

# DroughtWatch for Mongolia under Regional Cooperative Mechanism

## Experiences and lessons

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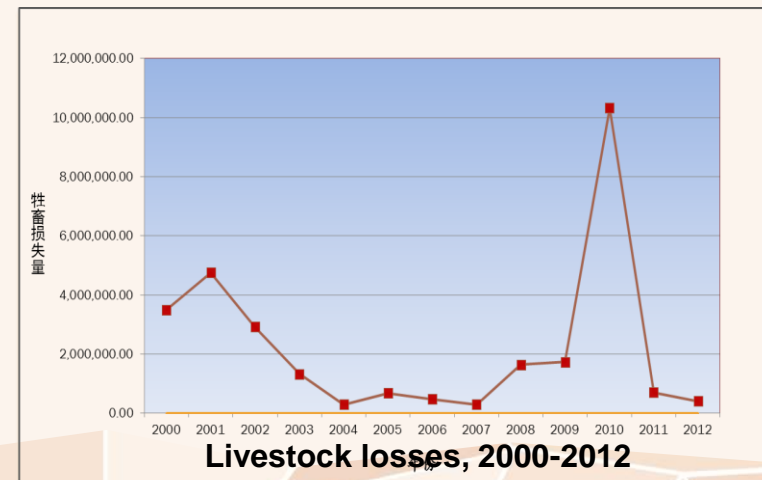
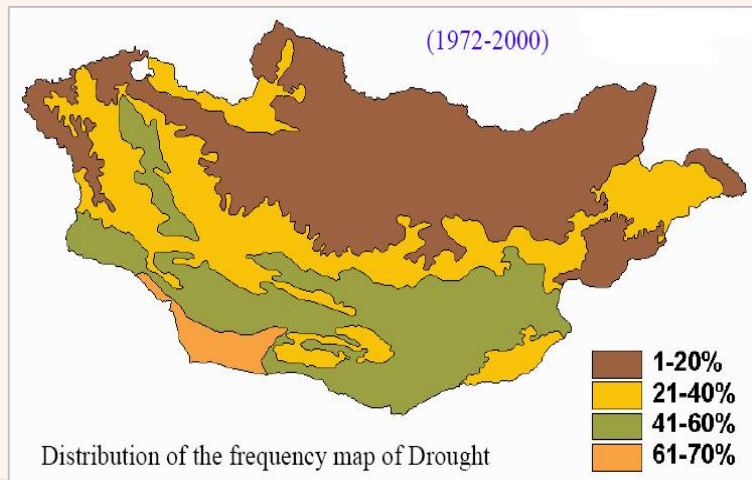
**Institute of Remote Sensing and Digital Earth (RADI)**

**Chinese Academy of Sciences (CAS)**

# Mongolian Drought

Drought is mainly nature disaster in Mongolia(global warming, climate change), and result in enormous economic losses.

- ❑ 30-70% areas happens drought in Mongolia.
- ❑ In 2010, one third of total livestock died. One reason is the poor condition of many pastures as a result of last summer's drought (2009).



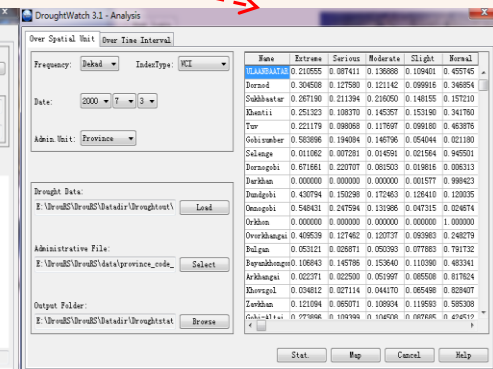
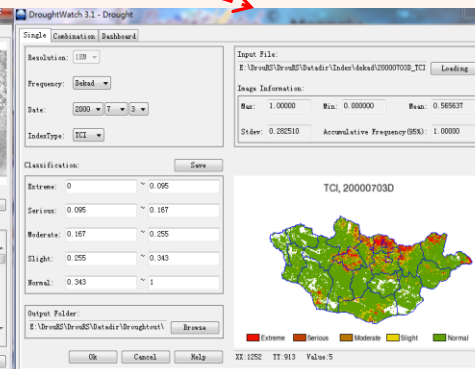
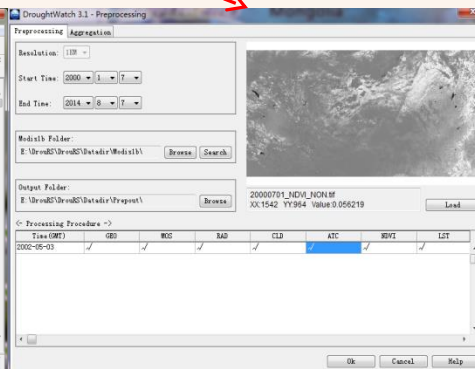
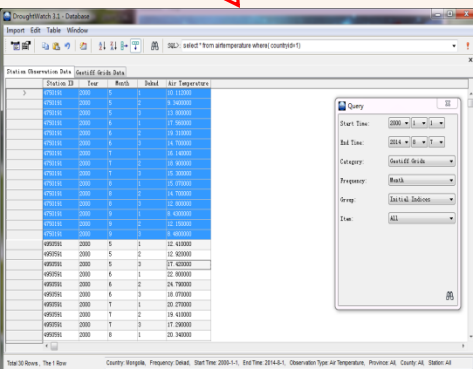
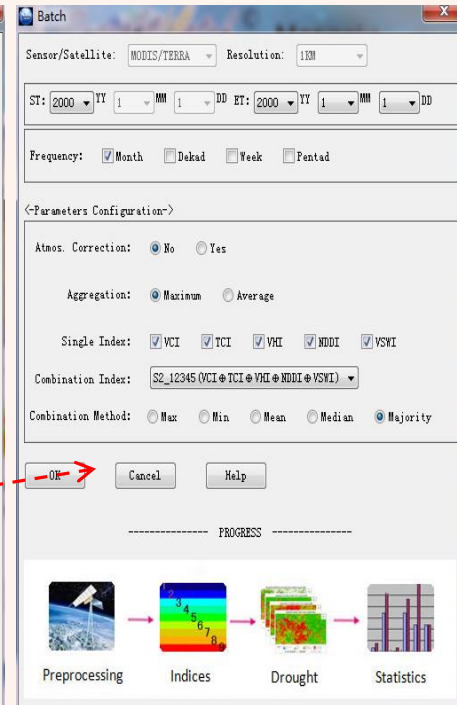
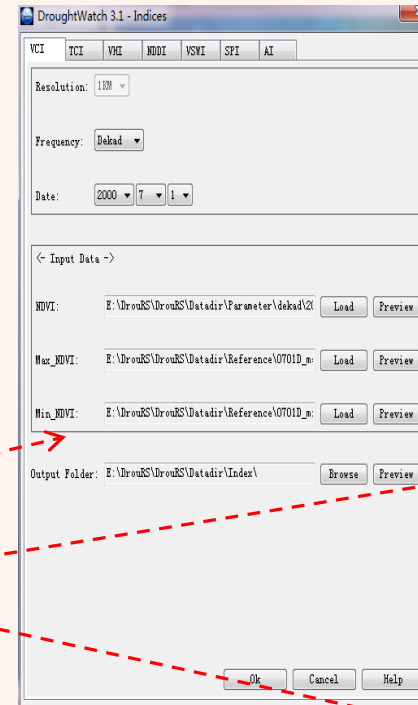
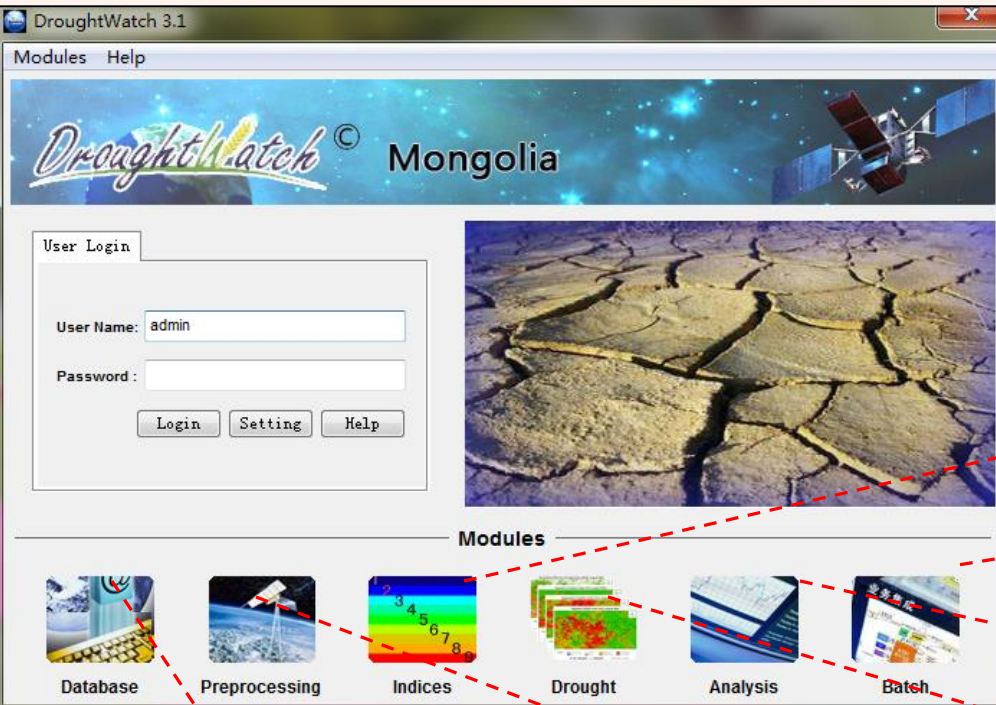
# Challenges

- ❑ The timeliness needed in drought information
- ❑ Mongolia underutilized low spatial information technique
- ❑ Paucity of appropriate drought monitoring system due to constraints of professional knowledge, financial capacity, as well as human resources.
- ❑ Mongolia is the **first pilot** for ESCAP's Regional Collaborative Mechanism on Drought Monitoring and Early Warning by China service node.

# Objectives and Contents

- ❑ Developing drought monitoring methods and system for Mongolia.
  - ❑ Drought monitoring methods
  - ❑ Building up the spatial information database
  - ❑ Drought monitoring system for Mongolia
- ❑ Enhancing capacity for Drought Monitoring in Mongolia
  - ❑ On the job training and joint academic research
  - ❑ Customizing and deploying the drought monitoring system
  - ❑ Field campaign support and validation work
  - ❑ Academic workshops
  - ❑ Information services and technical support

# System Customization





Institute of Remote Sensing and Digital Earth  
Chinese Academy of Sciences

*DroughtWatch*

Version 3.1

July 1, 2018

## DroughtWatch Manual



UNITED NATIONS  
**ESCAP**  
Economic and Social Commission for Asia and the Pacific

“Strengthening Mongolia’s capacity to monitor and warn  
drought/Duzd project” under Regional Drought Mechanism

## Validation Report 2017

Training period: 13 December to 9 January, 2018

Venue: RAD Olympic campus

### Contributors:

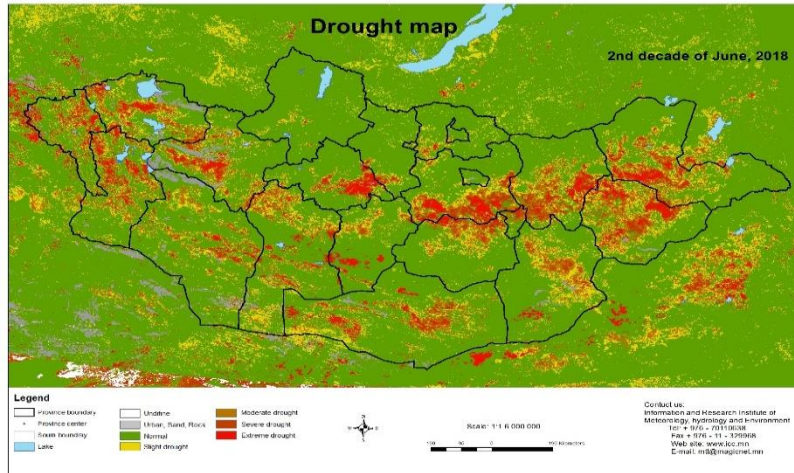
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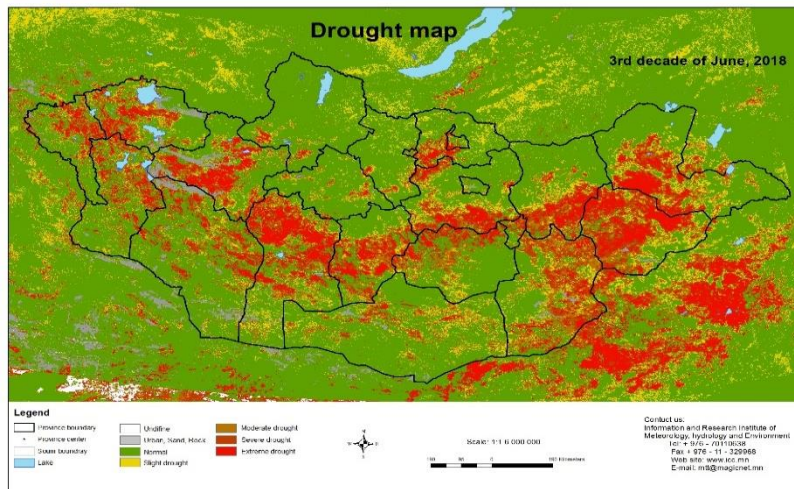


# Monitoring Results

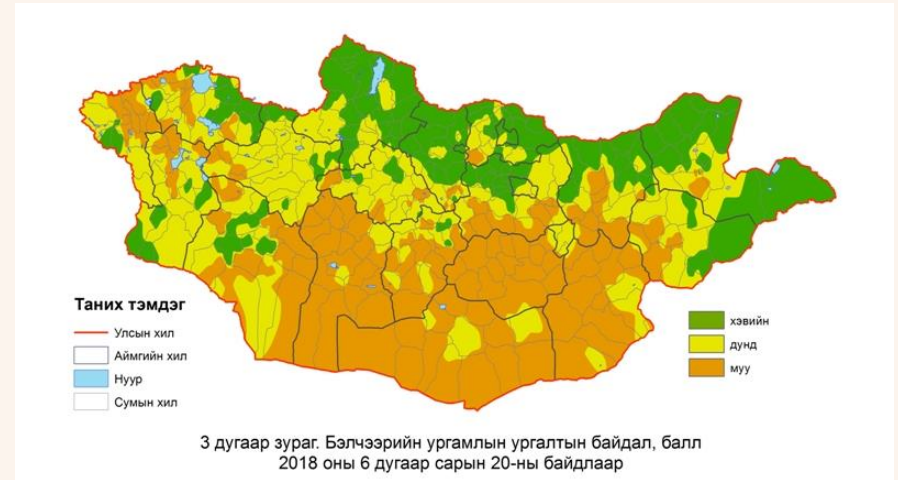
Remote sensing drought map /2<sup>nd</sup> decade, June 2018/



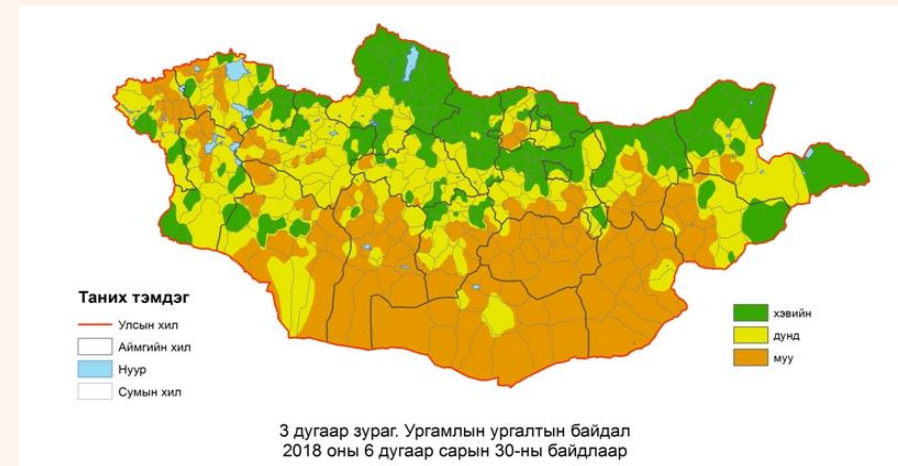
/3rd decade, June 2018/



Summer condition /2<sup>nd</sup> decade, June 2018/

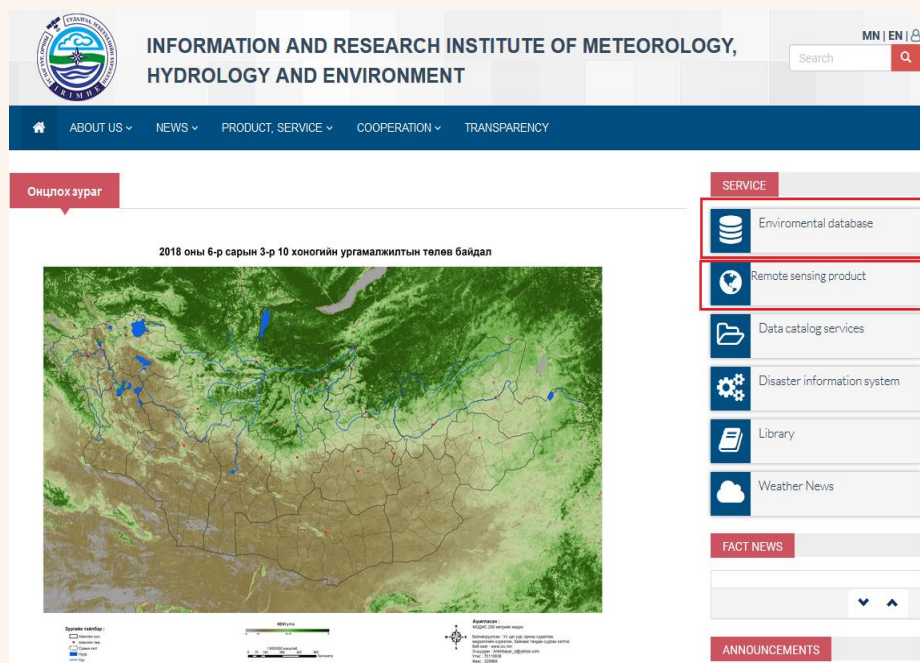


/3rd decade, June 2018/



Summer condition assessed by observers at Meteorological stations

# Products dissemination to users



<http://irimhe.namem.gov.mn>

**Servicing to organizations**



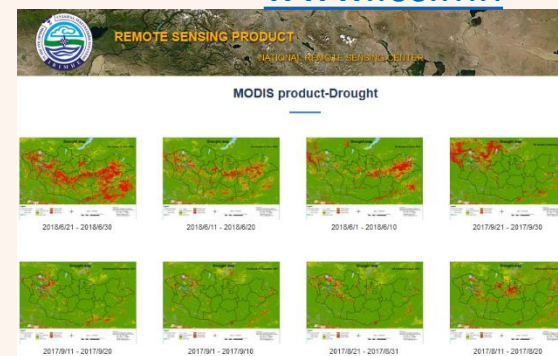
Ministry of Nature,  
Environmental and Tourism



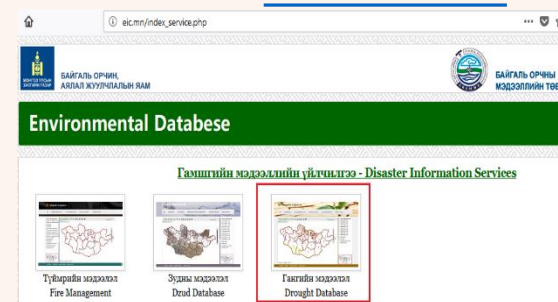
Ministry of Food,  
Agriculture and  
Light Industry



[www.icc.mn](http://www.icc.mn)



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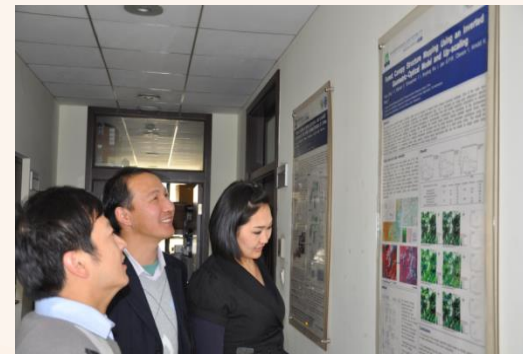
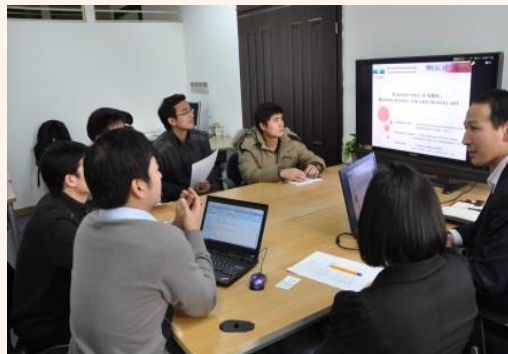
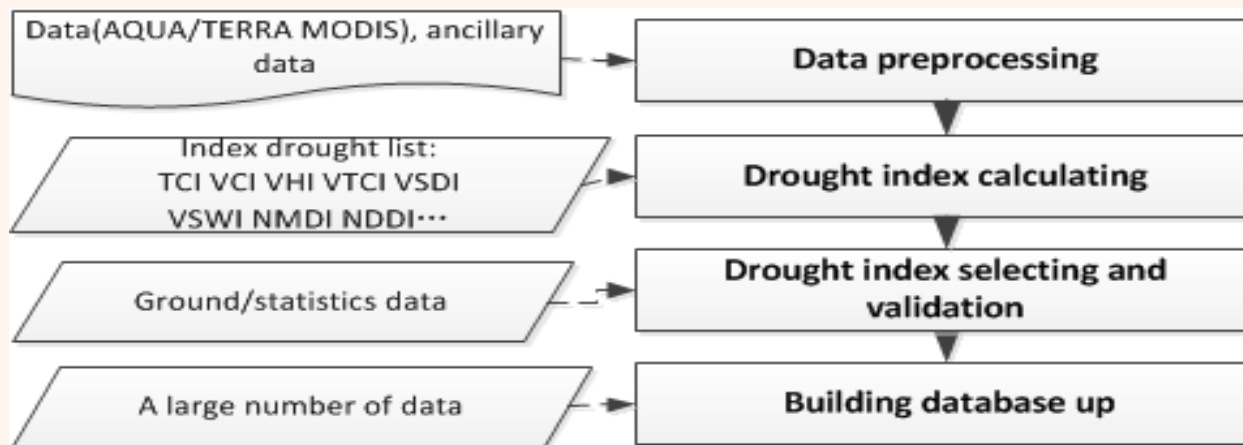


Drought product dissemination to  
local meteorological departments  
by internal network



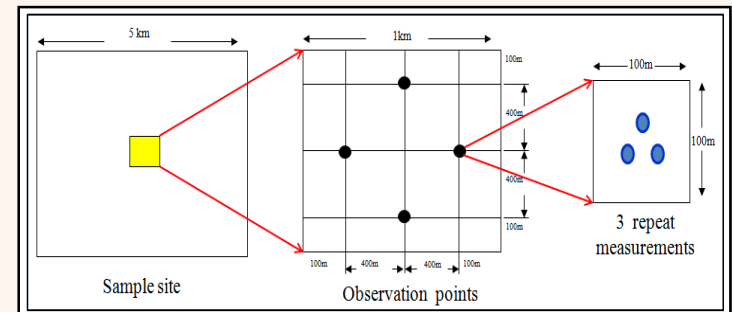
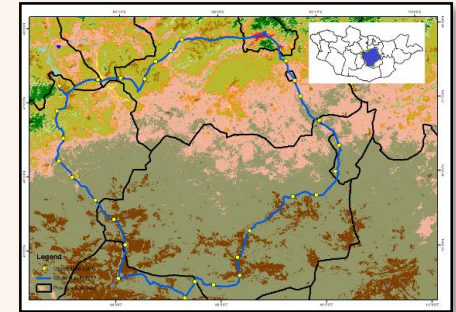
# Joint data processing

Data processing, building database, indices selection were achieved jointly by China and Mongolia experts in RADI, China(2014.02-04).



# Joint field works

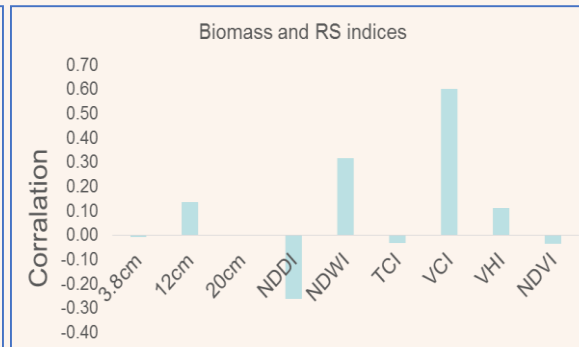
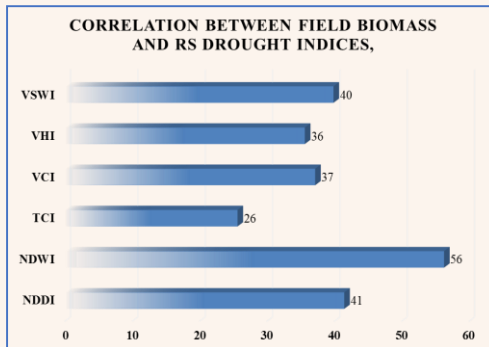
- Parameters: Soil moisture, vegetation biomass, height, coverage, biodiversity, livestock loss number by drought and spectrum.
- Participants: IRIMHE and RADI.
- 2014 to 2017 (July to August)



# Validation

## □ Drought products validation with field data from 2014-2017:

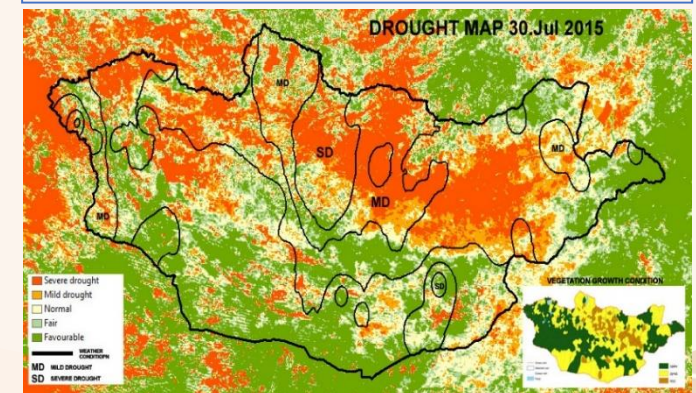
- Soil moisture
- Biomass
- Regional drought affected data from field observation
- Annual validation report



Decade	5_3	6_1	6_2	6_3	7_1	7_2	7_3	8_1	8_2	8_3	9_1	9_2	9_3
May-I-VHI	-0.09	0.16	-0.12	0.05	0.16	0.31	0.13	0.08	0.08	0.11	0.22	0.37	-0.23
May-II-VHI	0.11	0.33	0.19	0.32	0.47	0.47	0.41	0.14	0.22	0.25	0.35	0.45	0.16
May-III-VHI	0.25	0.52	0.48	0.62	0.53	0.11	-0.03	0.01	-0.13	0.06	-0.11	0.12	-0.29
June-I-VHI	0.47	0.54	0.71	0.44	0.00	-0.16	-0.17	-0.30	-0.14	-0.18	-0.10	-0.48	
June-II-VHI	0.58	0.74	0.48	0.06	-0.11	-0.11	-0.21	0.00	-0.10	-0.06	-0.25		
June-III-VHI	0.52	0.74	0.54	0.49	0.39	0.38	0.50	0.38	0.54	0.36			
July-I-VHI	0.71	0.62	0.62	0.52	0.54	0.62	0.49	0.58	0.38				
July-II-VHI	0.66	0.64	0.78	0.76	0.81	0.46	0.54	0.67					
July-III-VHI	0.69	0.71	0.73	0.78	0.53	0.45	0.62						
Aug-I-VHI	0.67	0.60	0.70	0.28	0.40	0.57							
Aug-II-VHI	0.58	0.69	0.34	0.36	0.65								
Aug-III-VHI	0.74	0.46	0.51	0.53									
Sep-I-VHI				0.44	0.49	0.85							
Sep-II-VHI				0.40	0.65								

R2	NDDI	VSWI	TCI	VCI	VHI
Soil moisture(TDR,12CM)	0.545	0.690	0.774	0.773	0.877
Soil moisture(TDR,20CM)	0.765	0.623	0.823	0.749	0.890
Soil moisture(EBA,10CM)	0.073	0.194	0.171	0.189	0.204

	BIOMASS ce/ha (averaged by two plot)		
		NORMAL	ANOMAL
VHI	0.42	0.76	0.69
TCI	0.55	0.78	0.67
VCI	0.45	0.29	0.09
NDDI	0.29	0.09	0.12
VSWI	-0.13	-0.05	0.34
NDVI	0.55	0.08	-0.45





# Joint validation

## Validation works plan

Validation Work Plan Schedule			
10 October to 9 November 2015, Venue: RADI Olympic Campus			
Days	Detailed activities	Contributions	
		RADI	NRSC
Day 1	Traveling to Beijing of China from Mongolia		
I	Field data quality control and processing		
Day 3	MODIS1b data downloading, checking and preprocessing	○	○
Day 4	Introduction and analysis of in-situ data of 2015 (precipitation, soil moisture, temperature, biomass and so on)	○	○
Day 5	Processing and checking about in-situ data of 2015, especially comparative analysis for several parameters	○	○
Day 6	Collection of meteorological and statistics data (soil moisture, air temperature, rainfall, drought statistics data);	○	○
Day 7	Calculation of meteorological drought indices	○	○
Day 10	Drawing the initial report of data processing	○	○
II	Validation of 2015 drought products using in-situ data		
Day 11-12	Drought indices calculation and statistics	○	○
Day 13-20	Drought indices suitability test (correlation analysis)	○	○
Day 13-20	Drought indices suitability test (spatial distribution)	○	○
Day 21	Supplementing the validation report	○	○
Day 24	Validation and intensive discussion	○	○
III	Conclusion and the validation report		
Day 25-26	Enriching and perfecting the validation results and the final report	○	○
Day 27-28	Formalizing the validation report	○	○
Day 31	Going back to Mongolia from Beijing		



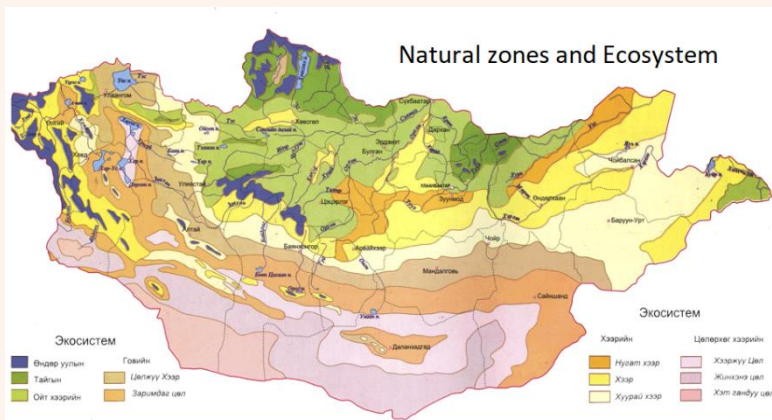
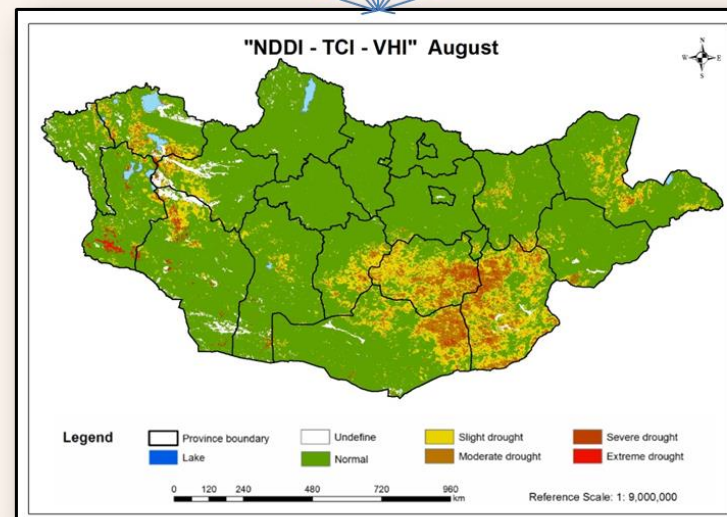
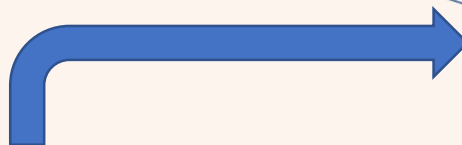
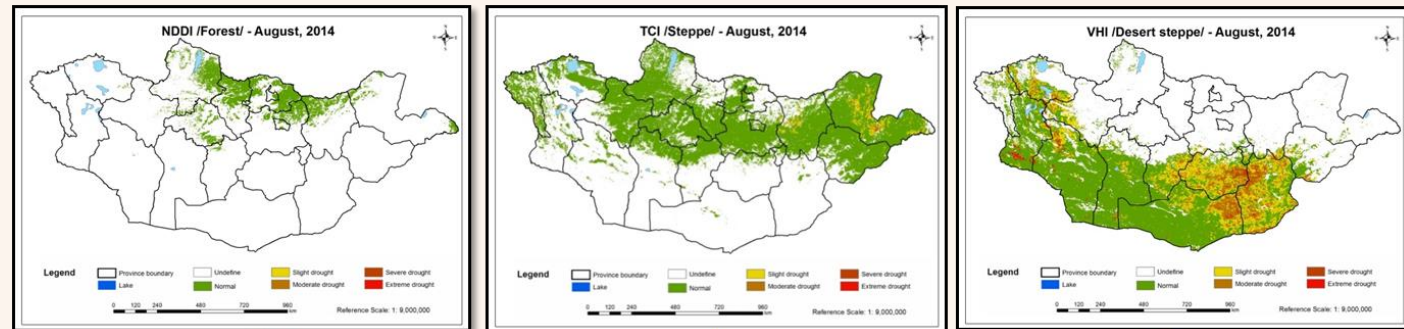
CONTENTS	
1.→ INTRODUCTION	6
1.1.→ Background	6
1.2.→ Scope and Objectives	8
1.3.→ Activity Schedule	8
1.4.→ Document Overview	10
2.→ DROUGHTWATCH SYSTEM PRODUCTS	11
2.1.→ Overview of DroughtWatch	11
2.2.→ Drought Products	12
3.→ STATIONS AND FIELD CAMPAIGN DATA	17
3.1.→ Meteorological station data	17
3.1.1.→ Precipitation	17
3.1.2.→ Air temperature	19
3.1.3.→ Summer condition data	19
3.1.4.→ Biomass	21
3.1.5.→ Soil moisture	21
3.2.→ Field campaign	22
3.2.1.→ Field campaign route	22
3.2.2.→ Observation parameters	24
3.3.→ Data preprocessing	26
4.→ OVERVIEW OF VALIDATION METHODOLOGY	27
4.1.→ Methodology	27
4.2.→ Correlation Analysis	27
4.3.→ Region Uniformity	28
5.→ VALIDATION IMPLEMENTATIONS	29
5.1.→ By biomass	29
5.1.1.→ Validation of station observation	29
5.1.2.→ Validation of field campaign	31
5.2.→ By summer condition data	34
5.3.→ By SPI	38
5.4.→ By PED	39
5.5.→ By soil moisture	44
5.5.1.→ Validation of stations observation	44
5.5.2.→ Validation of field campaign	45
5.6.→ By drought frequency data	48
5.7.→ Spatial consistency analysis	51
5.8.→ Field observation validation	58

## Validation report



# Localization for local ecosystem

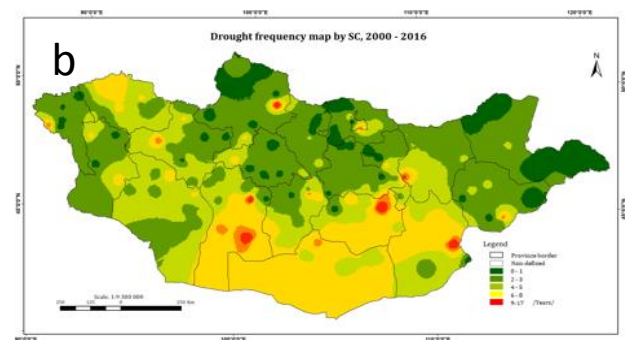
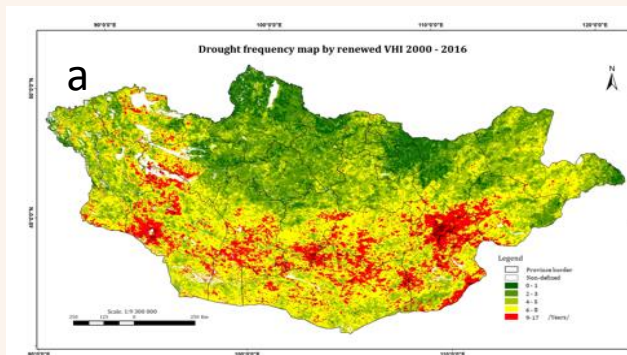
## Forest steppe & steppe & desert steppe



# Localization for seasonal variation

- ❑ Calculated the regression coefficients using fenced biomass against the two variables (TCI, VCI)
- ❑  $nVHI = W_{vci} * VCI + W_{tci} * TCI$
- ❑ The drought frequency maps based on nVHI and Summer condition 2000 – 2016

Weights	May	June	July	August	September
Wtci (VHI a)	0.41	0.31	0.27	0.31	0.42
Wvci (VHI b)	0.59	0.69	0.73	0.69	0.58



# Ownership

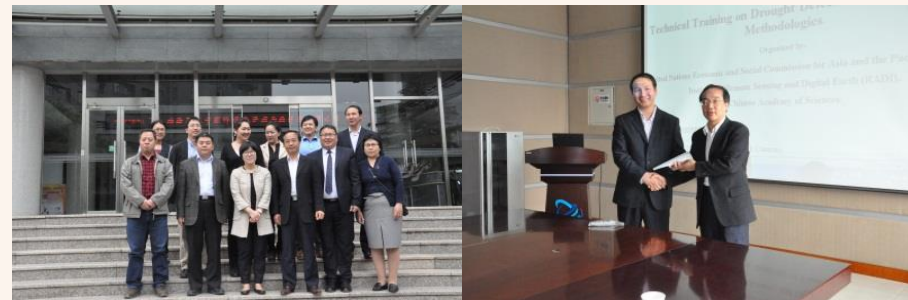
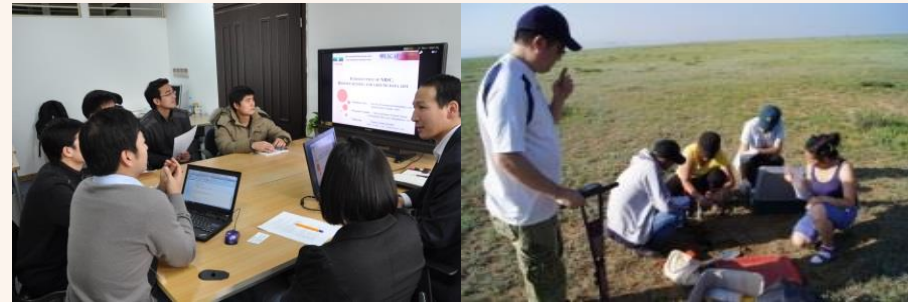
- ❑ DroughtWatch system have been deployed in NRSC of Mongolia in 2014, and fully operated by NRSC staff on monitoring, field work, and analysis.
- ❑ Now, DroughtWatch products and results are useful for planning, decision making at crop farming, forest and pastoral animal husbandry sector in Mongolia.





# Full Technical Transfer

- ❑ Technical advisory and support
- ❑ Technical Training
- ❑ On the job training
- ❑ Joint work on the data processing, indices selection, field work and validation from 2014 to 2017.
- ❑ Customization
- ❑ Localization
- ❑ Ph.D fellowship of UCAS and CAS-TWAS.





# Lessons

## ❑ Stakeholder engagement

- Need to give more training or advertisement to other users about the drought products
- Make stakeholder use of products

## ❑ Impact assessment for DroughtWatch enhanced

## ❑ Too long for project period

## ❑ But each year, joint work time is not enough, have to work hard

# Summary and recommendation

- ❑ ESCAP coordination, Mechanism of ownership and full technical transfer are essential to the success
- ❑ ESCAP and CAS support are guarantee to the commitment
- ❑ A good partnership between RADI and IRIMHE
- ❑ In this mechanism, extended to Cambodia and Sri Lanka
- ❑ Increase data resolution and capacity building.
- ❑ Stakeholders needs to engage at the earlier stage
- ❑ Incorporating climate forecast for drought forecast
- ❑ Extending to other applications as fire, dzud, and crop

Acknowledge: UNESCAP and CAS-TWAS programme

**Thank you for your attention!**