

REMOTE SENSING DROUGHT MONITORING AND ASSESSMENT BASED ON MODIS DATA IN MONGOLIA

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CONTENT

- Introduction
- Specifications of Mongolia
- Climate change in Mongolia
- Disaster situation
- Drought Monitoring
 - Operational RS works
 - Ground measurements

INTRODUCTION

In the recent years, climate change has been one of our major problem.

Furthermore, drought is the single most important weather-related natural disaster.

Therefore, we need to use spatial techniques of Remote Sensing for drought monitoring

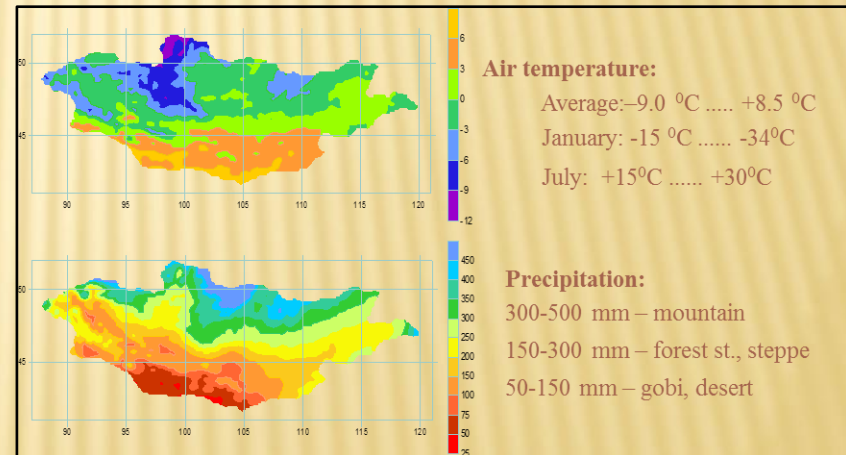
BACKGROUND

Mongolia is a landlocked country located in Central Asia. The highland with an area of 1,565,000 km² and a population of 3 million, The country is bordered by Russia to the north and China to the south, east and west.



- Land locked
- Different Natural zones
- Severe Continental Climate (4 seasons, long winter, short summer)

- Economy based on Agriculture/ Animal Husbandry (> 40 mln livestock, pasture > 90%)
- Less industry (mining)
- Low density of human population 3. million/1,565 mln sq.km 50% - in capital city (UB)
- Few bigger cities and towns

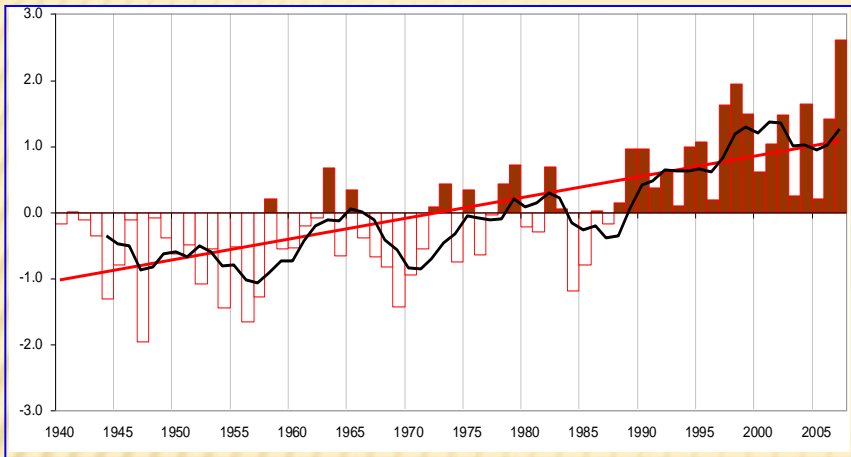


Mongolia nature and geography

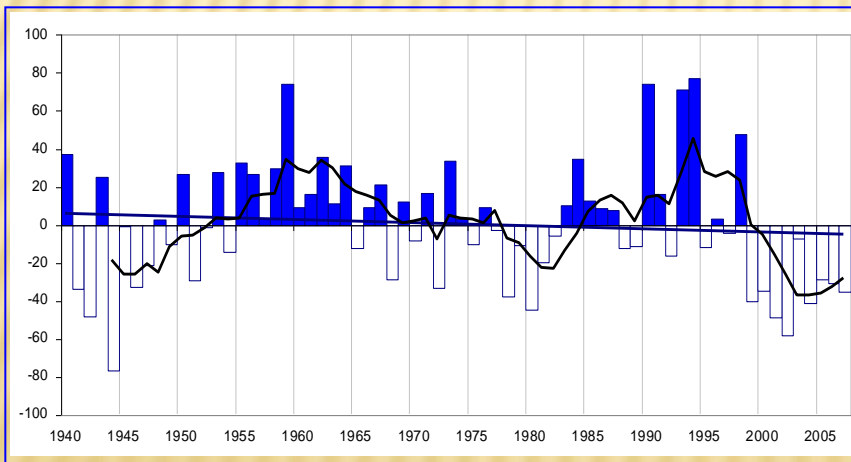
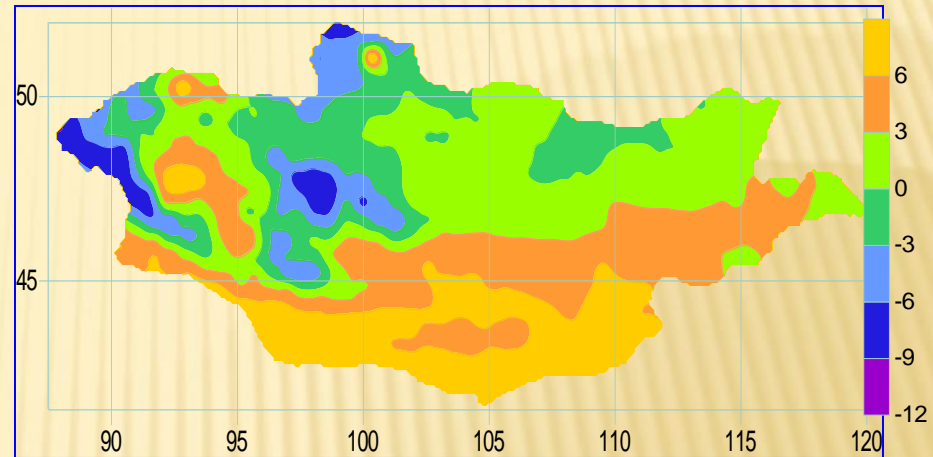
Mongolia has one of the coldest climates in the world, with temperatures dropping below -25°C for several months each year. And but summer is hot and not so long. Therefore Mongolia is known to the world as a country of "Blue Sky" 4

CLIMATE CHANGE IN MONGOLIA

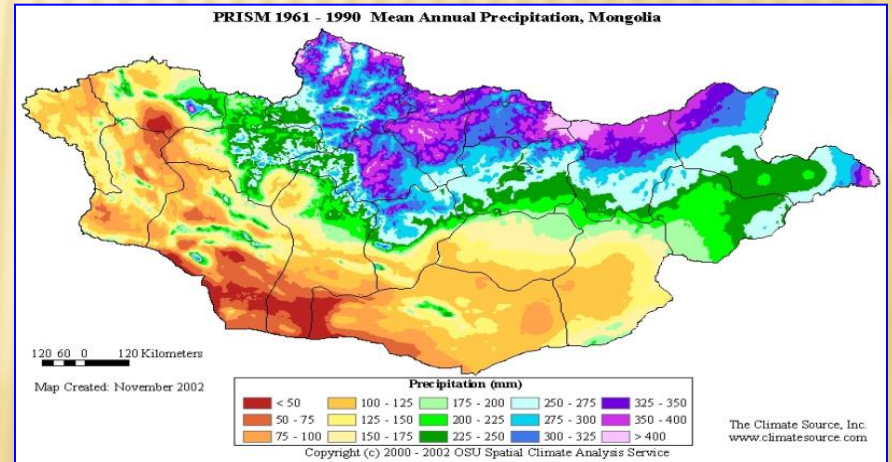
CURRENT SITUATION:



Annual mean Air temperature change trend since 1940
Increased in 2.1degree C



Annual precipitation change trend since 1940
Decreased in 7%



DISASTER SITUATION OF MONGOLIA (MAIN DISASTERS)

Drought

Major Disaster in Mongolia

Drought, Dzug, (Fire)

- ✘ Dzug- harsh winter(cold+heavy snow)
- ✘ **Drought** occurs every year affecting 30 – 70% of total area=> inadequate pasture, hay and fodder.
- ✘ Drought in summer followed by dzud in winter => livestock lossess.



Storms



Dust storm

Dzug (Winter storms)



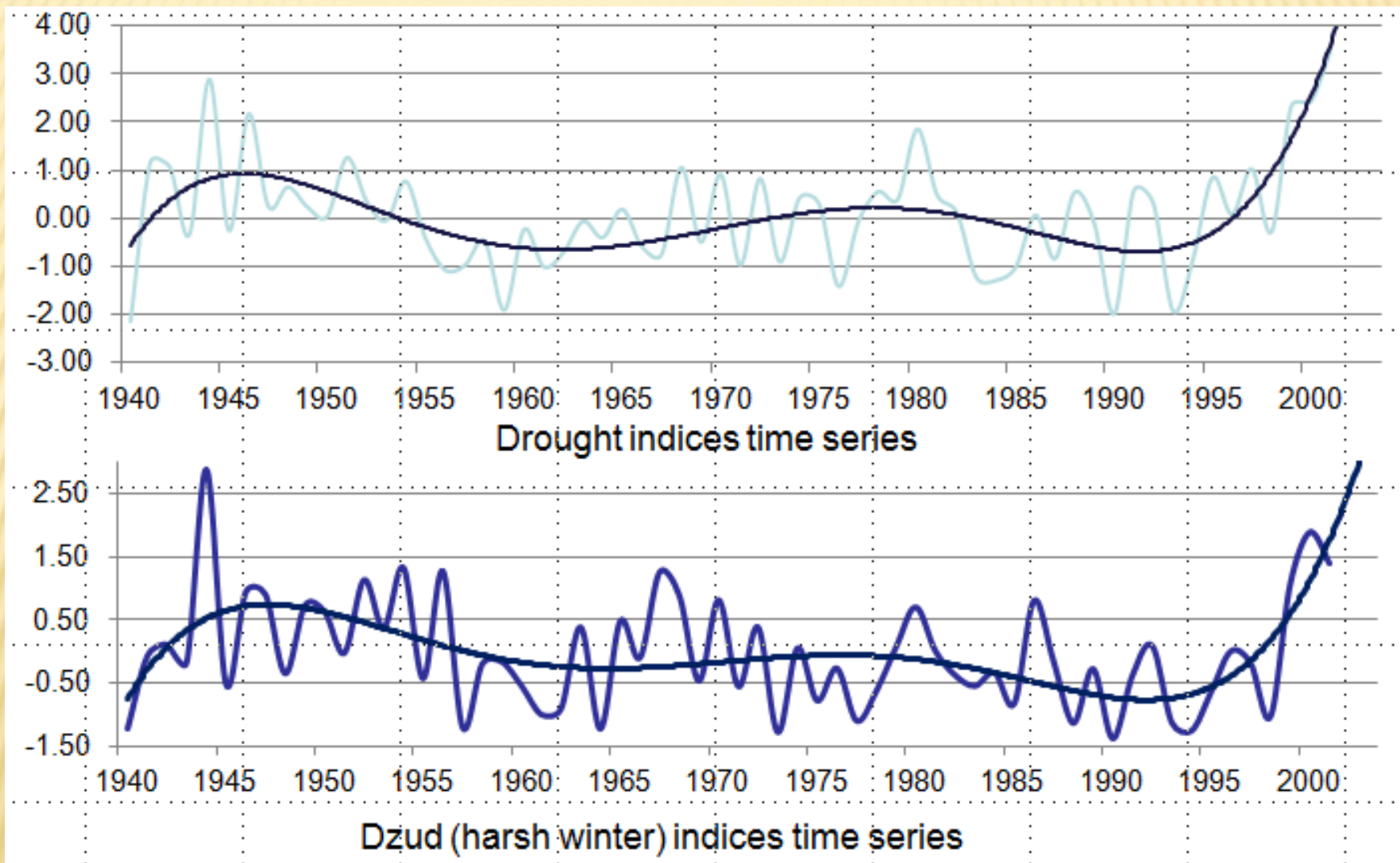
Winter storms

Wildfire



Wildfire

DROUGHT MONITORING



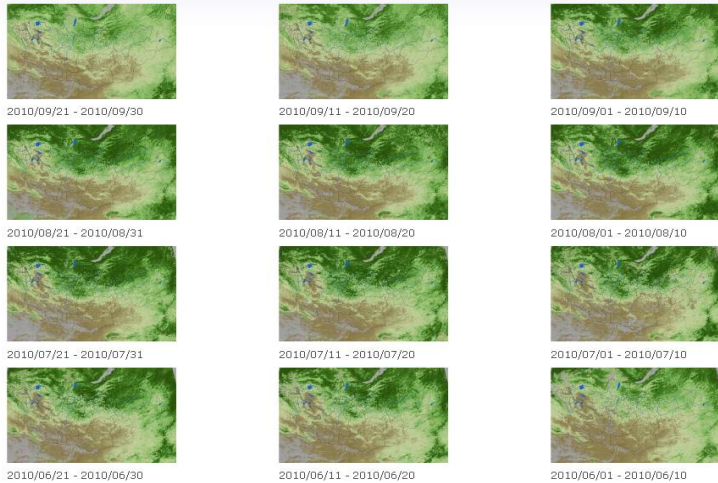
The intensity, frequency and area of natural hazards/natural disasters are increasing
(L.Natsagdorj et al, 2004)

Pasture & Drought monitoring using satellite data

National Remote Sensing Center / – responsible for Satellite data receiving, processing and servicing (**Aqua, Terra/MODIS, Soumi-NPP, NOAA, MetOp-B, FY-2**).

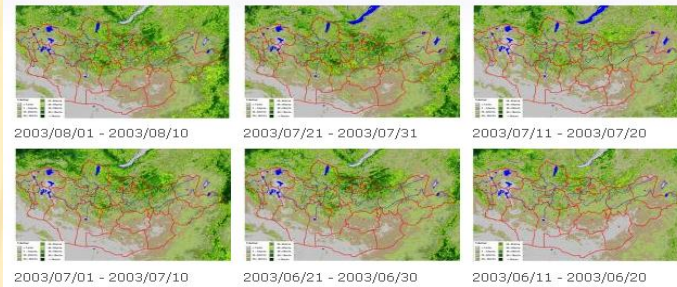
MODIS/NDVI data, 250m, 10 daily

MODIS Products - Vegetation Maps

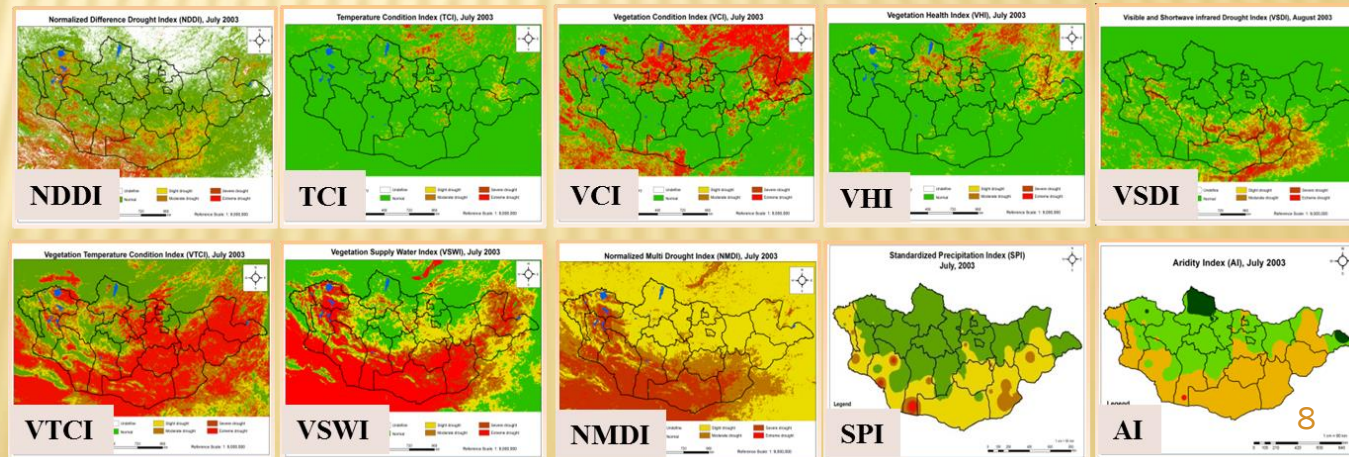


Biomass and pasture, NOAA 19 data, 10 days

NOAA Products - Biomass Maps



MODIS/ Drought index, 10 days



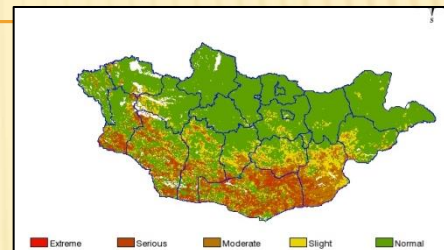
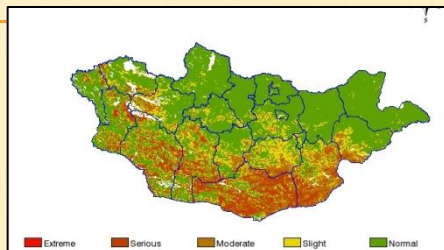
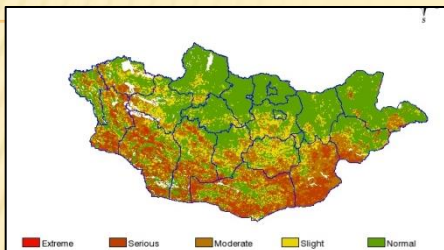
NDWI Drought index

1st 10 day

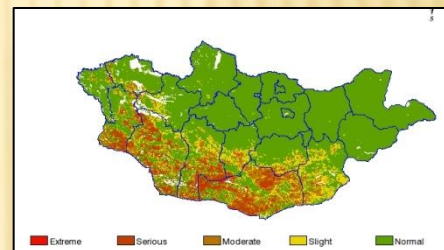
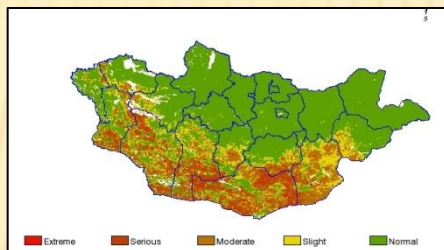
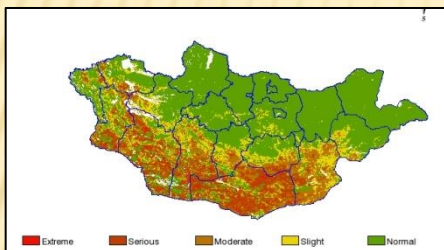
2nd 10 day

3rd 10 day

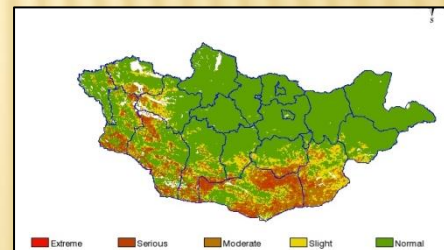
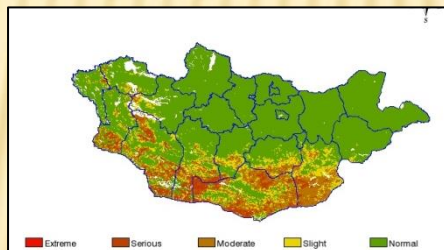
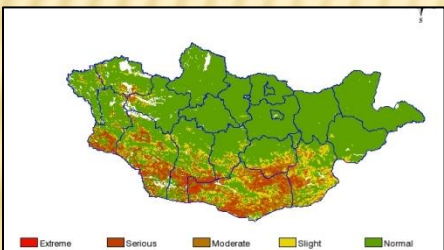
May



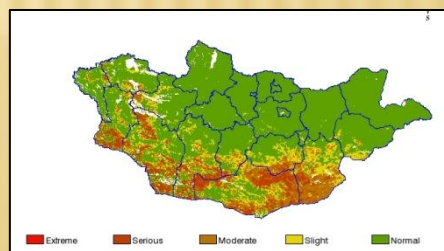
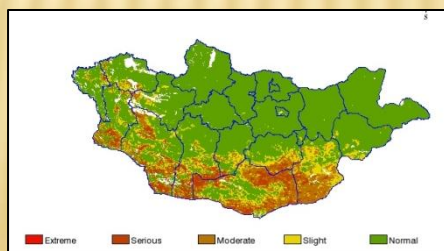
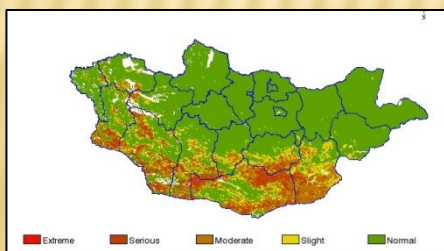
June



July



August



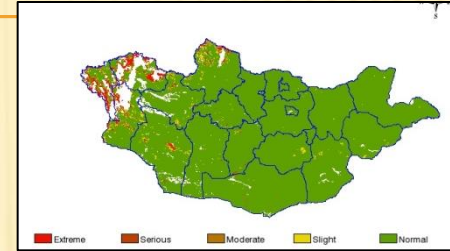
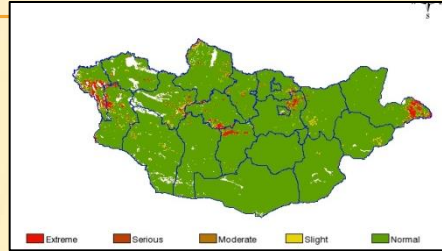
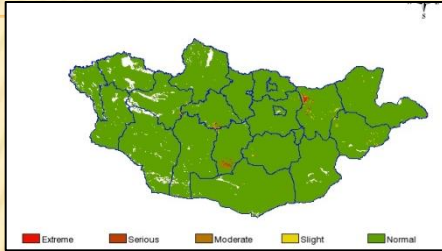
VCI Drought index

1st 10 day

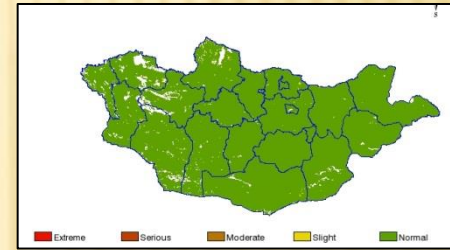
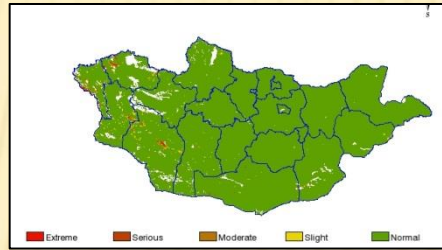
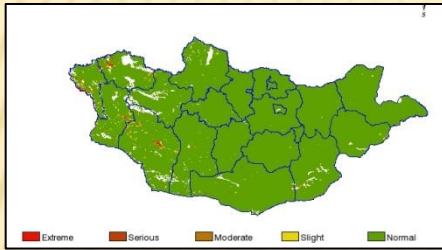
2nd 10 day

3rd 10 day

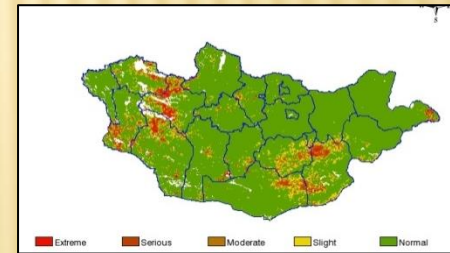
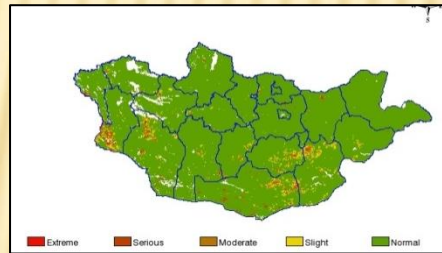
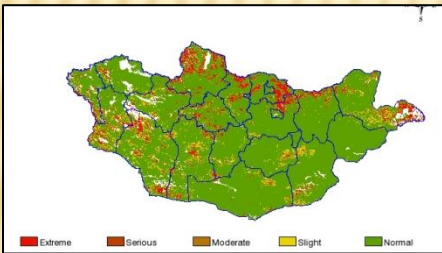
May



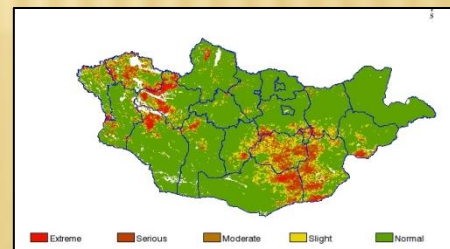
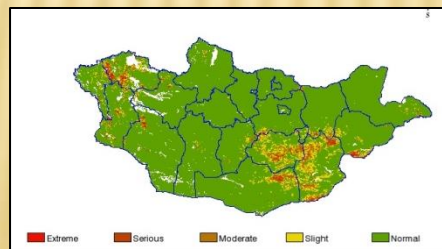
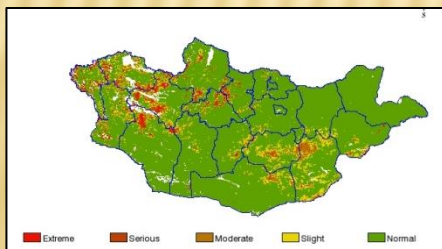
June



July



August



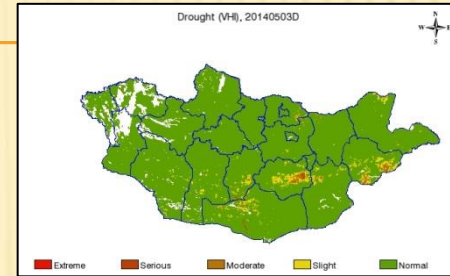
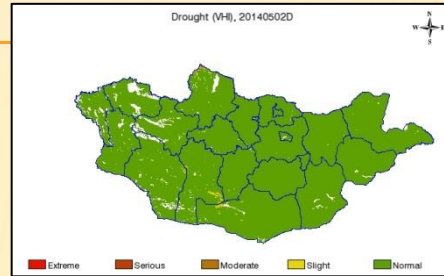
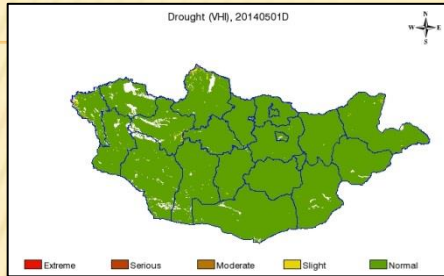
VHI Drought index

1st 10 day

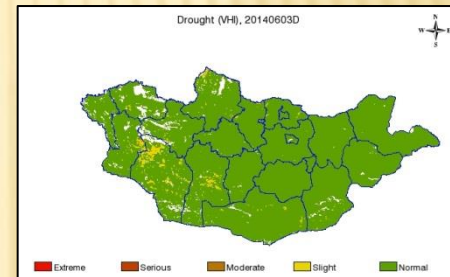
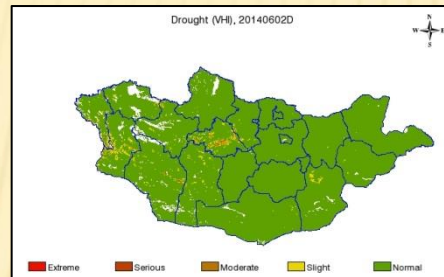
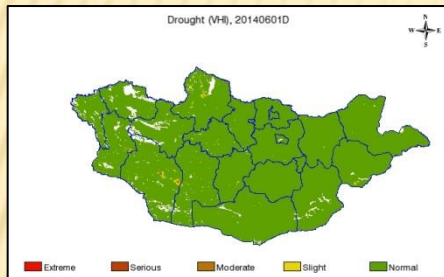
2nd 10 day

3rd 10 day

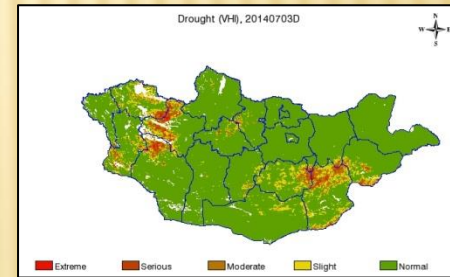
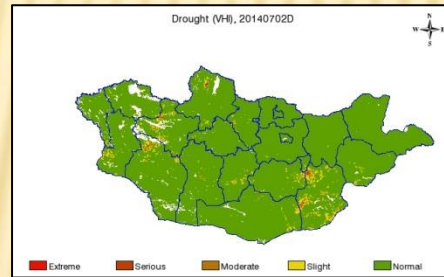
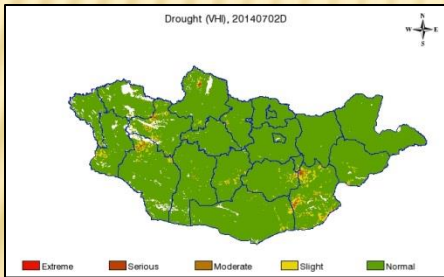
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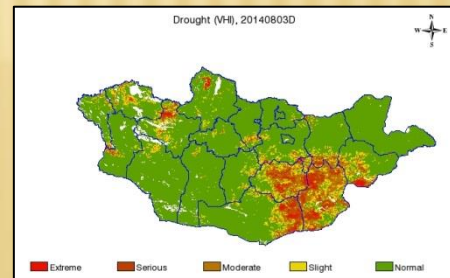
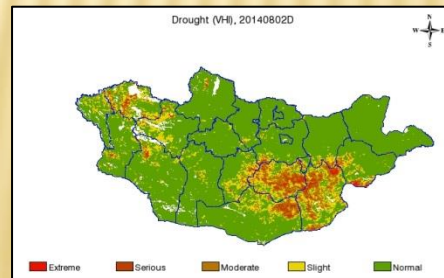
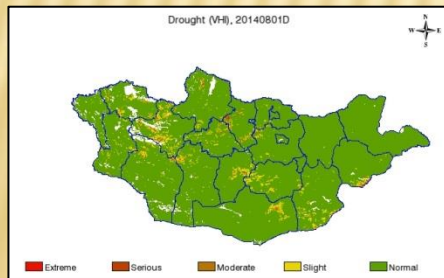
June



July

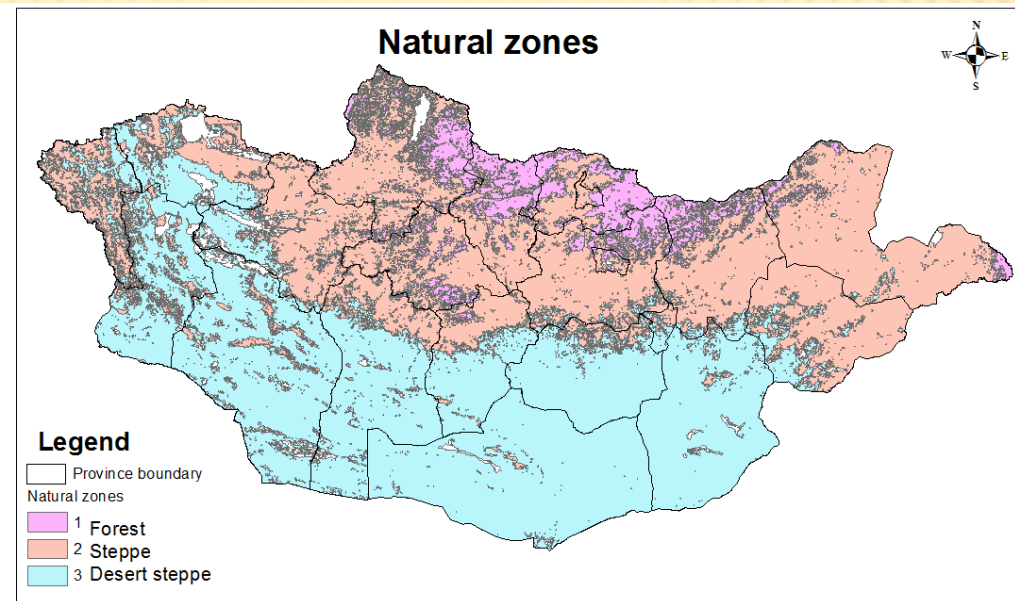


August



Drought statistic by natural zones

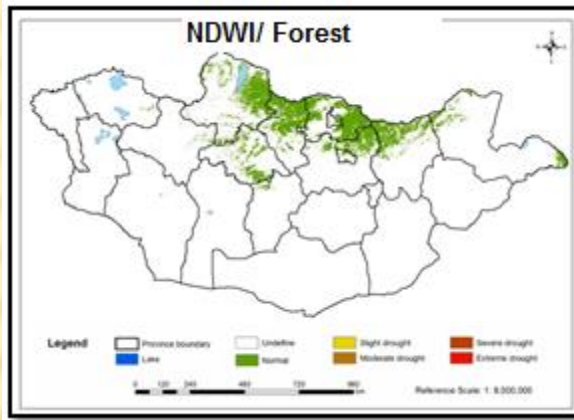
Drought mapping was made combined by 3 regions which has more than 50% correlation including forest, steppe, desert steppe. The correlations between RS Drought index and SPI index calculated by meteorological parameter were different in various natural zones separately.



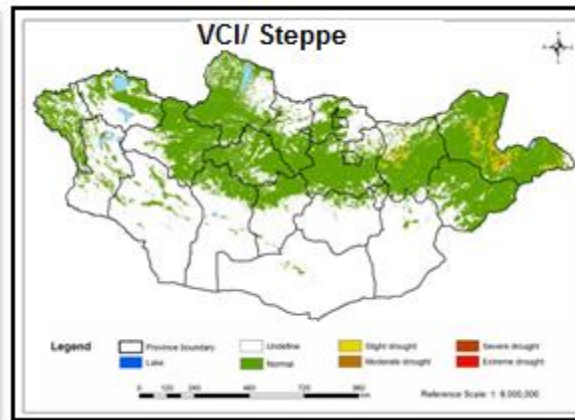
Natural regional made from mapping of land cover classification by MODIS data in 2010.

| | Soil moisture 10cm vs RS indices | AI vs RS indices | SPI vs RS indices |
|---------------|--|------------------------|-------------------------|
| Forest | $r > 45$ (NDDI, VHI, TCI...) | | |
| Steppe | $r > 45$ (VSWI) | $r > 49$ (TCI) | $r > 46$ (TCI, VSWI) |
| Desert Steppe | $r > 45$ (VHI) | $r > 45$ (TCI, VHI) | $r > 46$ (TCI) |

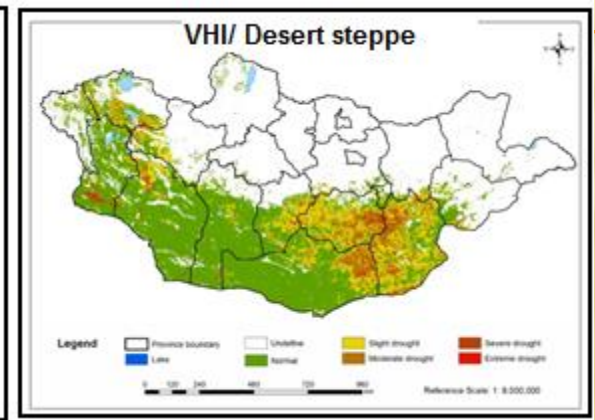
Combined by Drought indices



Forest

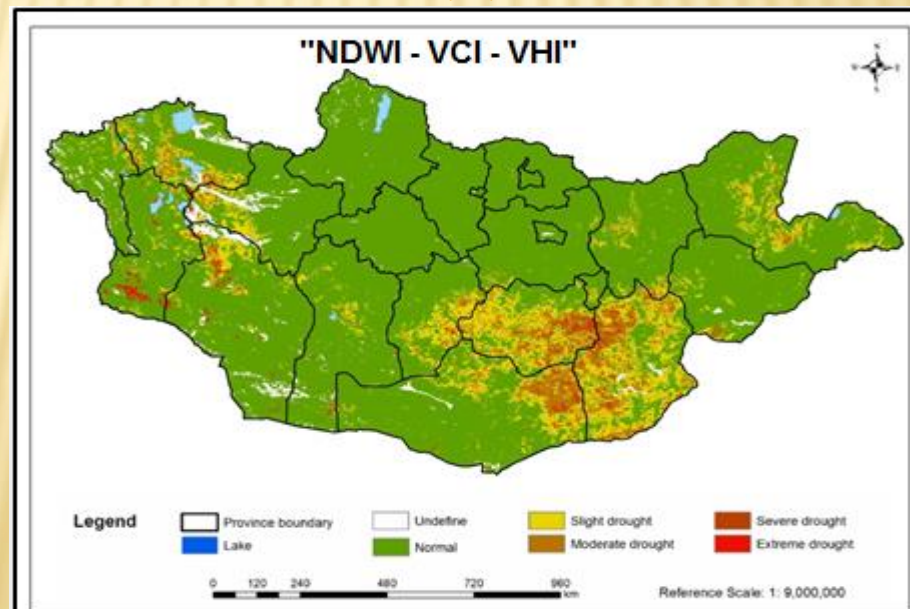
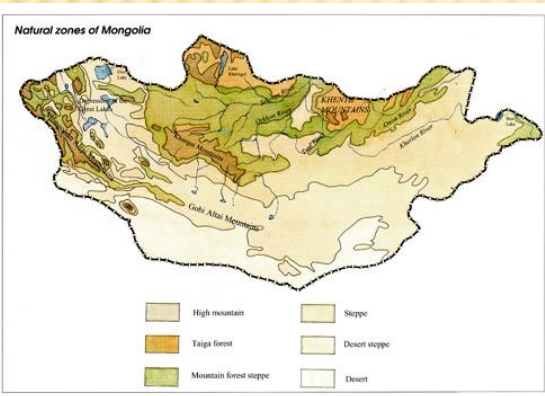


Steppe

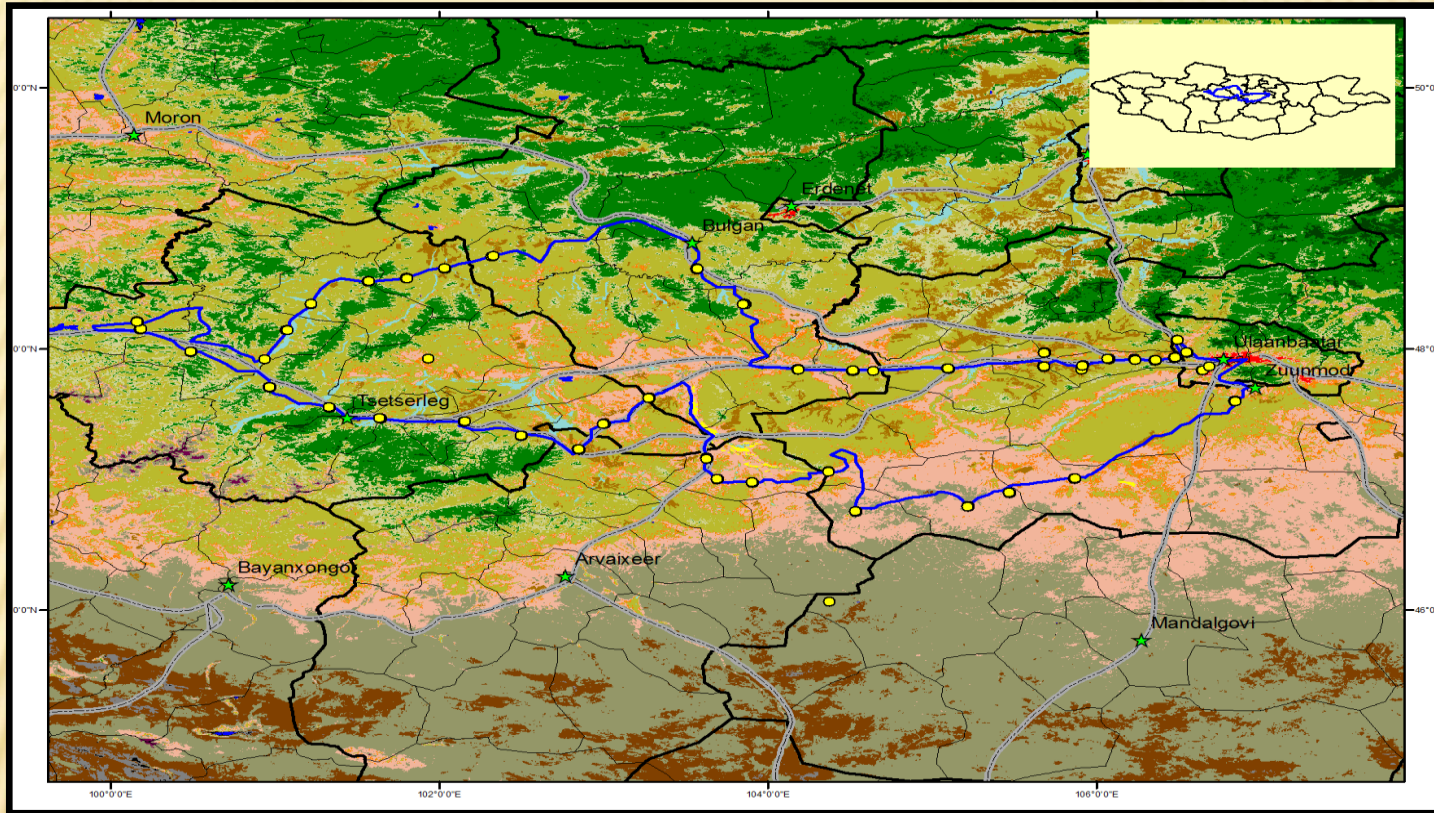


Desert steppe

Combine



Field measurement

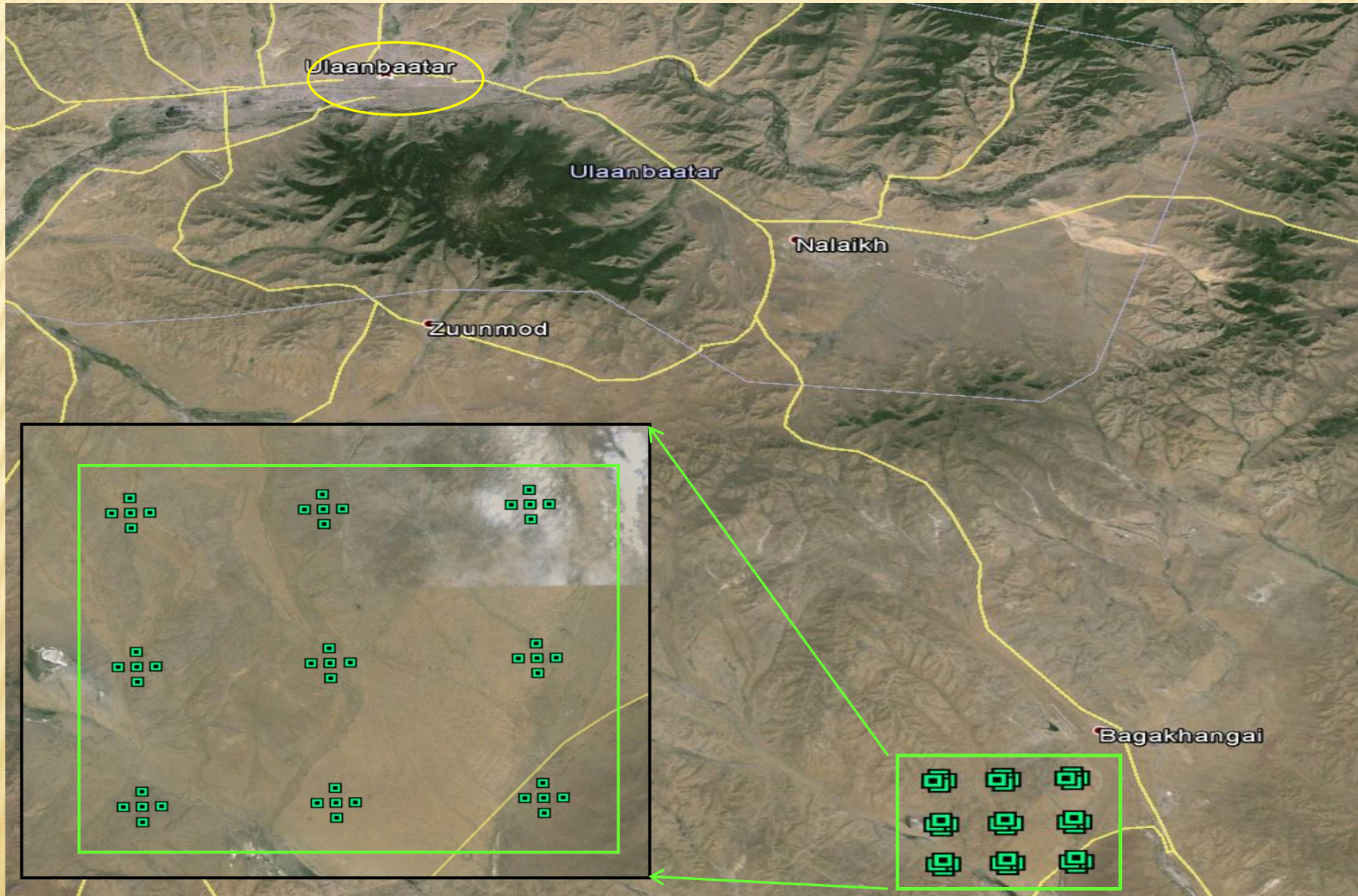


Total: 2000 km

The joint field work.

1. Institute of Remote Sensing and Digital Earth Chinese Academy of Sciences
2. Meteorological institute of Mongolia

Fixed filed area

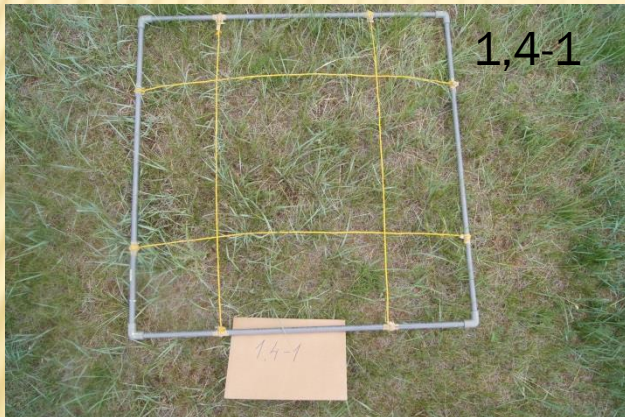


$150 \text{ km} * 2 = 300 \text{ km} * 2 \text{ days} = 600 \text{ km}$ 15

FIELD MEASUREMENT

Field work for drought

Before cutting Biomass



After cut Biomass



Soil moisture



Drought Monitoring system from RADl of CAS China

The screenshot displays the DroughtWatch 3.1 software interface. At the top, the title bar reads "DroughtWatch 3.1" and the menu bar includes "Modules", "Tools", and "Help". Below the menu bar is a banner with the "DroughtWatch" logo and the word "DEMO".

On the left side, there is a "User Login" section with the following fields and buttons:

- User Name:
- Password:
- Buttons: Login, Register, Setting, Help

On the right side, there is a large image of a satellite in orbit above a cracked, dry landscape.

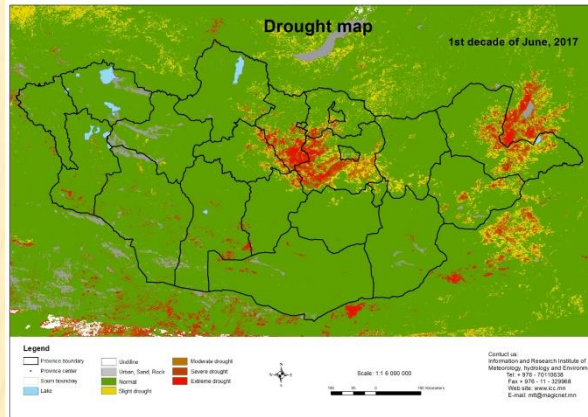
Below the banner, a section titled "Modules" contains six icons with labels:

- Database
- Preprocessing
- Indices
- Drought
- Analysis
- Batch

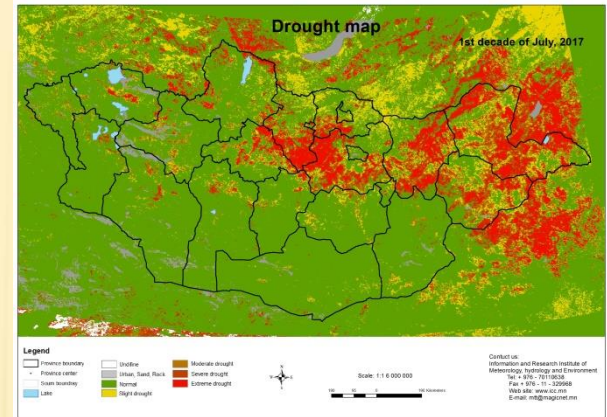
At the bottom of the image, six smaller windows are shown, each corresponding to one of the modules listed above. These windows display various data entry forms, tables, and analysis results.

Drought Monitoring maps of Mongolia

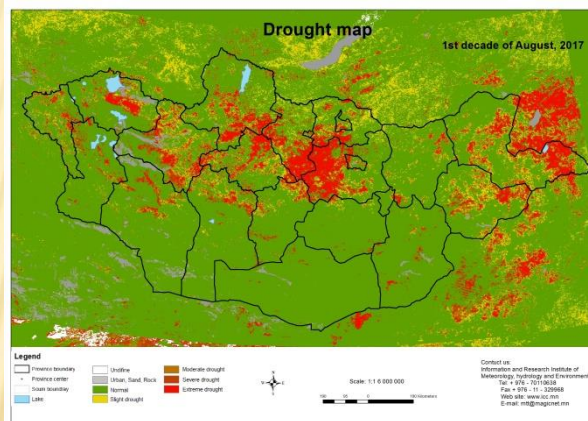
June, 2017



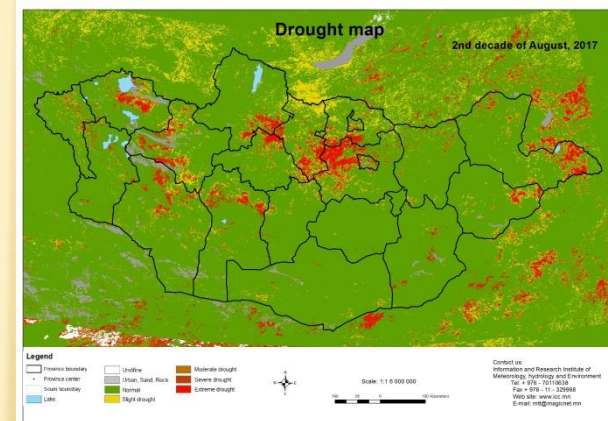
July, 2017



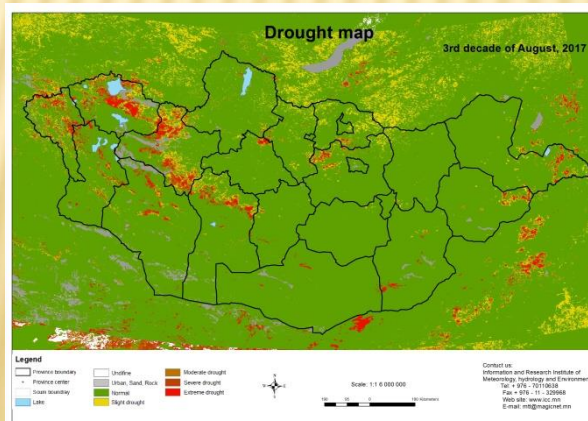
1st August, 2017



2nd August, 2017



3rd August, 2017



**THANK YOU FOR
ATTENTION!**