NEESPI Regional Science Team Meeting 16-20 Sept 2007, Urumqi, China

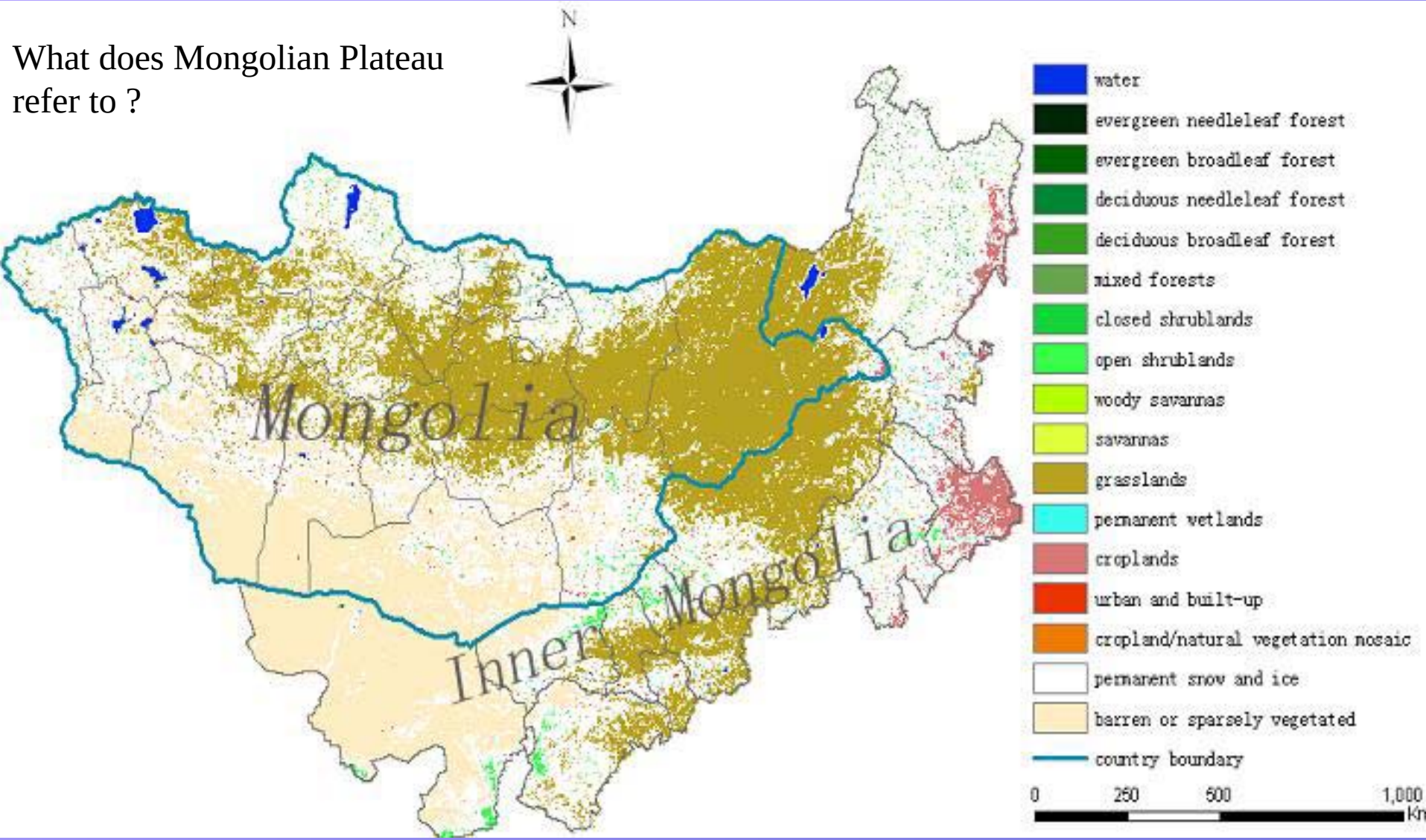
Environment and Sustainable Development of Mongolian Plateau Region: an overview of international collaboration activities and results

Funding sponsor: Chinese Academy of Sciences

Lin Zhen, Jiyuan Liu, D. Dorjgotov, O. Batkhishig, Qinxue Wang, Yuhai Bao

IGSNRR of CAS, IG of MAS, NIES of Japan, IMNU

What does Mongolian Plateau refer to ?

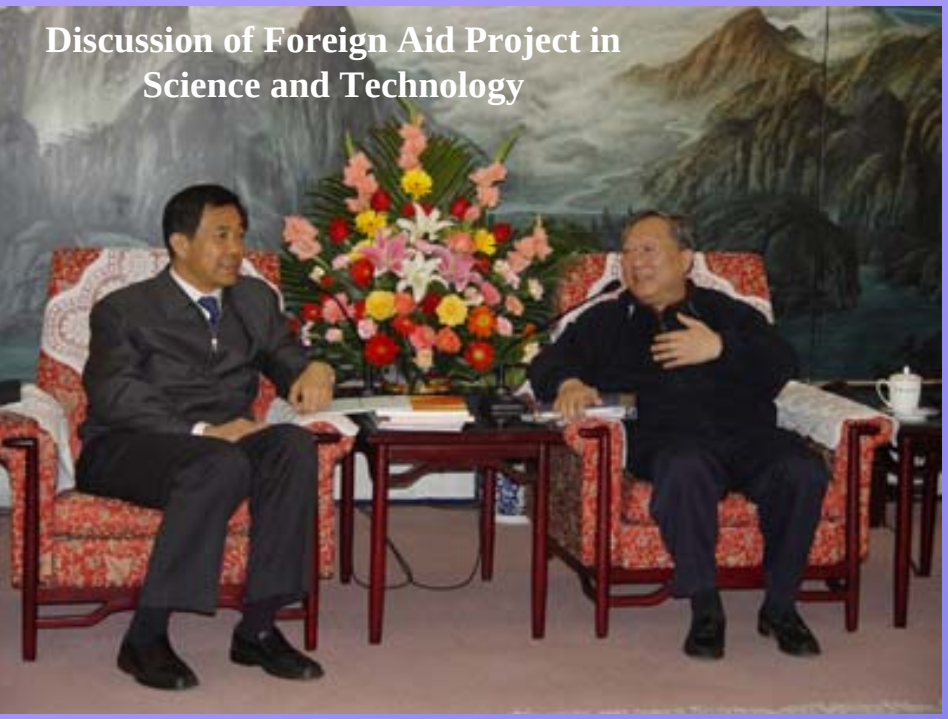


The Mongolian Plateau is part of the larger Central Asian Plateau and has an area of approximately 2,600,000 square kilometers. It is occupied by Mongolia in the north and Inner Mongolia (an autonomous region of China) in the south. The plateau includes the Gobi Desert as well as dry steppe regions. It has an elevation of roughly 900 to 1,500 meters. Human density: 0-50 people/km2.

Outline

- Background and focus of China-Mongolia collaboration
- Climate change and impacts
- Consumption and perceptions of ecosystem services: Mongolia vs Inner Mongolia
- Environmental consequence: soil erosion mechanism Mongolia vs Inner Mongolia
- Plans for future research and collaboration

BACKGROUND


Discussion of Foreign Aid Project in Science and Technology

Acting President T. Galbaatar of MAS

President Lu Yong-Xiang of CAS

In 2003: The Memorandum of Scientific Cooperation between CAS and MAS

In 2004: Establishment of Joint Committee on Scientific Cooperation Between CAS-MAS, and the First Meeting of the Committee in Beijing

BACKGROUND

China-Mongolia-Japan
Meeting, Aug 2005
Ulaanbaatar

Vice presidential meeting

CAS-MAS, Oct 2005
Ulaanbaatar

Cooperation Agreement between
IGSNRR, IG & IMNU
Dec 2005

Dec 22, 2005

IGSNRR-CAS, Beijing

Important Notes in MOU

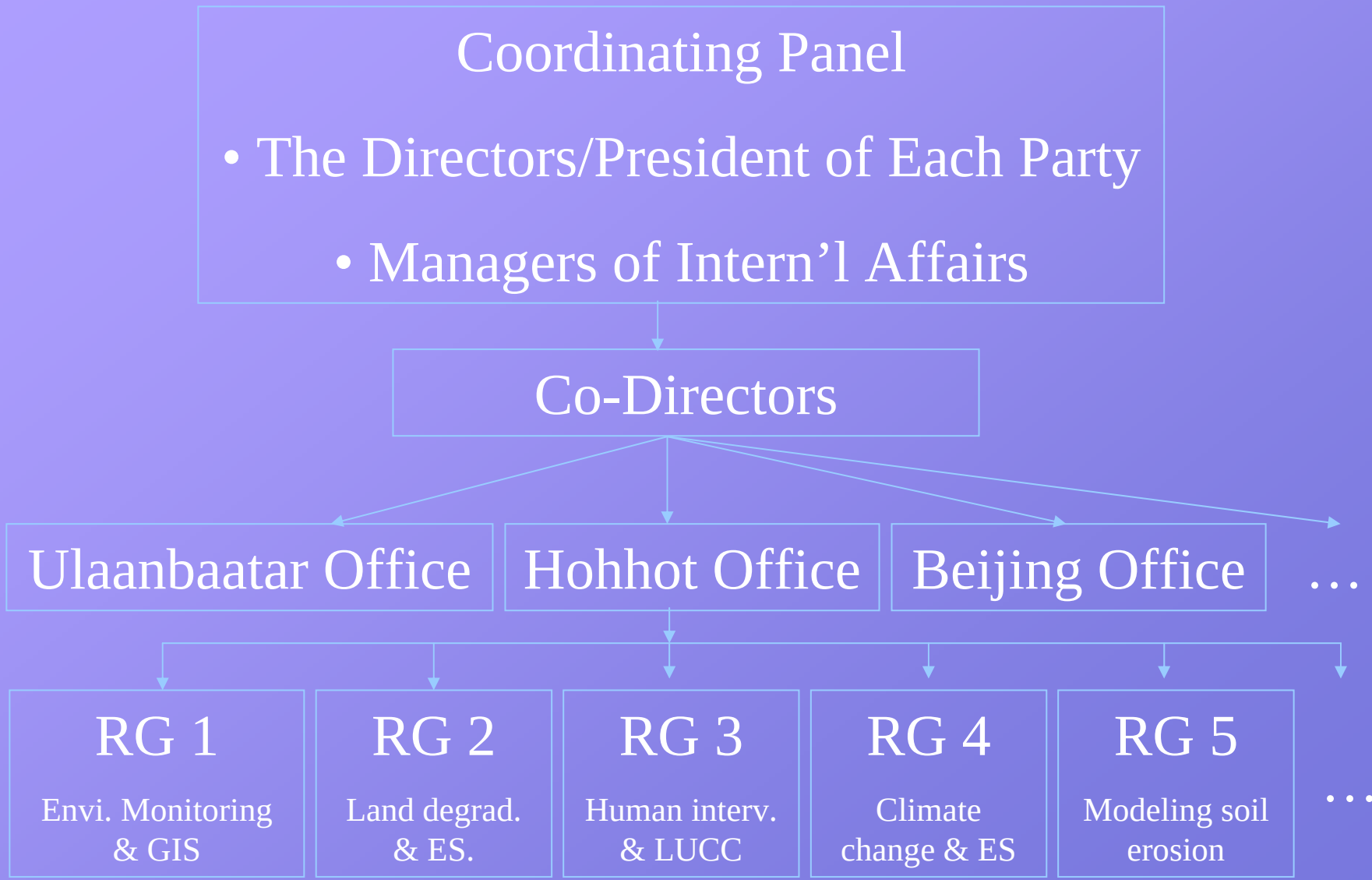
- Joint field survey and building a national level GIS
- Establishing ecosystem monitoring /research stations in Mongolia
- Joint research programs in the field of environment and sustainable development
- Personnel exchanges and capacity building

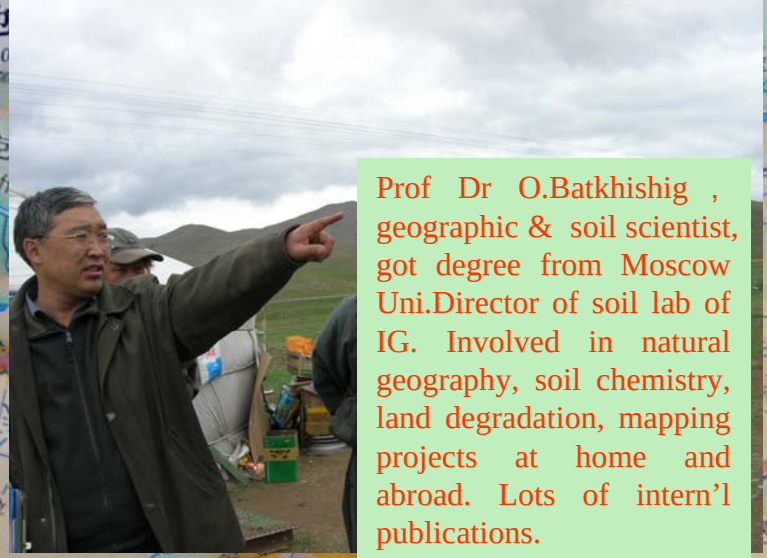
Implementation mechanism:

setting up an international joint research center for Mongolian Plateau study


Opening Ceremony of JRC
26 Aug, 2006, Inner Mongolia

Organizational Structure





Prof Dr O.Batkhishig , geographic & soil scientist, got degree from Moscow Uni.Director of soil lab of IG. Involved in natural geography, soil chemistry, land degradation, mapping projects at home and abroad. Lots of intern'l publications.

Ulaanbaatar Office

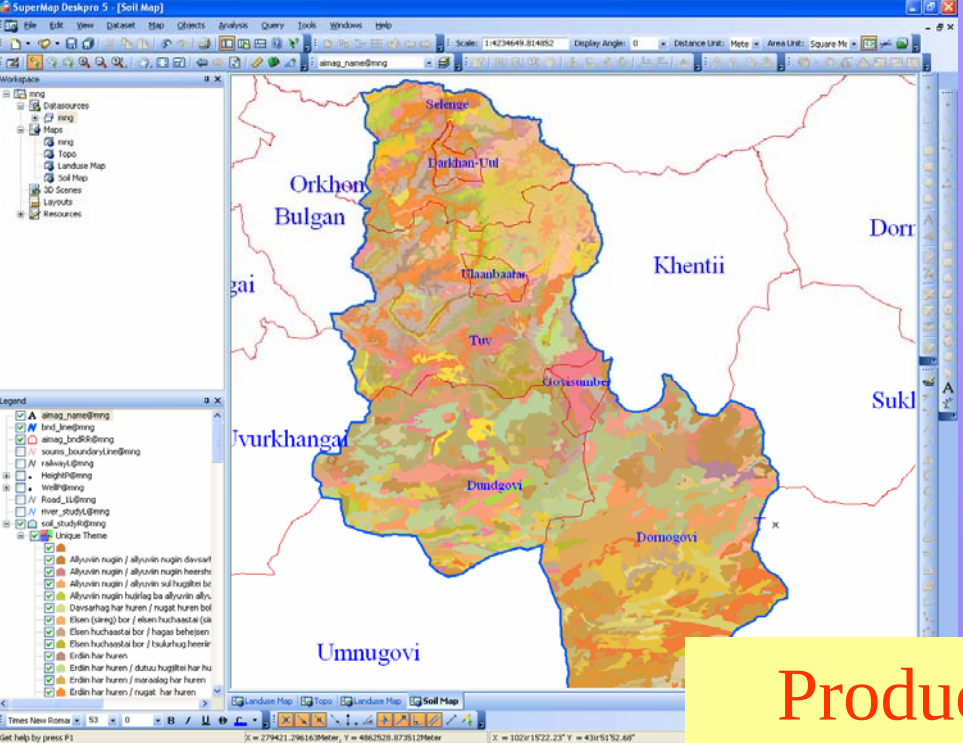
Beijing Office

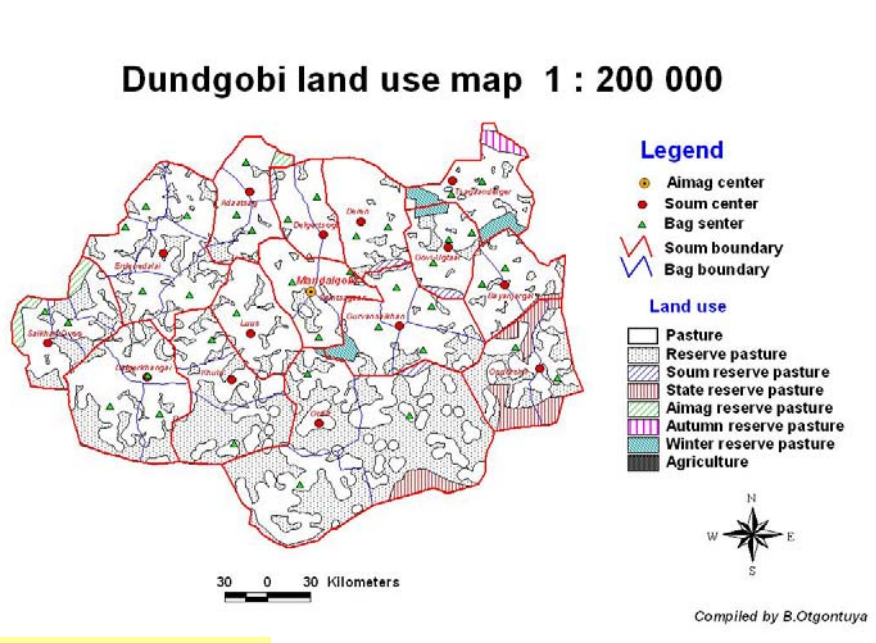
Hohhot Office

Prof Dr Yuhai Bao , graduated from IRSA of CAS in 1999.RS & GIS scientist, director of the key lab for RS & GIS of IM, vice president of the College of Geographic Sciences, IMNU. FOR: RS survey of res.-envi., LUCC, RS & GIS based forest, soil erosion, desertification,developed GIS for land & resources of IM, has wide intern'l collaboration, a member of IGBP.Above 30 papers and 2 monographs. Well-known to the people and resources of the MP.

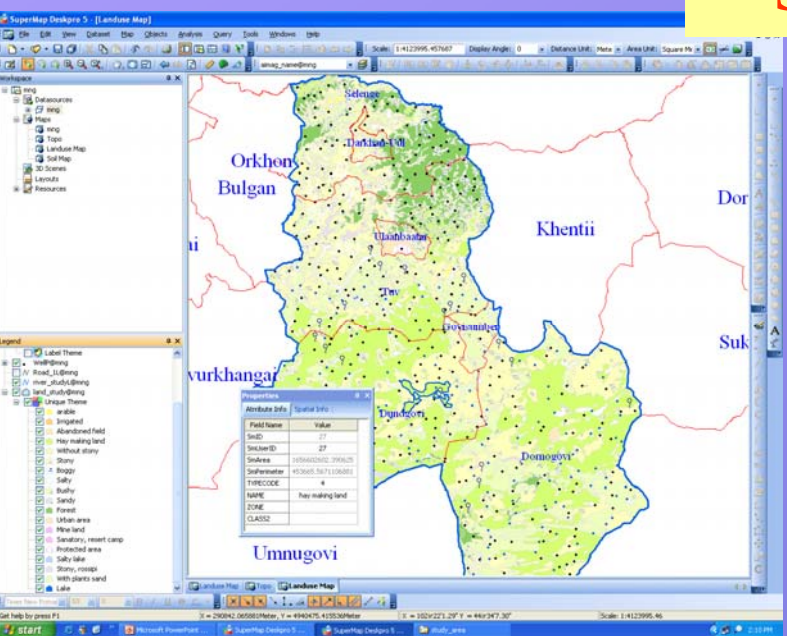
Dr Lin Zhen, Asc Porf with IGSNRR of CAS, graduated from AIT in 2003, majoring in socio-ecology and NRM. Secretary general of res.-eco. committee of CANR. FOR: ecosystem-human interactions & eco-compensation. Ab 30 publications and 1 monography. Good relations with intern'l org.

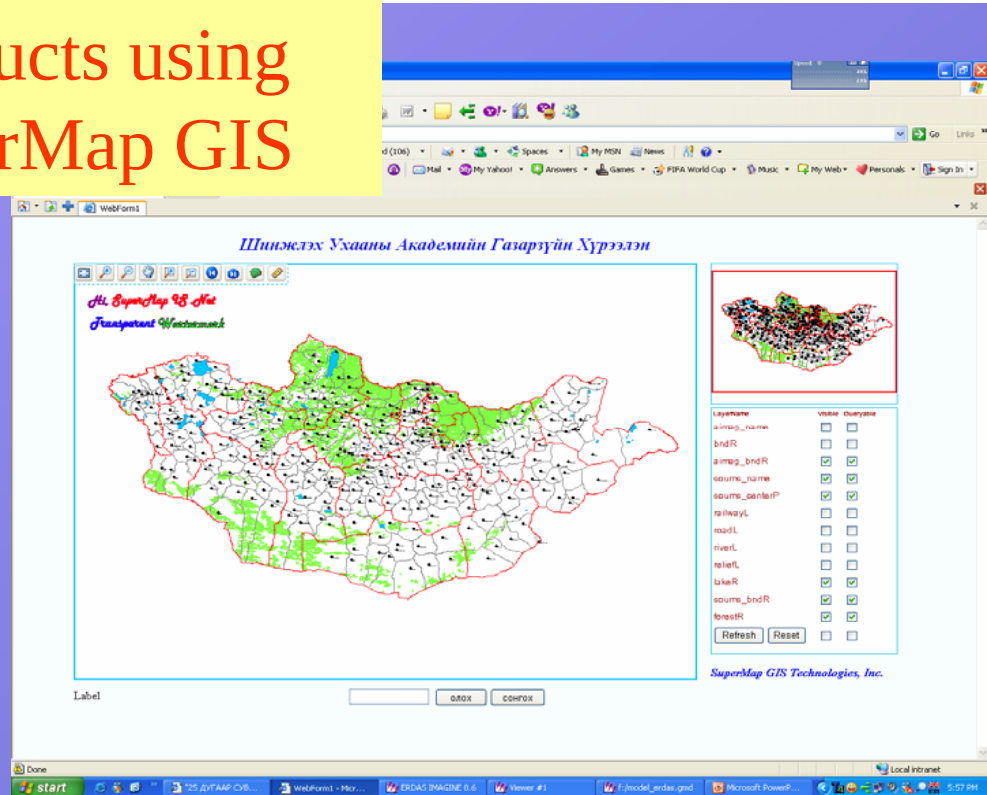
1. Capacity building: GIS & RS Training (Jul-Aug, 2006, IGSNRR)



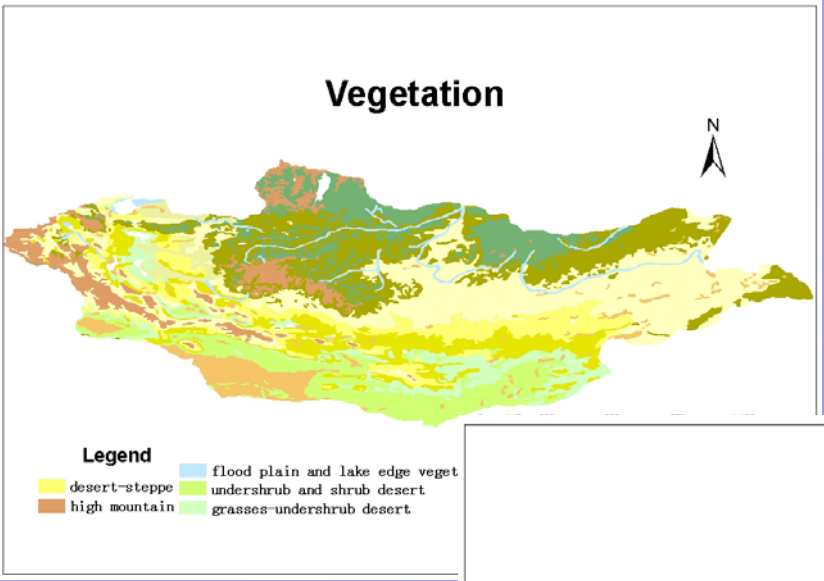


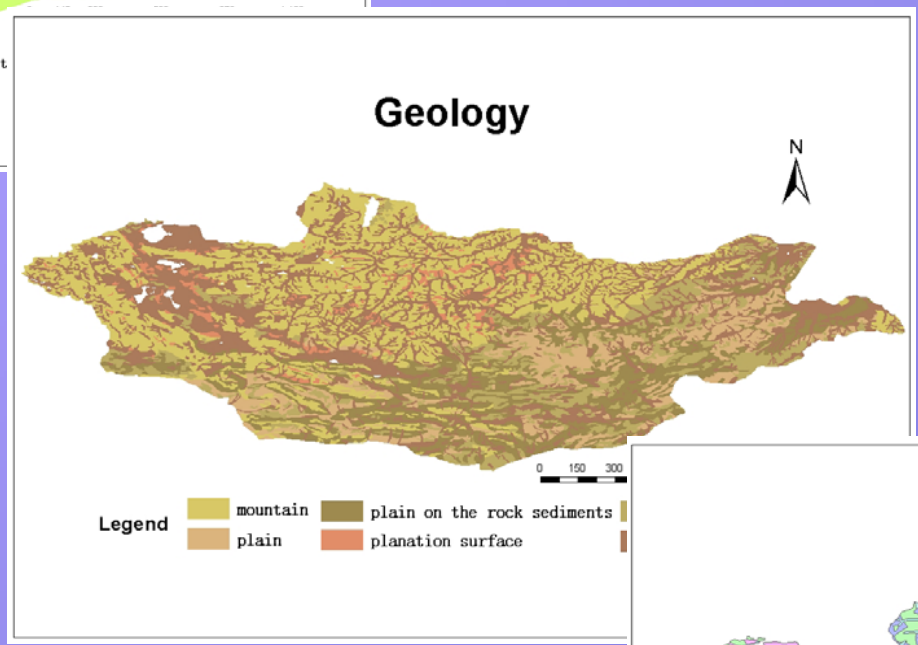
Products using SuperMap GIS

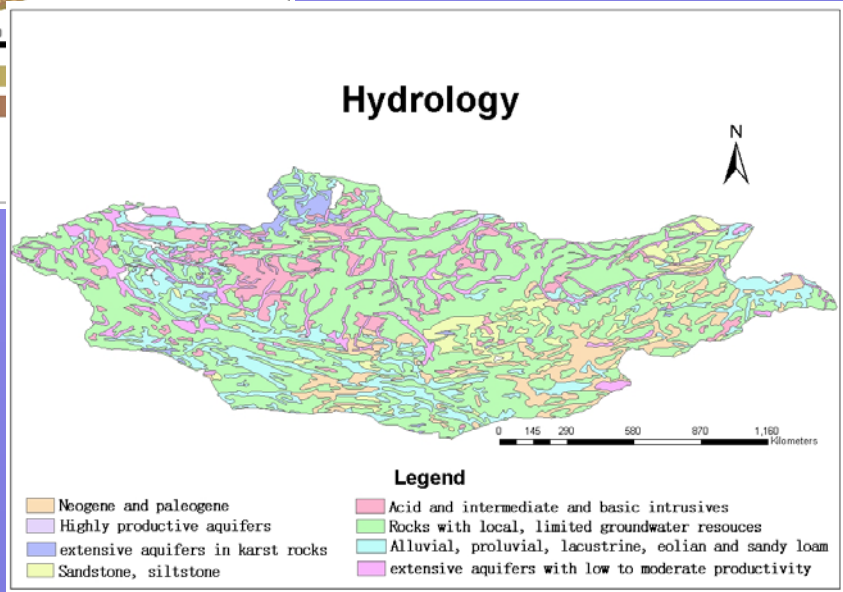




Building Mongolian GIS system







So far, altogether 21 vector maps have been developed.

International Exchanges

- Joint field surveys: since 2005.
- Visiting
- International conference on Environment and Sustainable Development of Mongolian Plateau and Surrounding Regions:

  - The first meeting: Ulaanbaatar 2005

  - The second meeting: Hohhot 2006

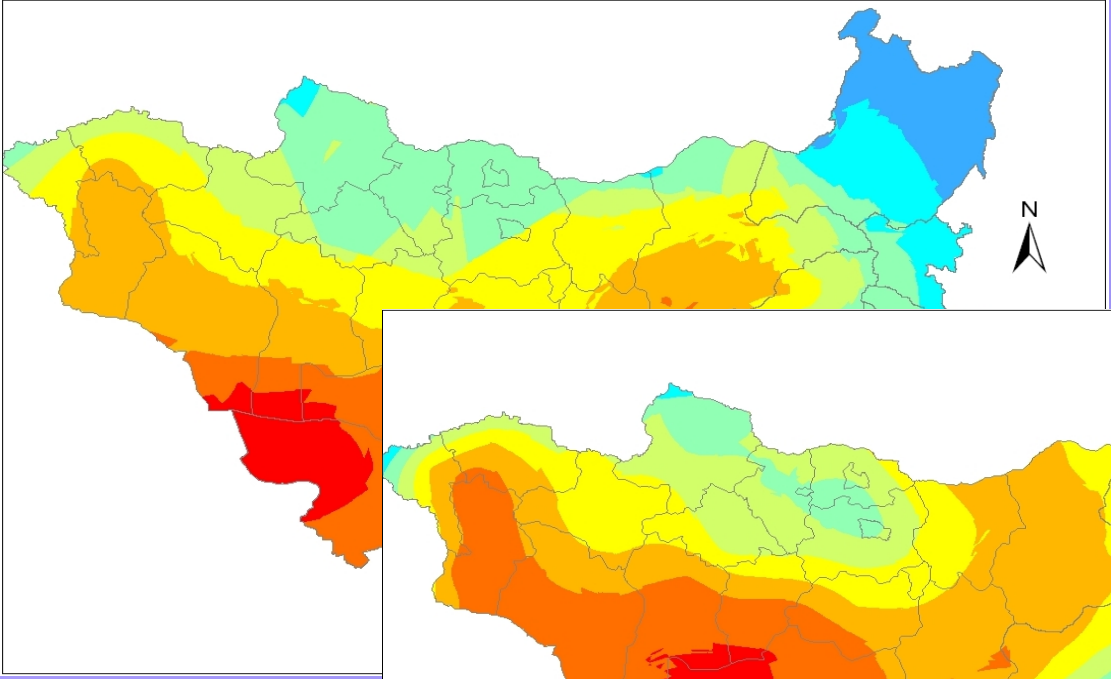
  - The third meeting: 26-27 Nov 2007, IGSNRR of CAS, Beijing

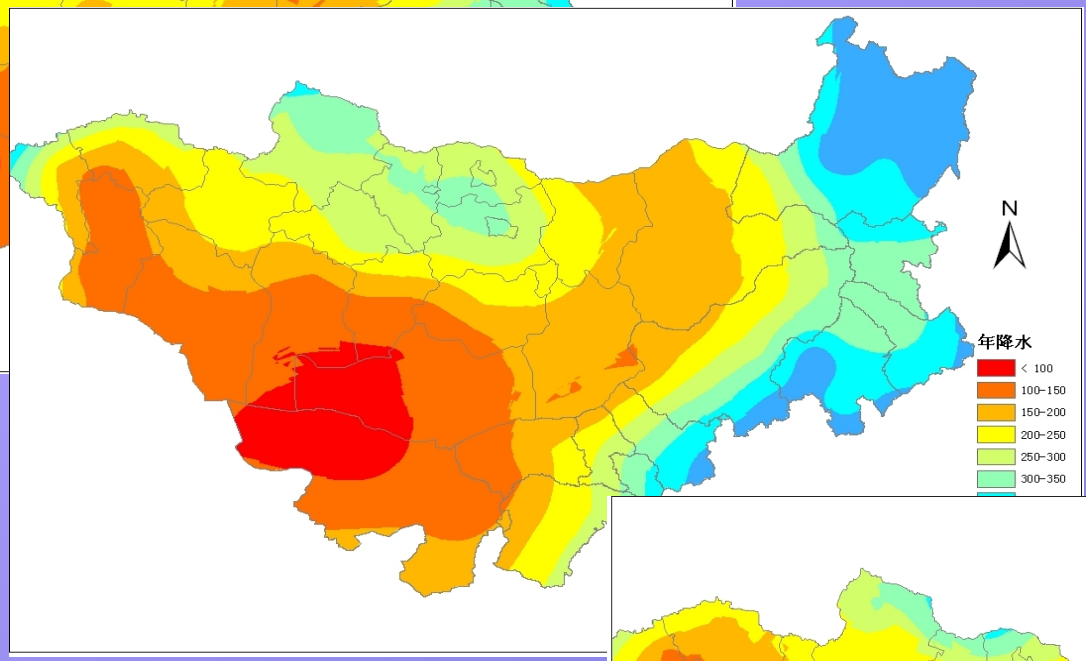
2. Climate Changes and Impacts

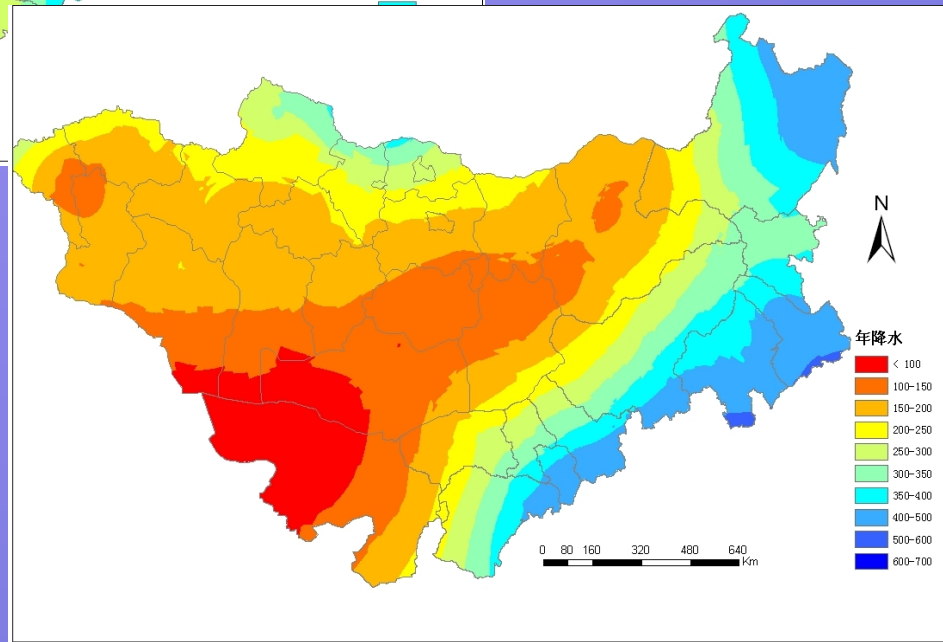
1995

2000

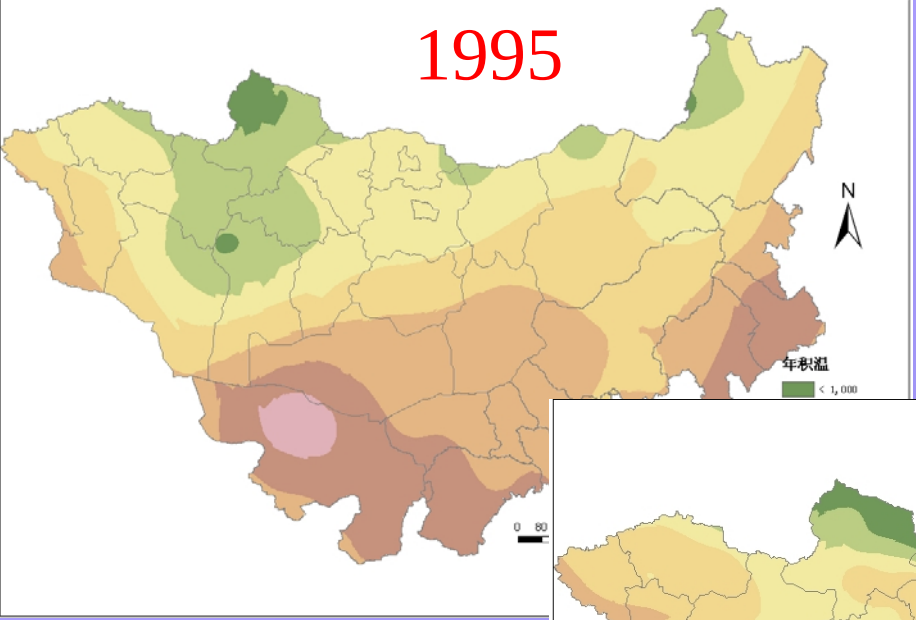
2004

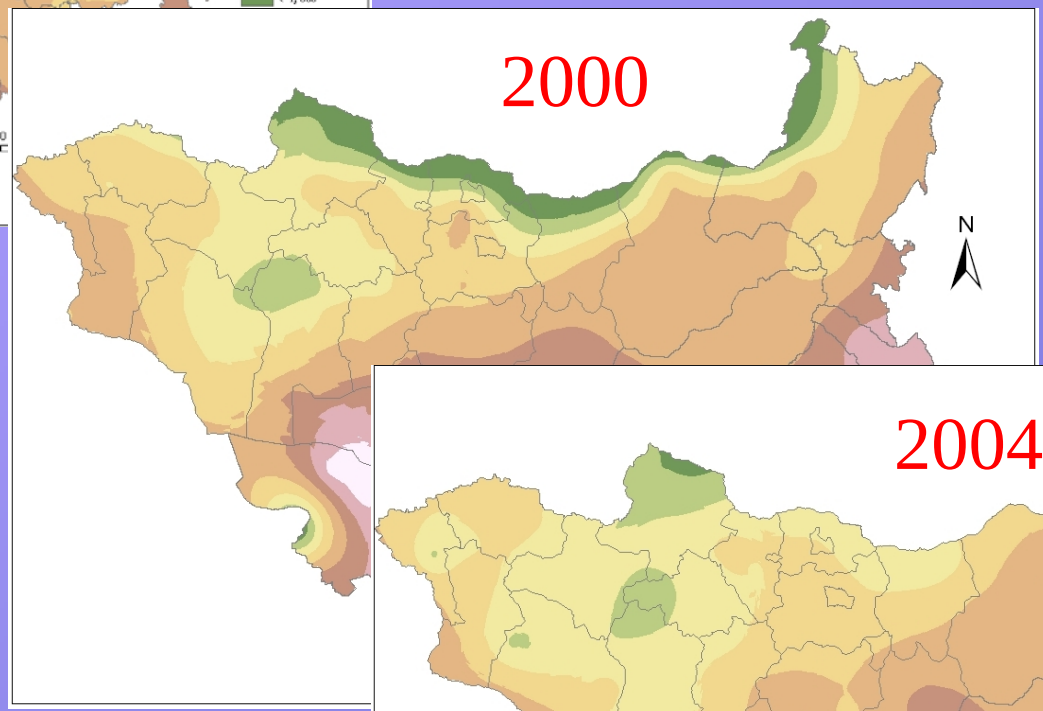


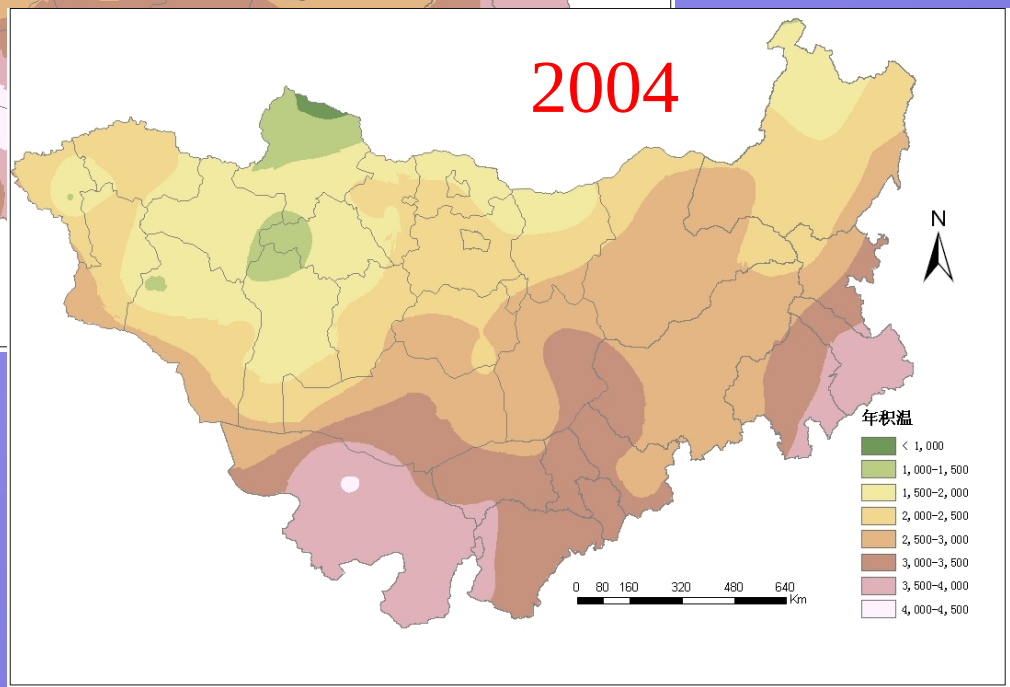




Precipitation of MN

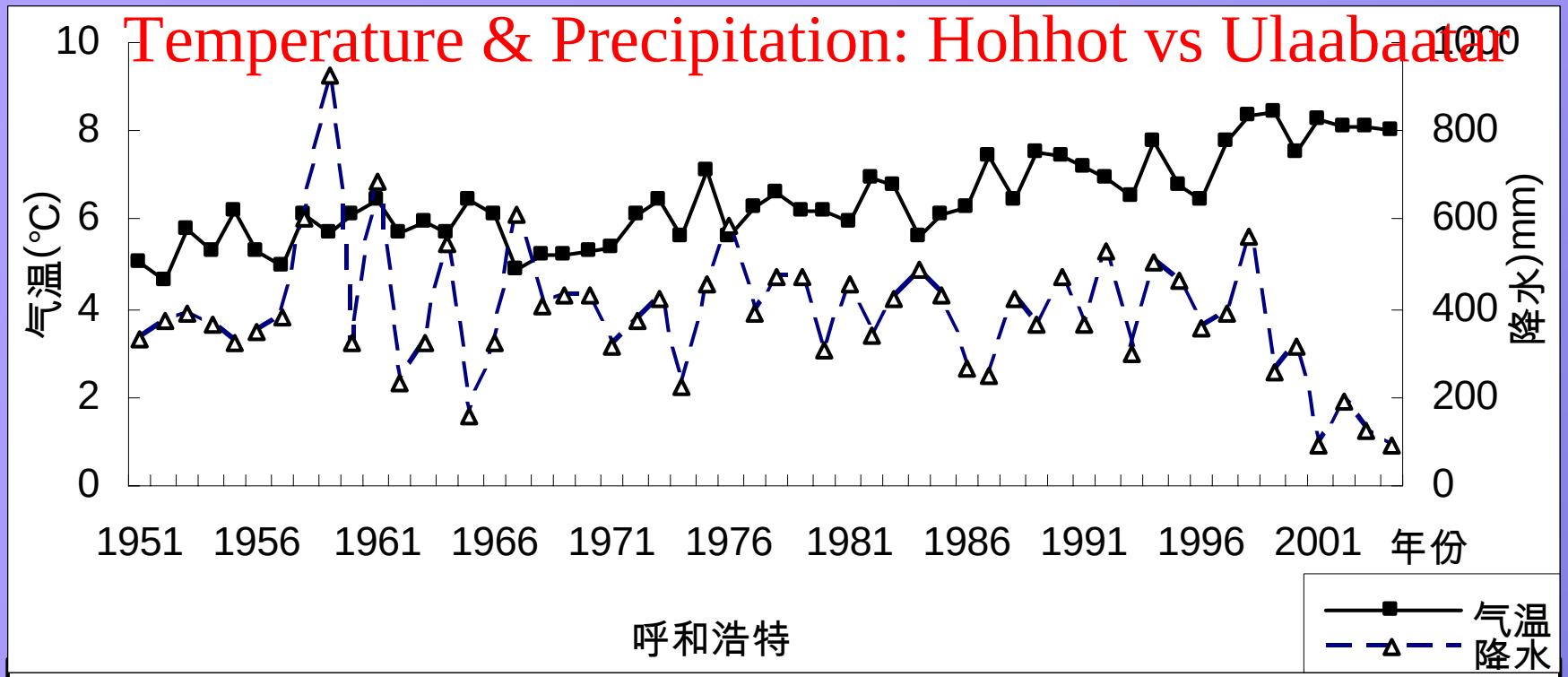


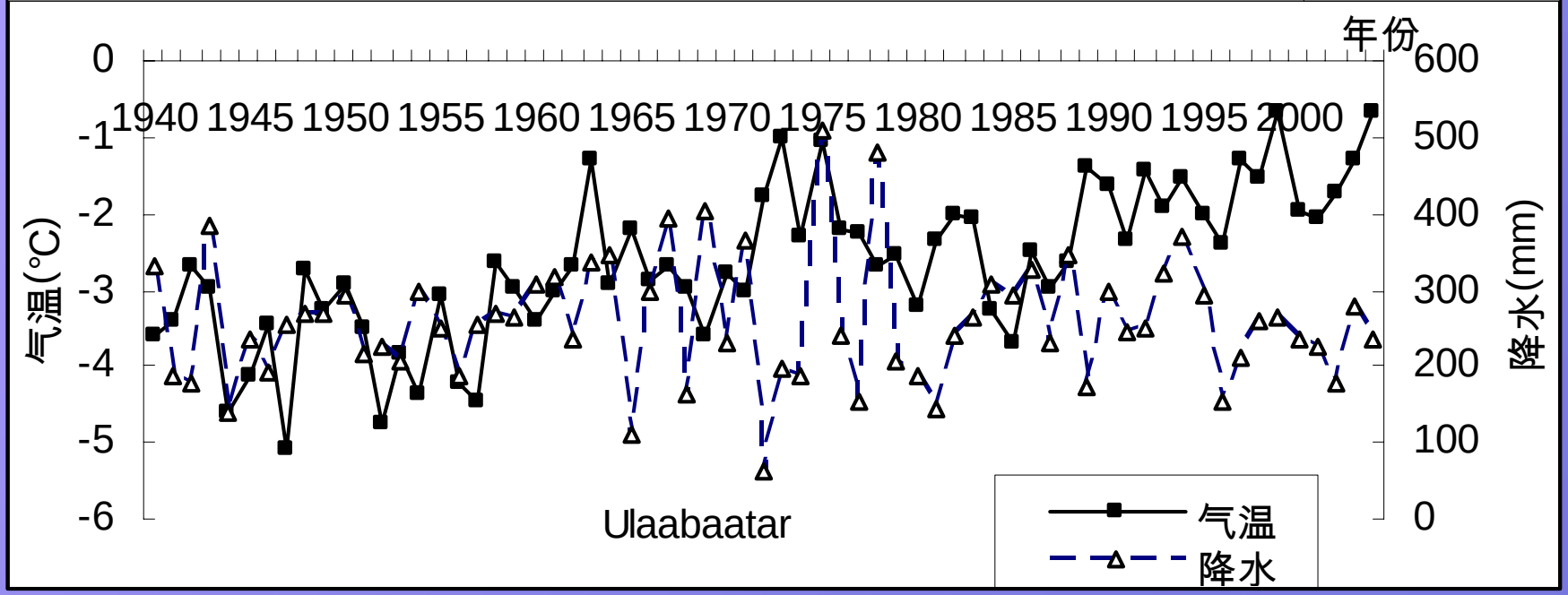


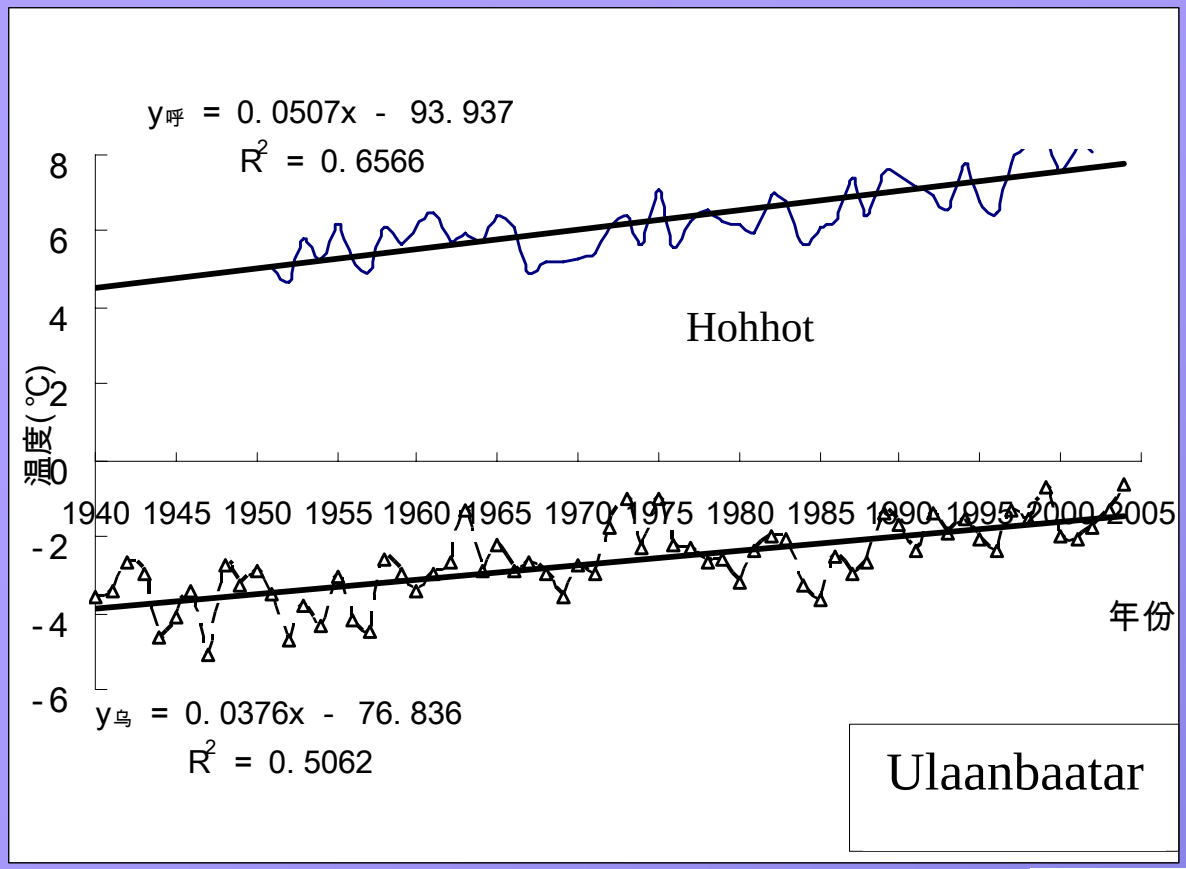


Increment in Accumulated Temperature ≥10°of MN

Temperature & Precipitation: Hohhot vs Ulaabaatar

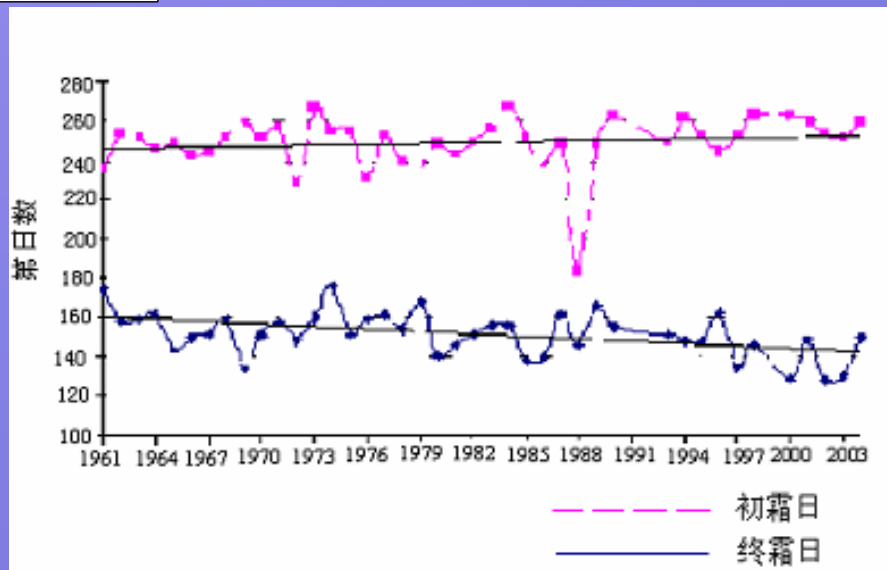




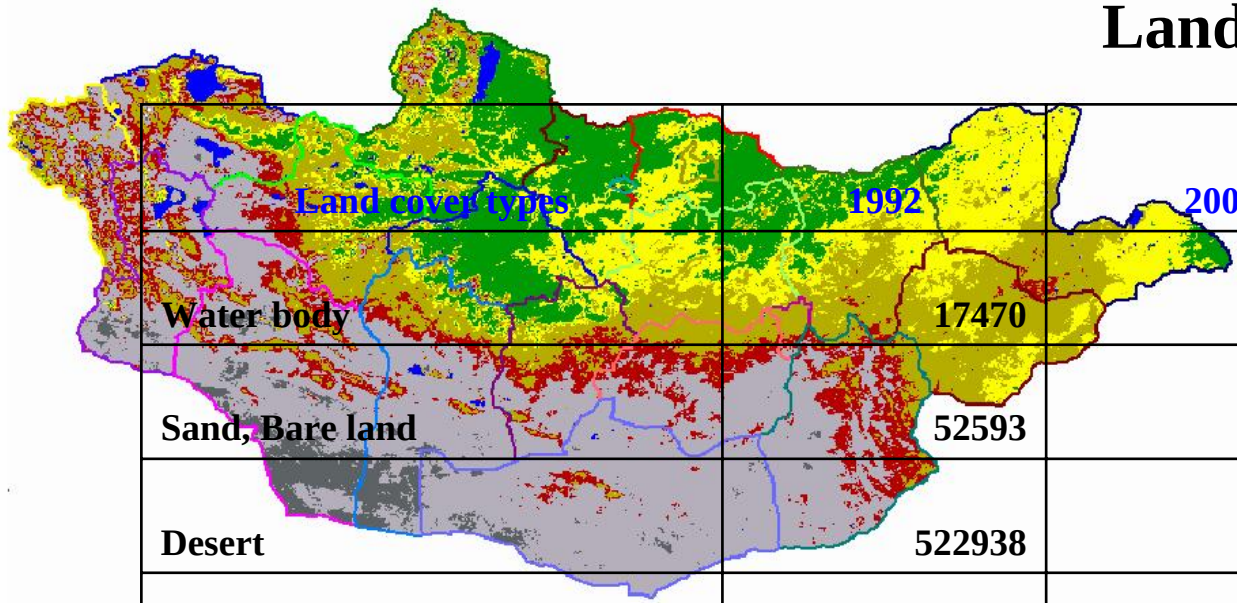


Ten years' temperature increase:
Hohhot 0.51℃,
Ulaanbaatar 0.38℃

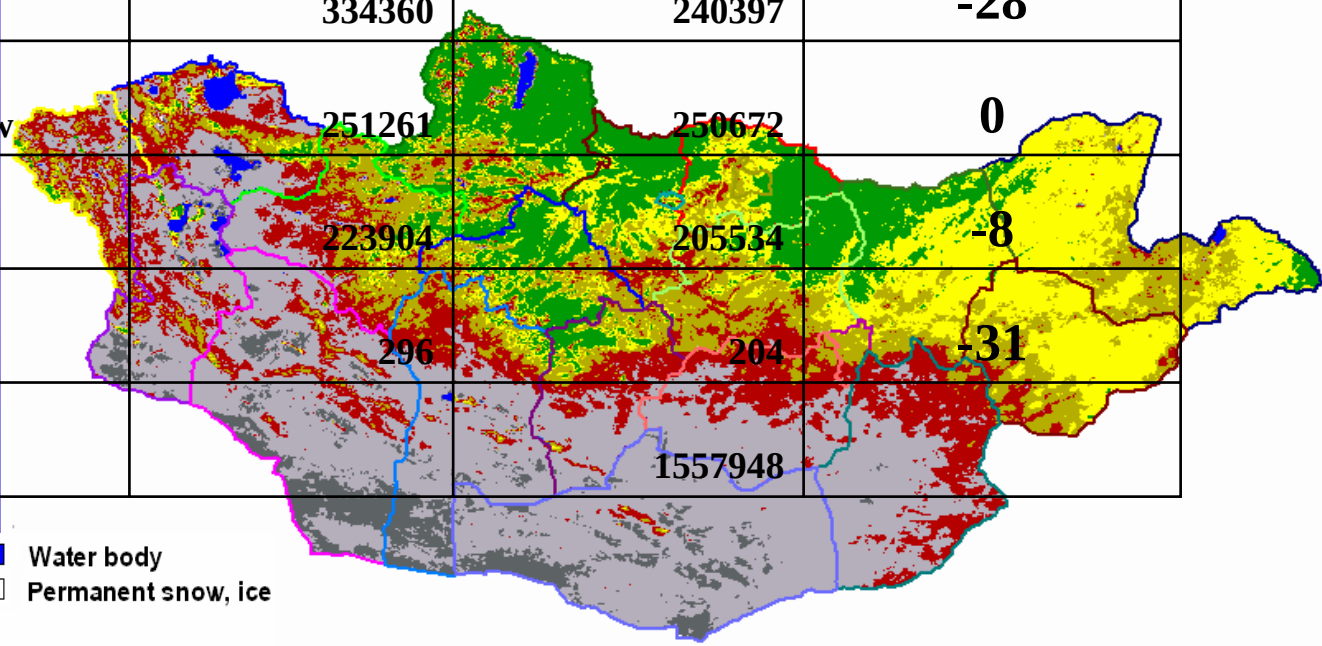
Frost free days increased by 7 ~ 12 d in Northern Mongolia, a favorable tendency for crop growth.



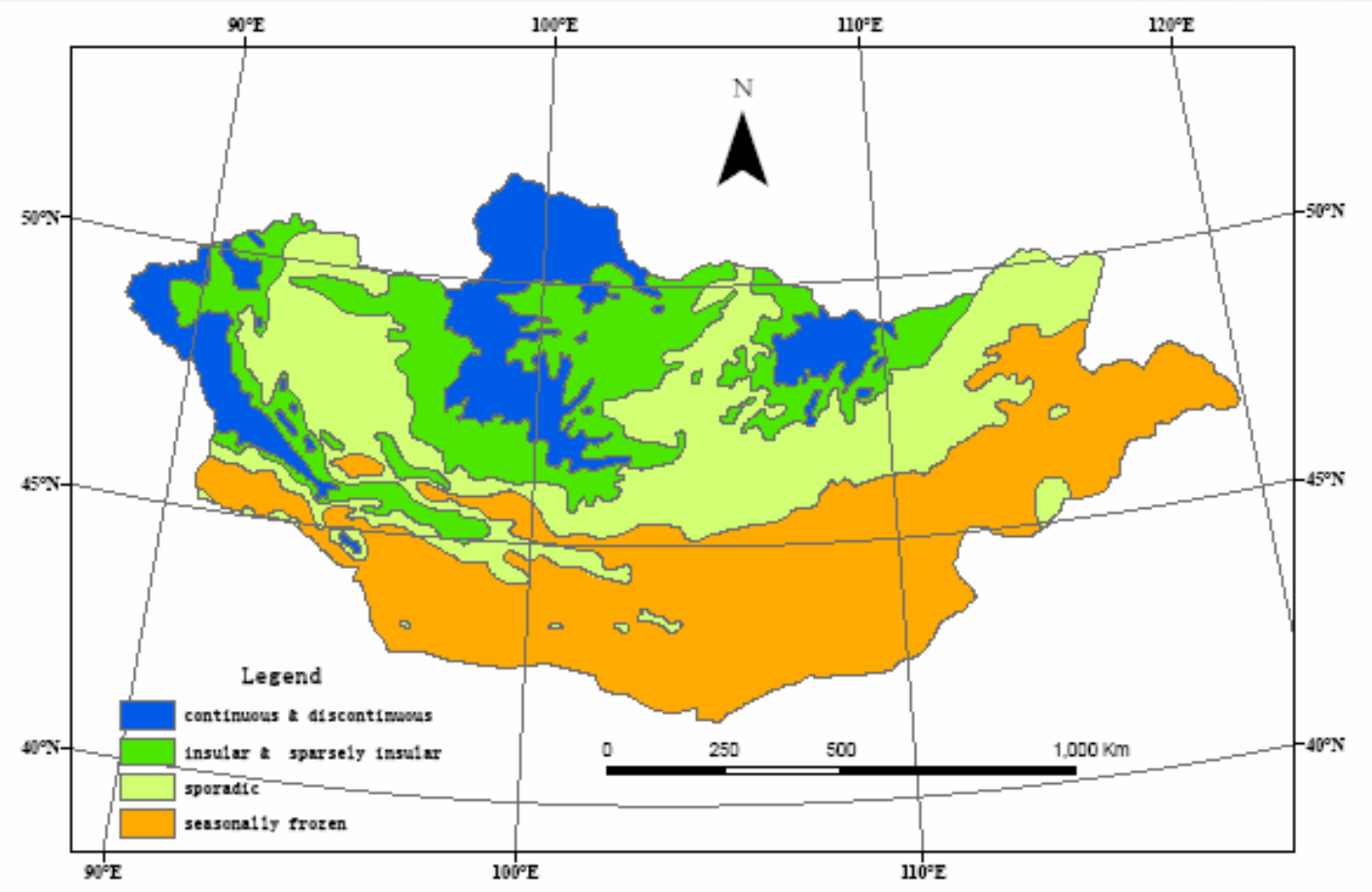
Land cover of MN 1992-2002



Land cover types	1992	2002	Changes (%)
Water body	17470	11131	-36
Sand, Bare land	52593	76700	46
Desert	522938	525259	0
Desert Steppe	155126	253936	64
Dry Steppe	334360	240397	-28
Grassland, Steppe, Meadow	251261	250672	0
Forested area	223904	205534	-8
Permanent snow, ice	296	204	-31
Total (sq. km.)		1557948	



Forested area
Grassland (steppe)
Dry steppe
Desert steppe
Desert (Gobi)
Barren land
Water body
Permanent snow, ice



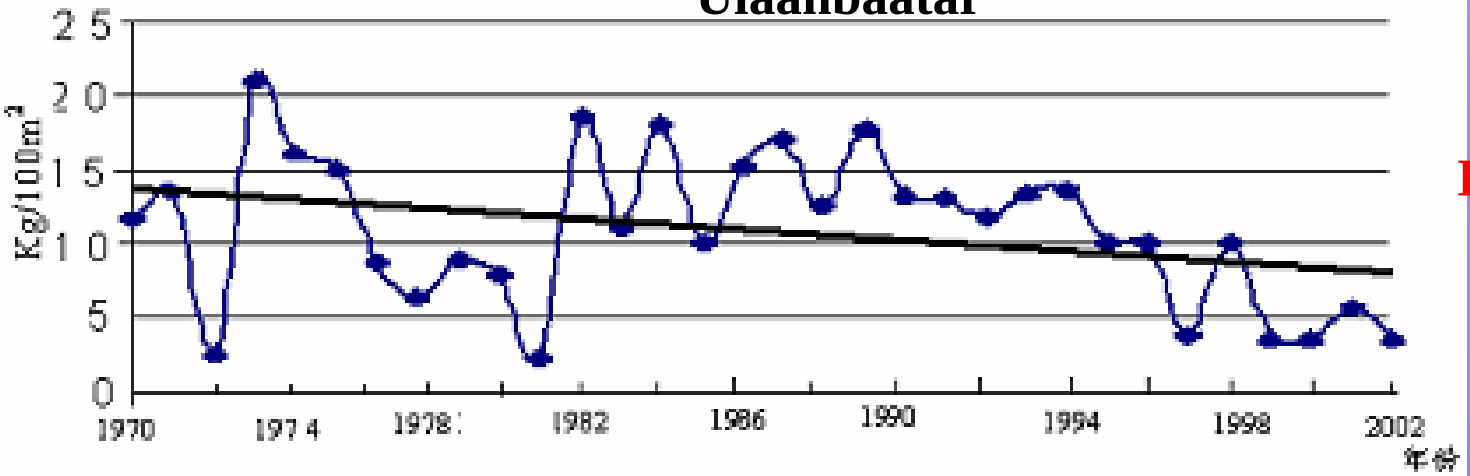
Permafrost distribution in Mongolia (after Sodnom et al, 1990)

Pulse EKKOPRO ground-penetrating radar

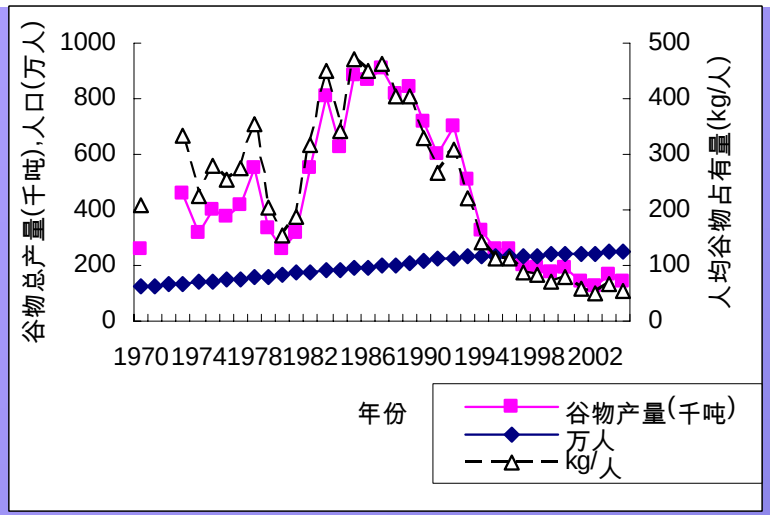
Permafrost degradation is observed in all the CALM and GTN-P boreholes of Mongolia. (Sharkhuu, 2003).

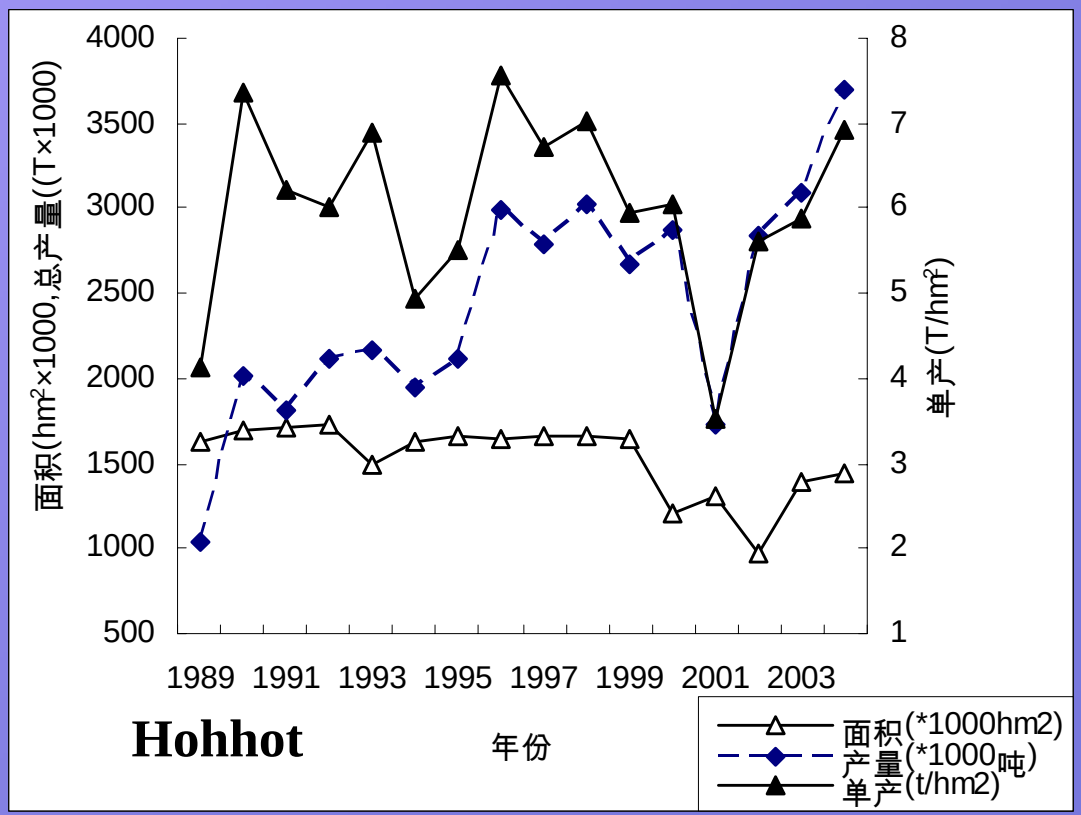
Dagvadorjet al (2001) predicted that the area of permafrost will be shrunk to 24%-28% of Mongolia's territory by 2040 and 16%-25% by 2070.

Ulaanbaatar

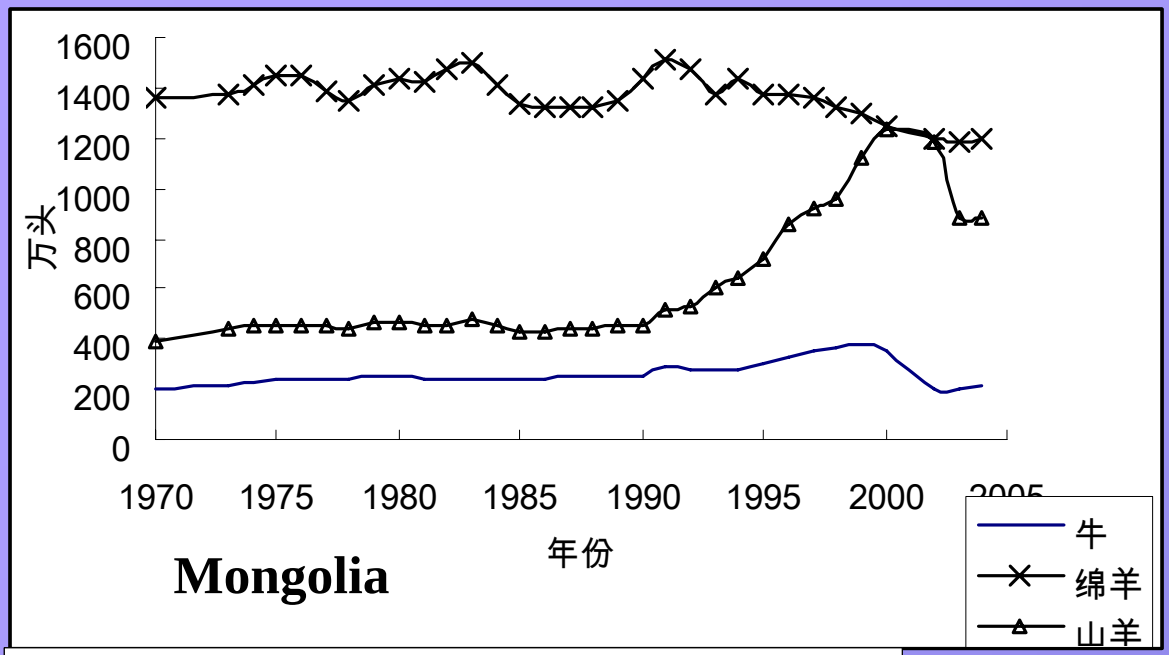


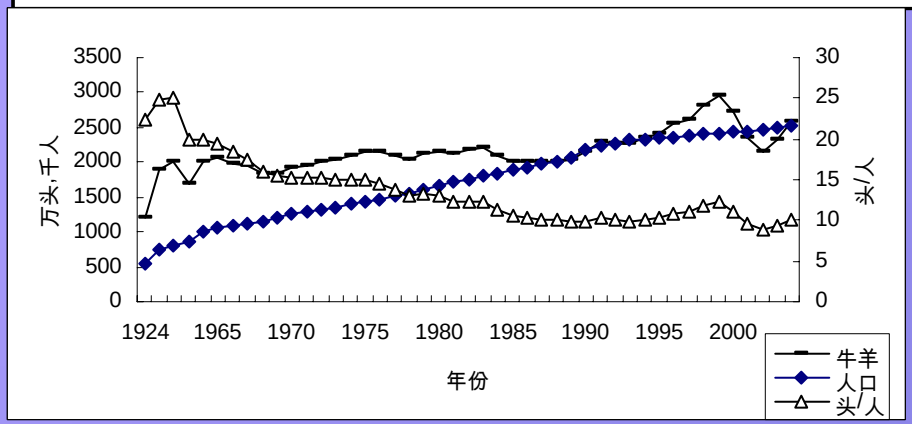
Impact of climate change on crop yield

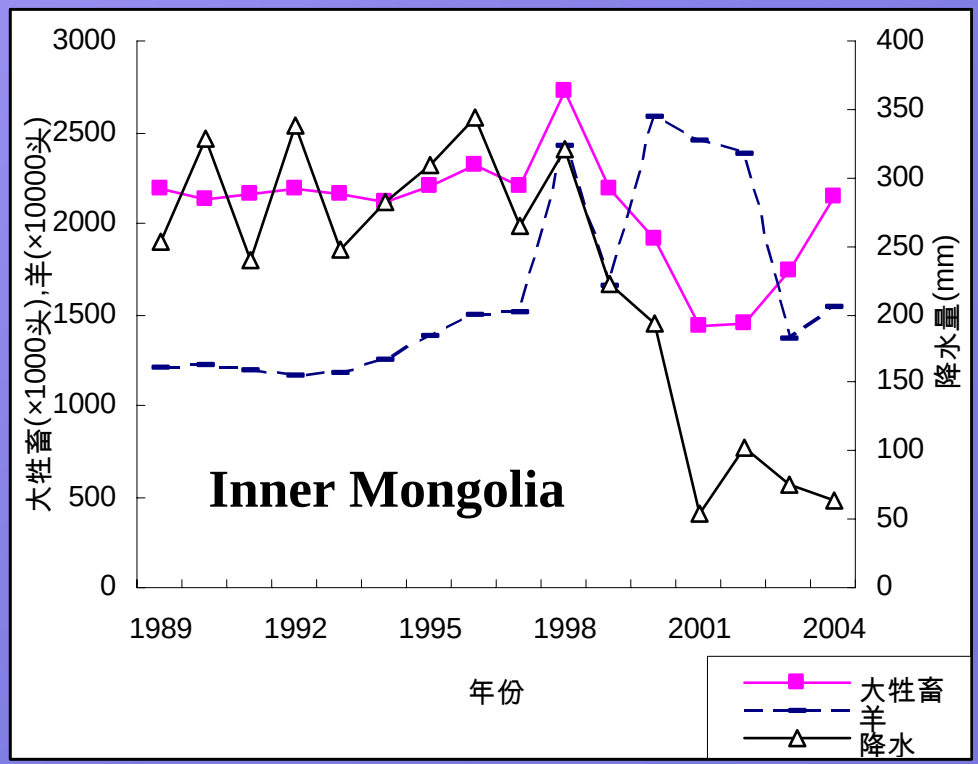




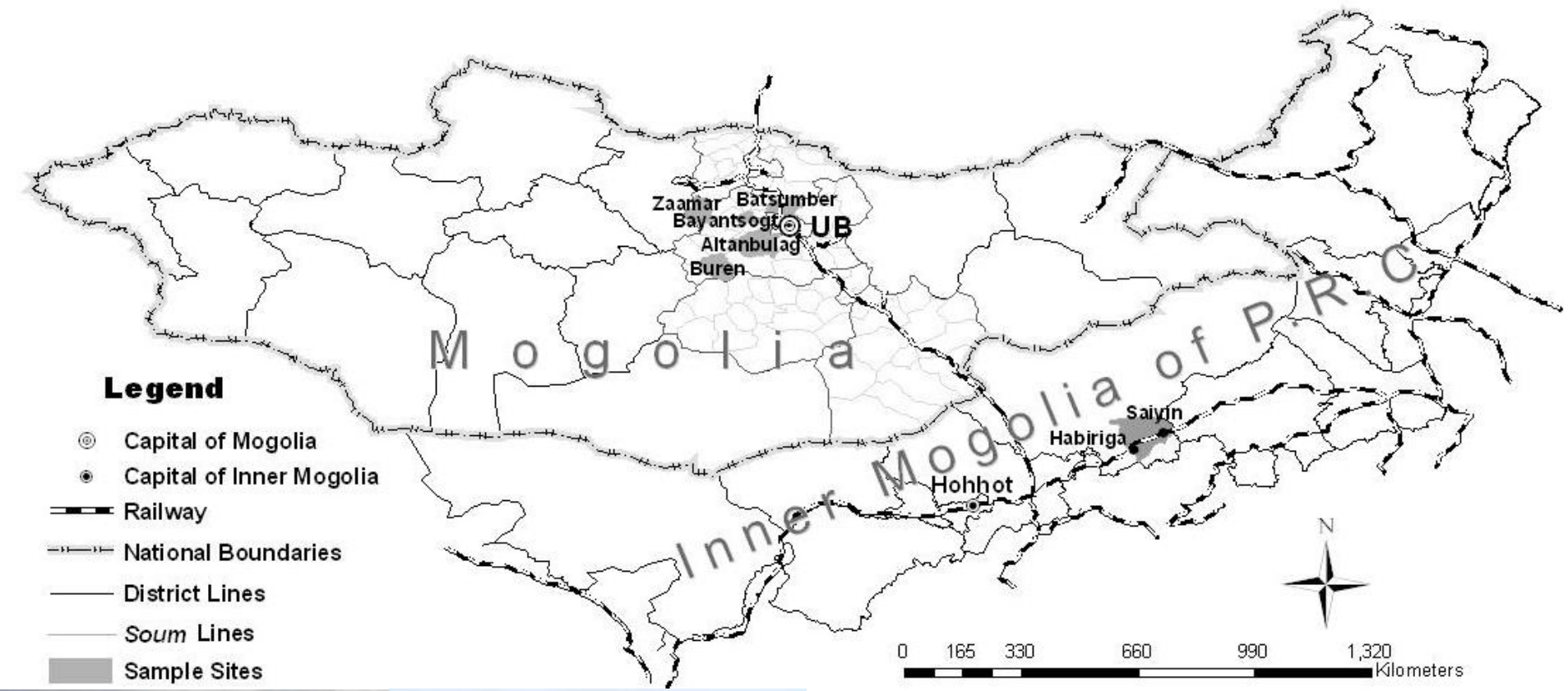
Impact of climate change on livestock







3. Human-natural system: Consumption and perceptions of ecosystem services: Mongolia vs Inner Mongolia



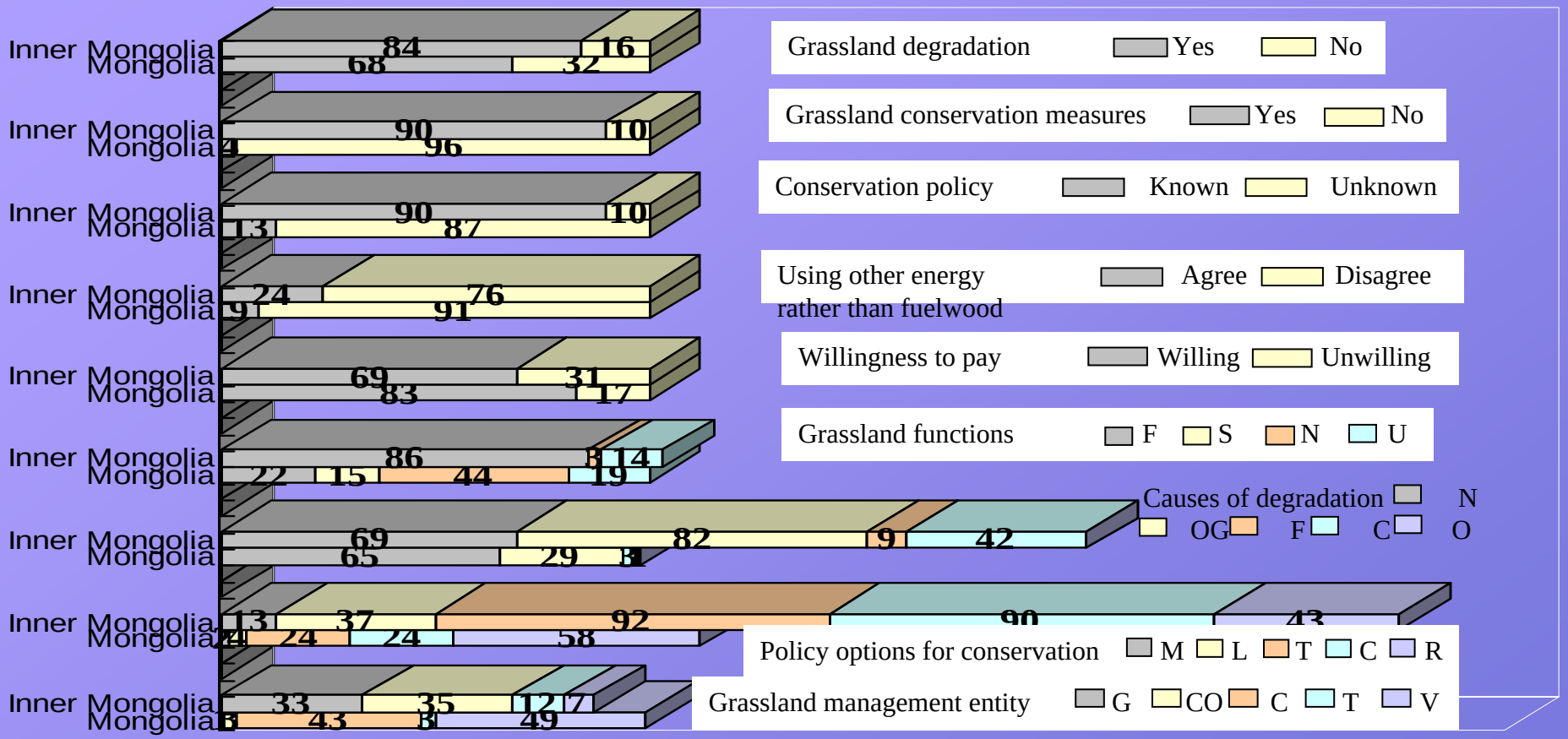
Consumption items	Mongolia	Inner Mongolia
	kg/cap.yr	kg/cap.yr
Crops		
Wheat	133.12*	103.46
Rice	50.26	33.18
Potato	20.93	27.96
Vegetables	6.81	27.85
Sub-total	*211.12*	*192.45*
Meat		
Mutton	42.3	43.54
Beef	59.28	66.65
Horse meat	82.65	0
Sub-total	*184.23*	*110.19*
Milk and products	786.19	100.78
Fuel		
Fuelwood	434.90	416.73
Dried grass	53.86	49.23
Crop residue	8.39	138.46
Animal dung	2705.54	1411.54

Nutrition intakes from actual consumptions and assessment

Items	Mongolia				Inner Mongolia			
	Caloric	Protein	Fat	Carbohy drate	Caloric	Protein	Fat	Carbohy drate
Nutrition Intake	19,781	199	203	531	10,472	94	95	320
Plant (%)	38	24	4	73	55	40	7	92
Animal (%)	62	76	96	27	45	60	93	8
Intake reference	9,630	77*	70	400	9,630	77	70	400
Sufficiency (%)	205	259	290	133	109	122	136	80

* Reference percentage: plant protein 70%, and animal protein 30%.

Perceptions of local stakeholders of ecosystem changes and conservation



Grassland functions: F-fodder; S-soil conservation; N-natural beauty; U-unknown
Causes of degradation: N-natural disaster; OG-overgrazing; F-fuel collection; C-cultivation; O-others
Policy options for conservation: M-migration; L-limit livestock; T-tourism; C-cultivation of value added crops; R-remain as it is
Grassland management entity: G-government; CO-co-managed by community and government; C-community; T-township; V-village committee

Respondents knowledge and perceptions of grassland ecosystem conservation

logistic regression results

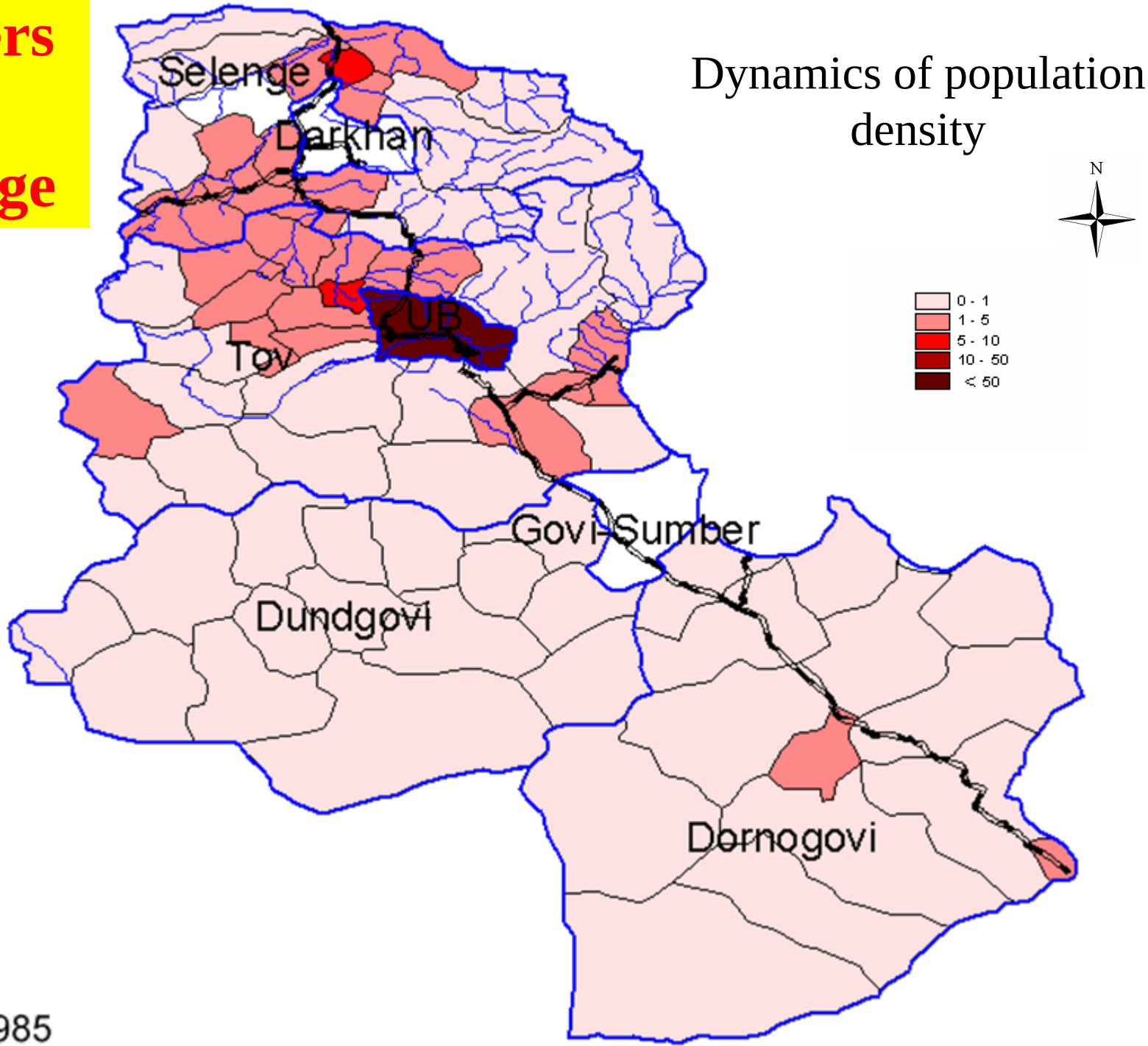
Question (X^2 , P , R^2)	Answer	Statistic variables	Input variables				
			GEN	AGE	EDU	HHS	LVR
Degradation of grassland (40.455 , 0.000 , 0.317)	Yes 1 No 0	B	0.758	-0.026	-0.030	0.320	0.002
		S.E.	0.571	0.013	0.211	0.126	0.002
		Wald	1.765	4.447	0.020	6.488	1.092
		P	0.184	0.035	0.887	0.011	0.296
		Exp(B)	2.135	0.974	0.971	1.378	1.002
Limiting animal raising (14.258, 0.014 , 0.106)	Willing 1 Unknown 2 Unwilling 3	B	0.651	0.031	0.292	0.337	-0.001
		S.E.	0.696	0.014	0.221	0.160	0.001
		Wald	0.876	4.687	1.750	4.431	0.564
		P	0.349	0.030	0.186	0.035	0.453
		Exp(B)	1.918	1.032	1.339	1.401	0.999
Developing tourism (19.402 , 0.002 , 0.129)	Willing 1 Unknown 2 Unwilling 3	B	1.857	0.002	0.124	0.238	0.002
		S.E.	0.559	0.011	0.169	0.120	0.001
		Wald	11.018	0.049	0.540	3.928	5.553
		P	0.001	0.825	0.463	0.047	0.018
		Exp(B)	6.404	1.002	1.132	1.268	1.002
Increasing value added crops (12.740 , 0.026 , 0.09)	Willing 1 Unknown 2 Unwilling 3	B	1.306	-0.009	-0.003	0.083	0.002
		S.E.	0.551	0.011	0.170	0.119	0.001
		Wald	5.617	0.665	0.000	0.492	6.386
		P	0.018	0.415	0.988	0.483	0.012
		Exp(B)	3.691	0.991	0.997	1.087	1.002

Environmental and Socio-Economic problems Perceived by Respondents

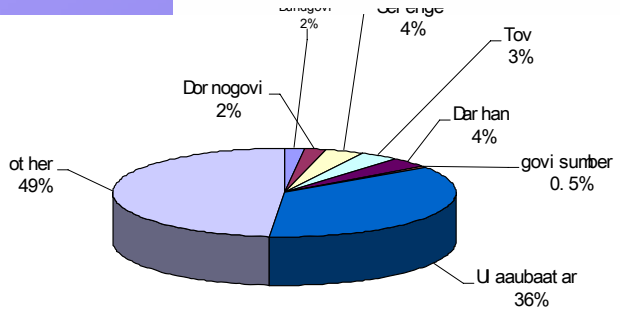
Index=1*P1+0.75*P2+0.5*P3+0.25*P4

Issues	Index Value (MN)	Rank (MN)	Rank (IMN)	Index Value (IMN)
Sand Storm	0.93	1	8	0.83
Cultivation Tech.	0.89	2	5	0.87
Drought	0.77	3	1	0.98
Snowfall	0.75	4	8	0.83
Cold	0.73	5	10	0.74
Low income	0.64	6	1	0.98
Pasture ins/dis,Edu	0.62	7	9	0.80
Disease of livestock	0.60	8	7	0.84
Medical care	0.59	9	4	0.94
Capital	0.58	10	2	0.97
Information	0.54	11	7	0.84
Insufficient water	0.53	12	3	0.95
Transportation	0.52	13	6	0.86
Animal rising tech.	0.47	14	8	0.83

Drivers of Change

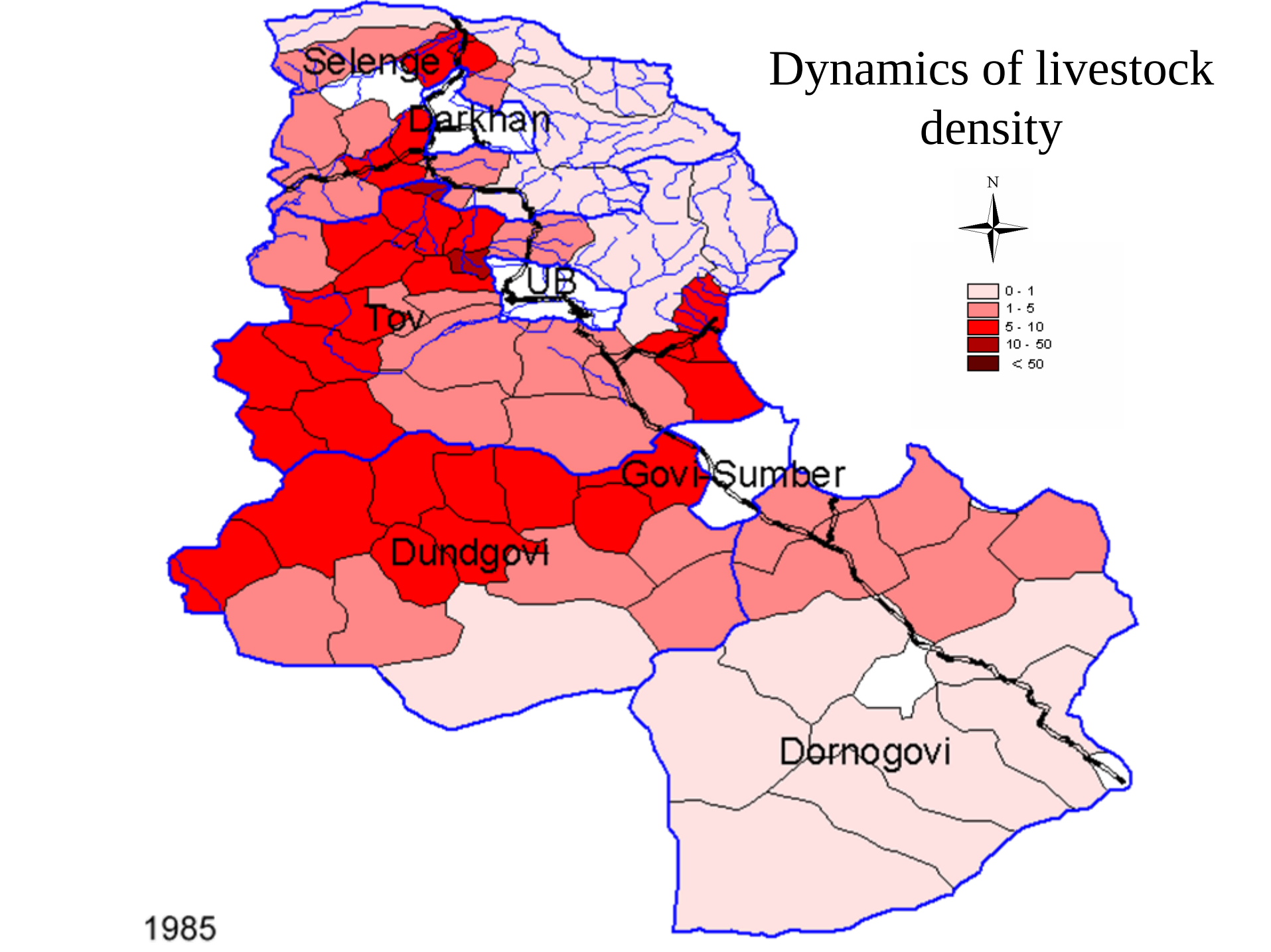


Population Changes (%) in 1985-2004 of Study Area

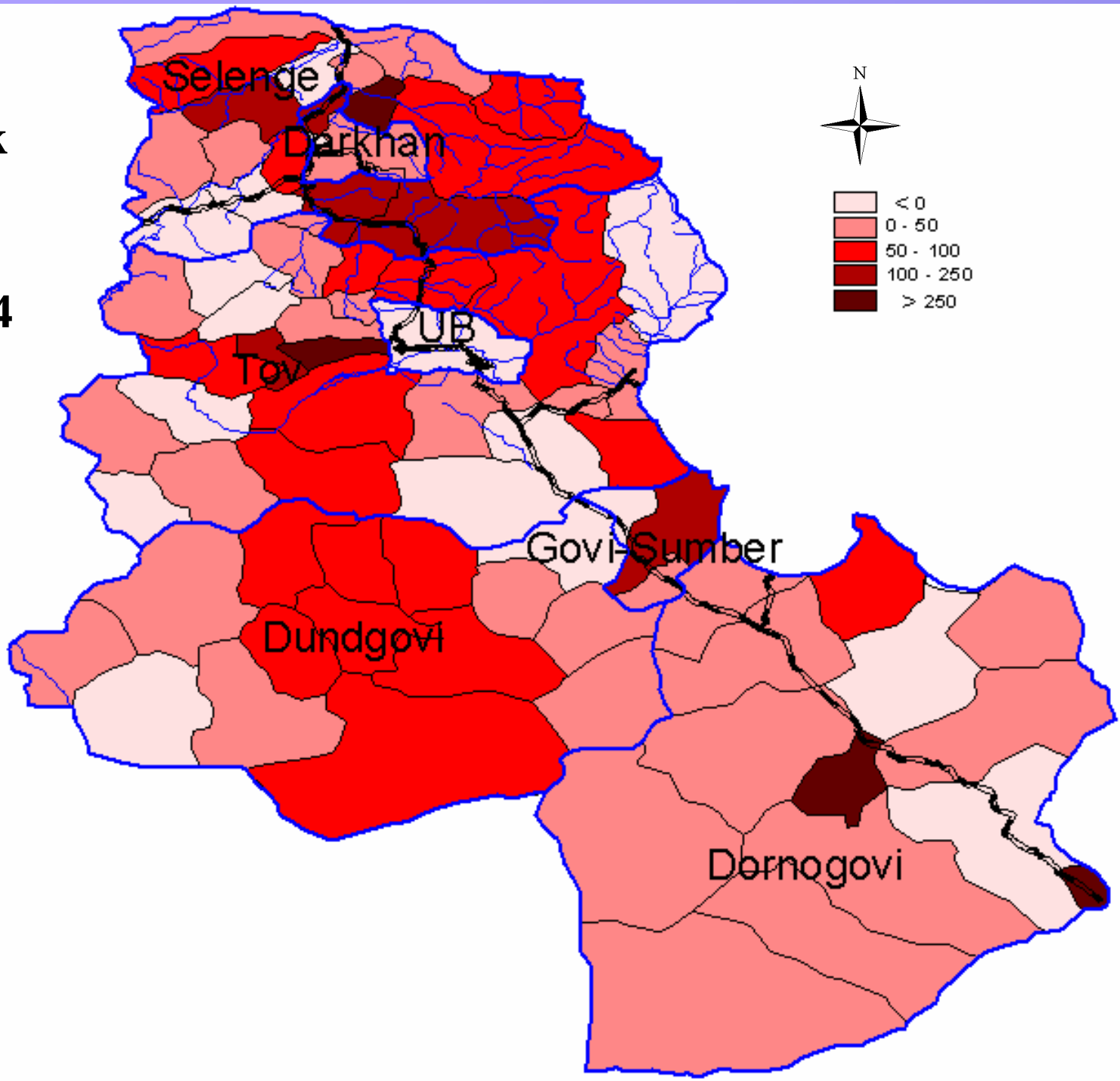


Population to total (%) as of 2004

Dynamics of livestock density



Livestock changes (%) in 1985-2004 of Study Area



4. Environmental consequence: soil erosion mechanism Mongolia vs Inner Mongolia

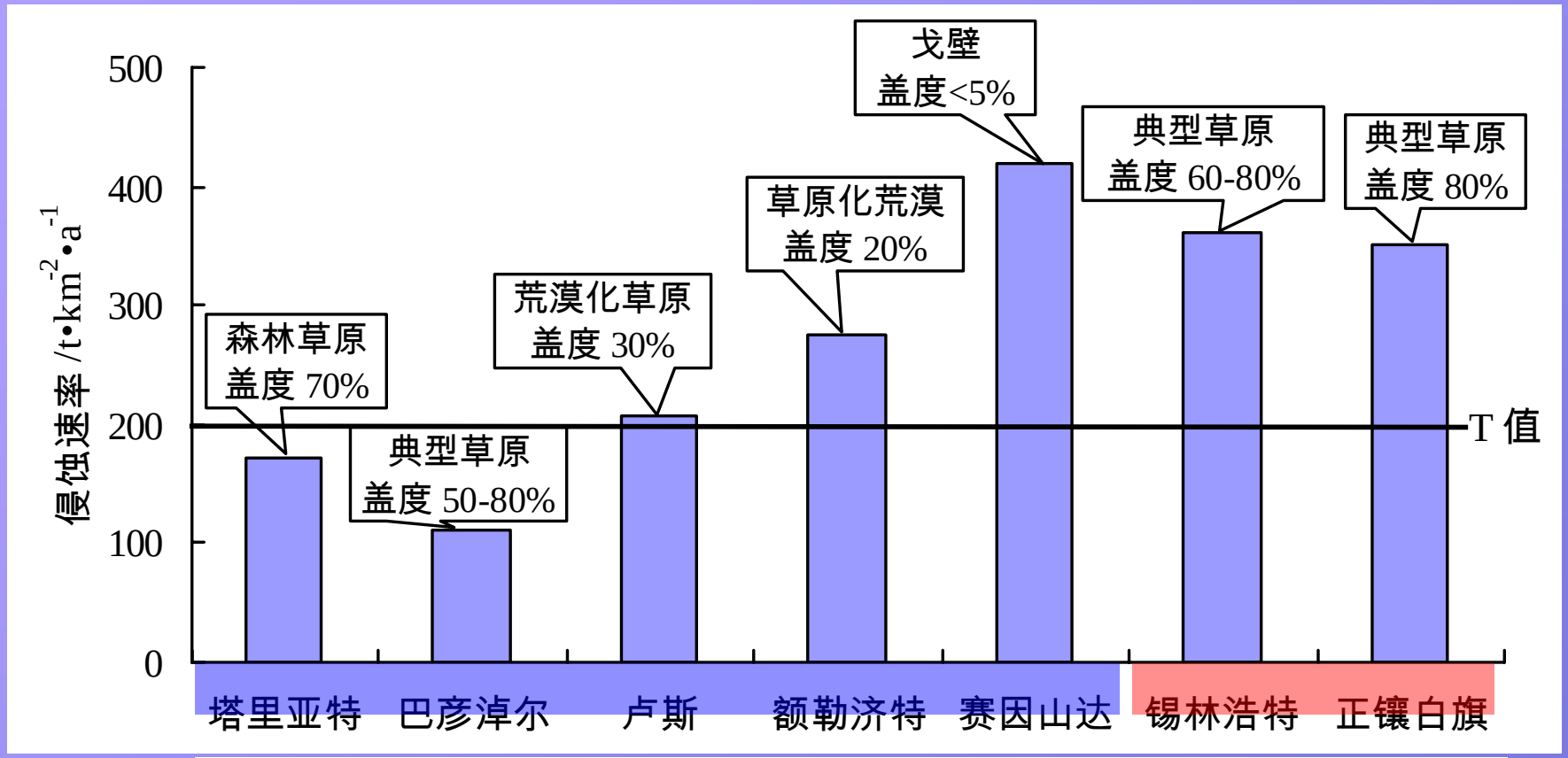
Across forest-grassland, typical grassland, desert grassland, Gobi, typical grassland, degrading typical grassland, and mixture of farming and herding

Scientists from the three Parties

Enjoying hard-working

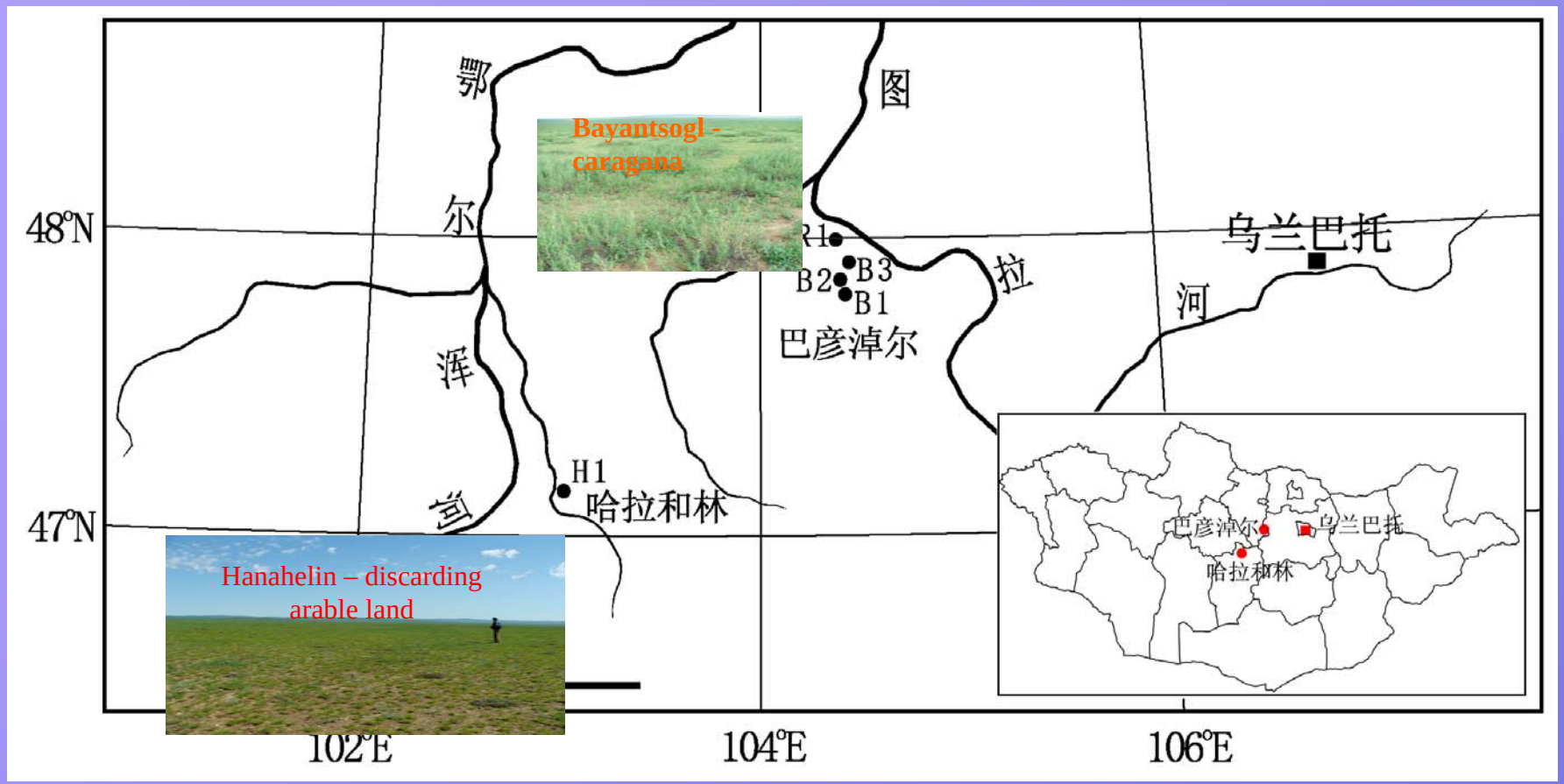
巴彦淖尔　塔里亚特　哈拉和林　卢 斯　额勒济特　赛因山达 Soil Samples: 95 MN, 84 IMN

Relations between green coverage and rate of soil erosion



Natural causes in MN vs human causes in IMN:

Decreasing precipitation and green coverage vs overgrazing and population



Response of herding vs farming to soil erosion

Rate of soil erosion using ^{137}Cs tracing method

采样点	^{137}Cs 面积活度 ($Bq \cdot m^{-2}$)	土壤容重 (g/cm^3)	年侵蚀厚度 (mm/a)	侵蚀速率 ($t \cdot km^{-2} \cdot a^{-1}$)
B1	1279.54±166.53	1.60	0.04	64.58
B2	1070.90±138.49	1.26	0.08	103.46
B3	846.45±100.89	1.24	0.14	169.07
H1	661.52±137.16	1.66	4.80	7987.92

Conclusions: grassland-light erosion; farmland-severe erosion, 50-100 times erosion rate of grassland.

Future Perspectives

Future Perspectives

Joint scientific research

- Joint survey on ecosystem-environment-socio-economic consequences
- Mapping LUCC
- Remote Sensing Image and Landuse data base
- Key ecosystem services and consumption patterns
- Soil erosion modeling & land degradation drivers

Future Perspectives

Exchanges and Capacity Building

- Training
- Joint master's & doctoral program
- Exchange of visiting scholars
- Conference, seminars, workshops




Thank You
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