseed • Potatoes
Statistics produced (ex. Crop type mapping, area estimation)	Area estimation of crop types
Frequency that statistics are produced	Ones
Dissemination of statistics	• By administrative units • Crop types
Size of geospatial team	Two persons
Roles in geospatial team	• Use remote sensing • Use satellite data • Determine the size of cropland in key agricultural regions by type of crop and to measure total harvest and yield per hectare by plant type.

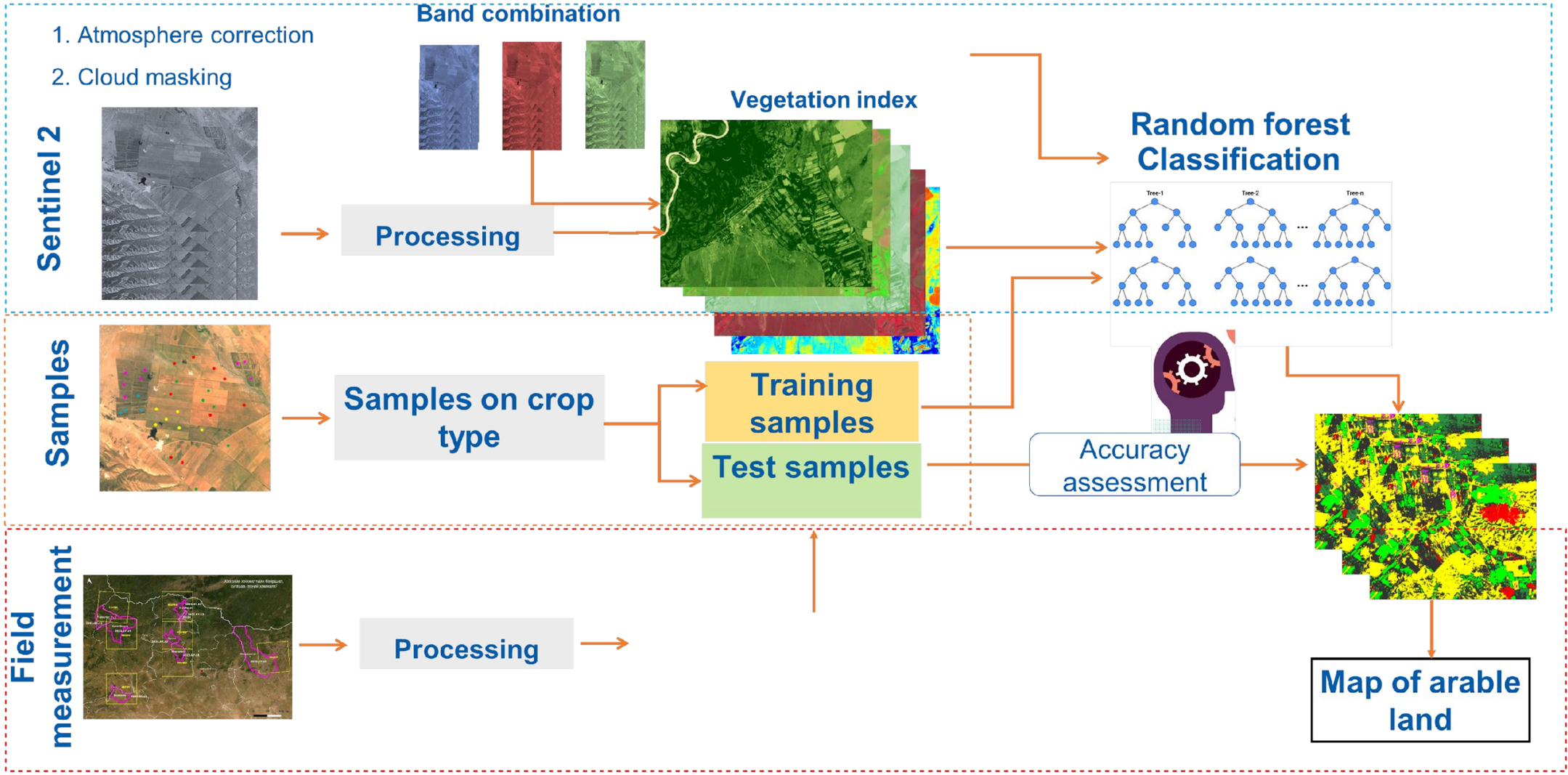
IN-SITU DATA– MONGOLIA

Data/survey source	. On site data . EO data /Sentinel-2/
Lead agency	National statistics office of Mongolia
Sampling approach	Collected samples once for define methodology
Data collection approach	Paper questionnaire
Variables collected	. Sown area . Crop type
Frequency of data collection	Ones

STUDY AREA

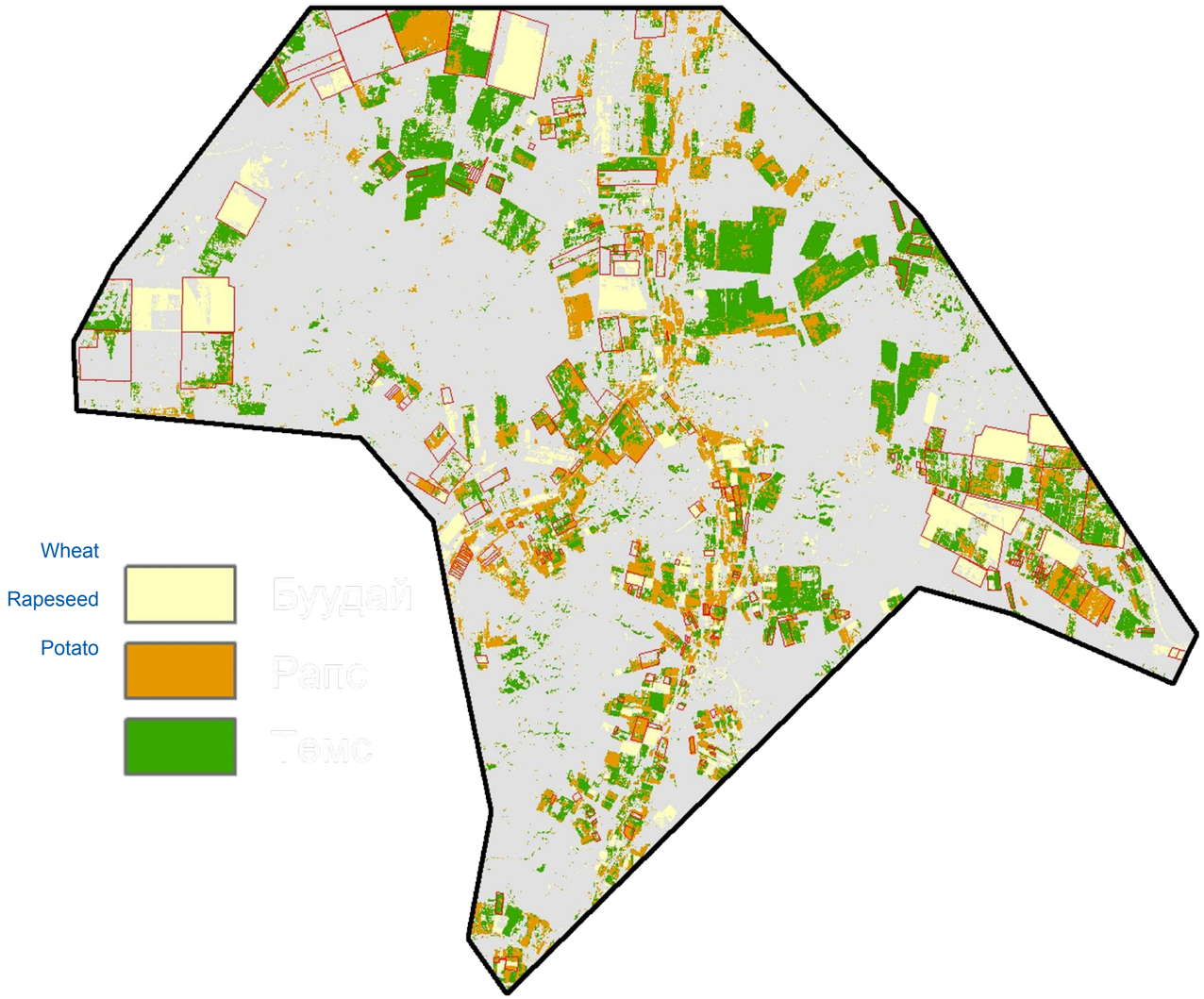

Хээрийн хэмжилтийн байршил
SentinelGrid
Судалгааны сумдууд
Улсын хил
Аймгийн хил
Сумын хил
Байгалийн бүс, бүслүүр
Өндөр уулын бүслүүр
Уулын тайга
Ойт хээрийн бүс
Хээрийн бүс
Говийн бүс
Цөлийн бүс
Нуур
0 50100 km
Tarialan
Khutag-Undur
Zuunburen
Orkhon
Orkhon
Jargalant
Umnudelger
Kharkhorin
УЛААНБААТАР
0 50 100 km
Sentinel 2 grid
State boundary
Aimag boundary
Soum boundary
Selected Soums

METHODOLOGY №1- RANDOM FOREST



RESULT

Overall accuracy - 76.92 %
kappa coefficient - 63.2%



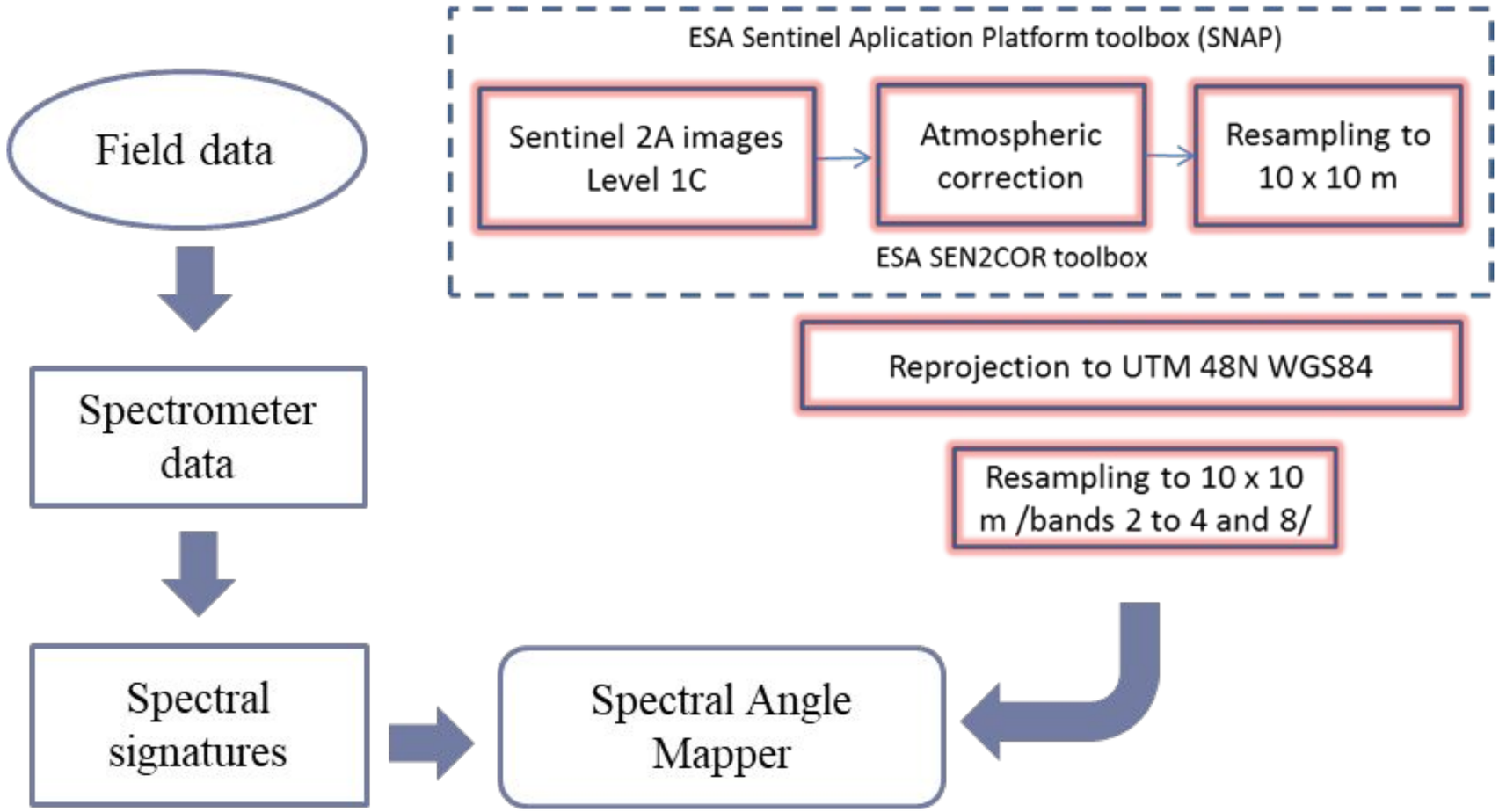
CHALLENGES

- In random forest methodology, it is important to identify the sample and correctly identify the type of crop. There was a lack of current records to accurately differentiate cropland by crop type during the survey.

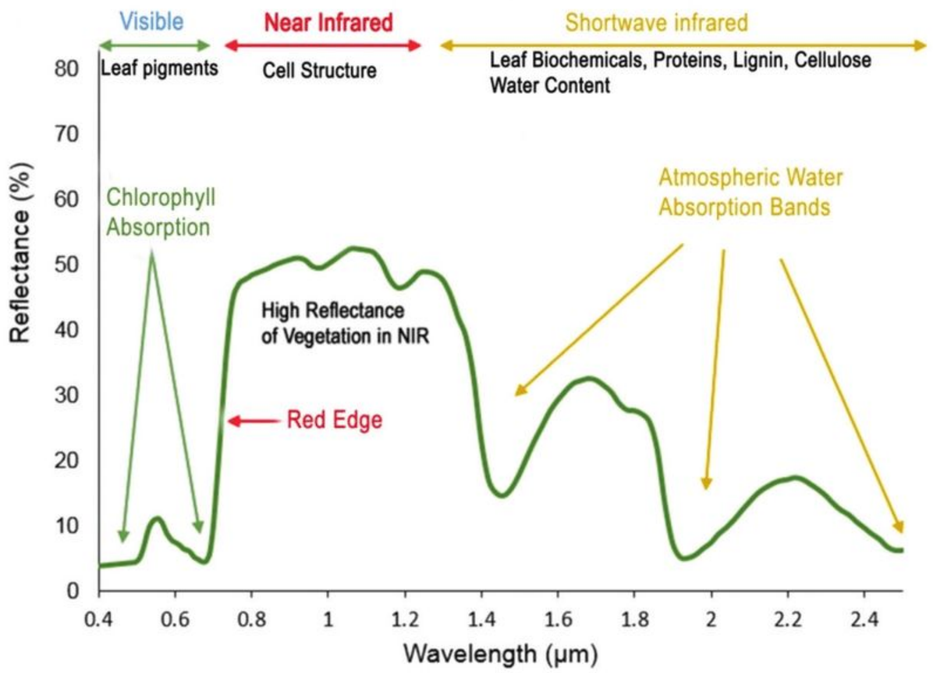
- Satellite imagery is time-consuming to prepare and process, and a need for a dedicated server for storing and back-up or cloud-based was necessary.

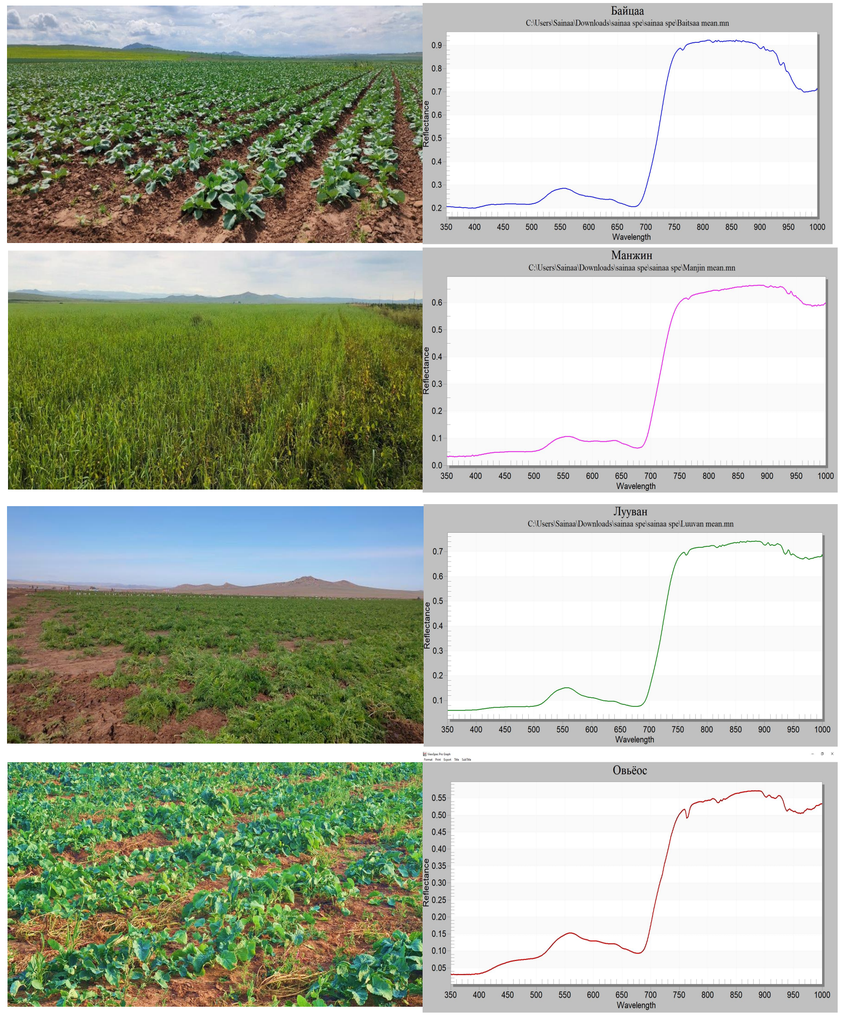
- Accurate assumptions and decisions can be made, but it takes time and effort to calculate the data for each decision tree.

METHODOLOGY №2. SPECTRAL ANGLE MAPPER (SAM)



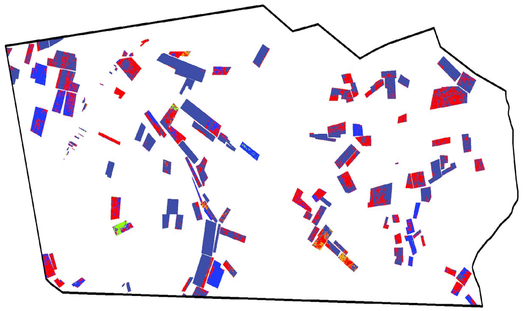
METHODOLOGY №2. SPECTRAL ANGLE MAPPER (SAM)





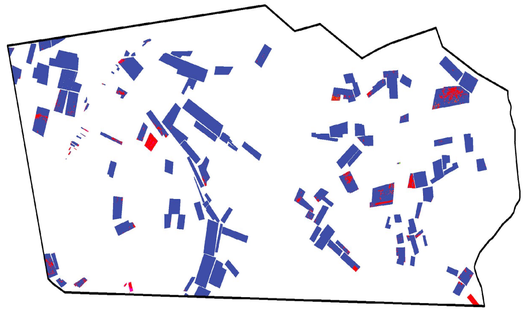
METHODOLOGY №2. SPECTRAL ANGLE MAPPER (SAM)

2016

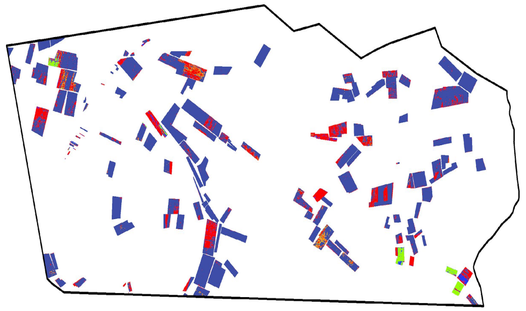


2018

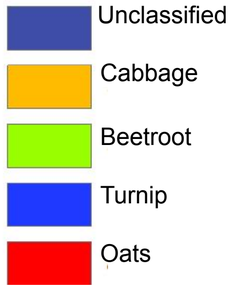
2019



2020



Overall accuracy - 92.85%
Kappa coefficient - 89%



CHALLENGES

- Compile a spectral database of cultivated plants to establish spectral signatures to measure quality,

- Record the spectral values of major pasture vegetation in order to distinguish pasture areas in addition to crop types.

COMPARISON OF METHODOLOGY

Methodology	Strengths	Weaknesses
Random forest	Commonly used	Data to use not available yet
	Used by other international researchers in their research	Depends on the resolution of satellite data
	It is possible to estimate crop yields	
SAM	No large amount of information is required	Vegetation spectral indices data not available yet
	It has good accuracy based on vegetation spectral index data	Depends on the resolution of satellite data
	It is possible to estimate crop yields	

EO DATA– CHALLENGES AND SOLUTIONS

Challenges:	Solutions:
Spatial and Temporal Resolution	Multi-Sensor Data Fusion
Crop Spectral Similarity	Feature Selection and Index Calculation
Cloud Cover and Atmospheric Conditions	Field data and validation
Field Heterogeneity	Cloud and Atmospheric Correction
Large area	Open Data and Collaborative Platforms
Lack of human capacity	Customized Classification Approaches
Data Availability and Cost	

CONCLUSION

As for the methodology, our experience shows:

- Apply the SAM method for crop type classification.
- Apply the Random forest for crop yield estimation.

As for further action to be taken to apply this test into practice:

- To develop an open source system similar to Sen2Agri system based on the SAM and Random forest methods in the future.
- To allocate more budget and train the NSO’s human resources for remote sensing,
- To explore possibilities of using remote sensing in next Agricultural Census in Mongolia.

NATIONAL
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THANK YOU FOR YOUR ATTENTION!

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