CAHMDA/DAFOH

Climate Change Adaptation Involving Land Use Management and Grazing Strategies by Use of Social Survey, Statistics, and Numerical Modeling

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Wageningen University & Research Centre

Joint workshop, Austin, Texas, 8–12 Sept., 2014

Outline

1. ADAM Project
2. Methodology-PAF
3. Inner Mongolia case
   - Western Inner Mongolia-Alxa
   - Field work , Survey
   - Social statistics
   - Stakeholder meeting
   - Numerical modelling
4. Conclusion

ADAM Project (FP6, 2006-2009)

Adaptation and Mitigation
—for supporting European Climate Policy

Prof. Mike Hulme, UEA

ADAM kick-off meeting, Amsterdam, 2006

ADAM Project:

Four domains:

- Scenarios
- Policy Appraisal
- Mitigation
- Adaptation

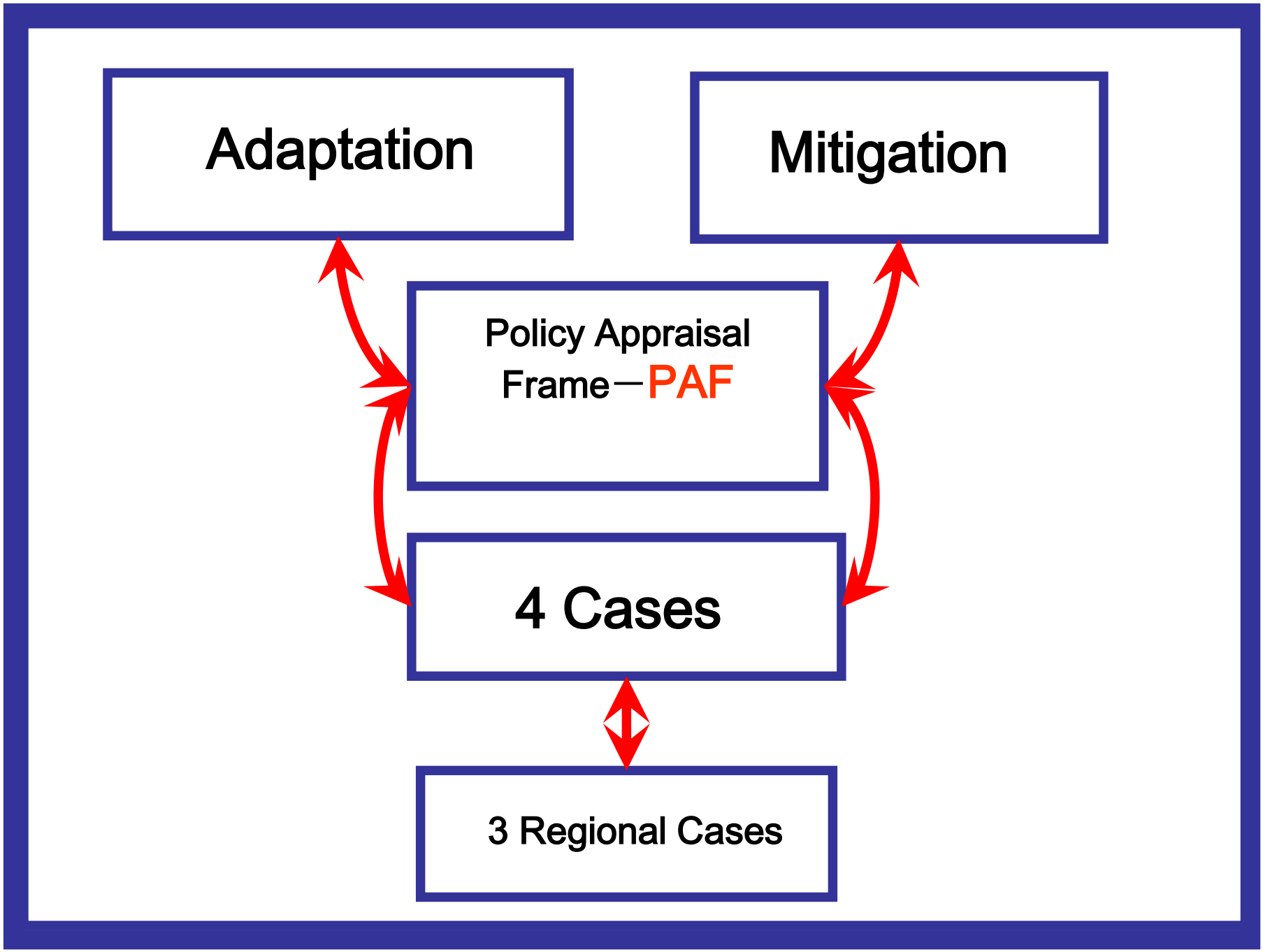
Four case studies

- Development of post-2012 policies for UNFCCC
- Europe's international development assistance
- Electricity sector
- **Three regional cases**

  Inner Mongolia , China

  Tasza River Basin, Hungary

  Guadiana River Basin, Spain


Adaptation
Mitigation
Policy Appraisal Frame—PAF
4 Cases
3 Regional Cases

Methodology

for ADAM Project

Policy-option Appraisal Frame-PAF

Four Stages during PAF Cycles

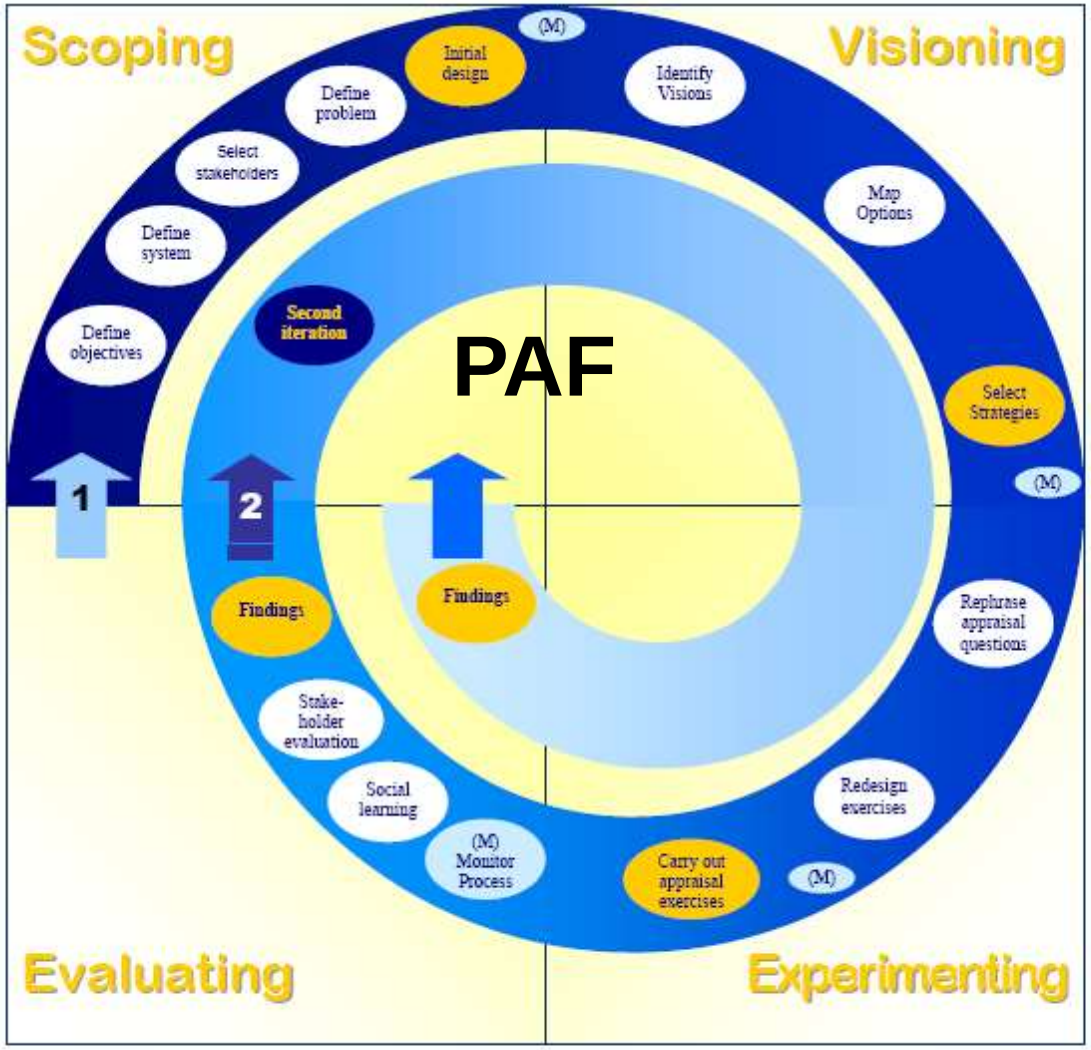
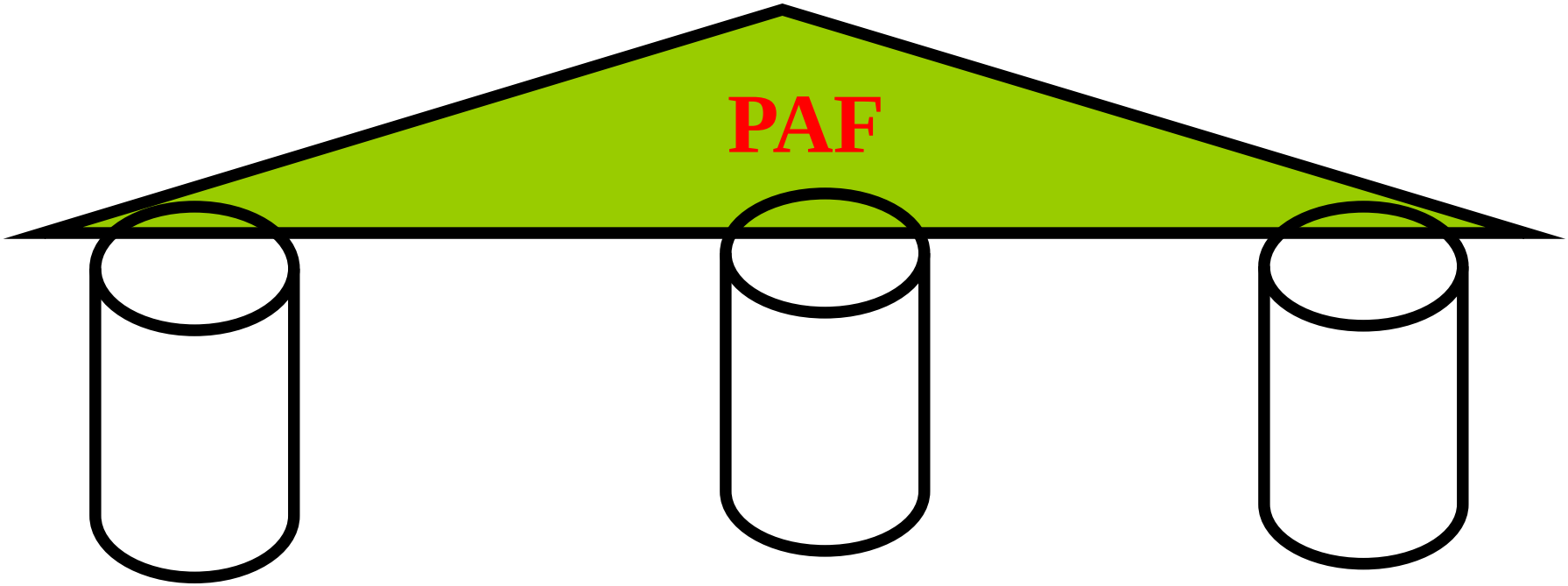


Figure 3: PAF Diagram – inner layer

Policy-option Appraisal Frame--PAF

Three Pillars for PAF



Analysis

Social statistics

Meta analysis

participatory

Survey ,field work

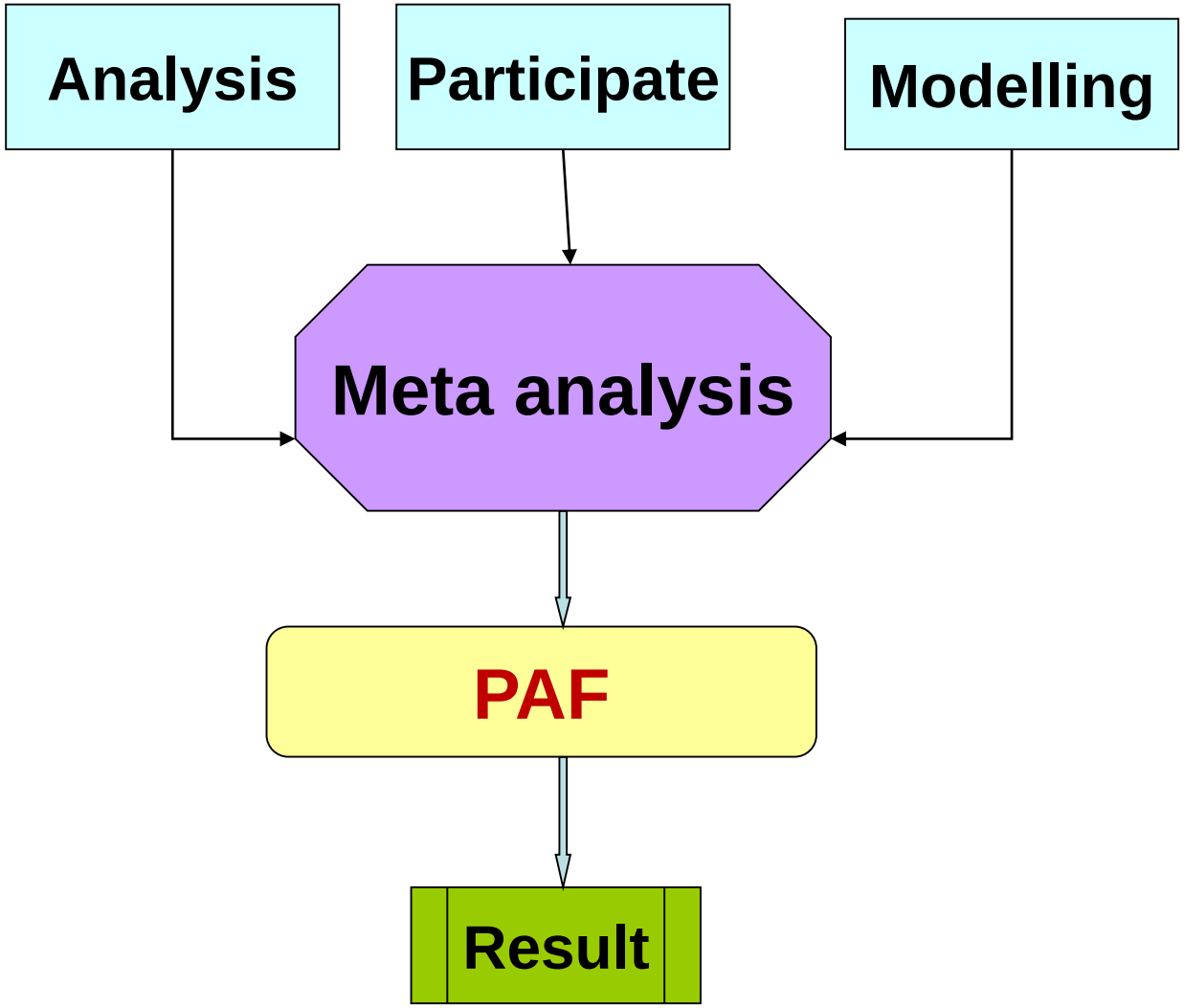
In-depth interview

Stakeholder meeting

modeling

Numerical simulation

Integrated Process



Inner Mongolia Case

-landuse

Prof. Congbin Fu
RCE-TEA, IAP, CAS

Case-study Area: Alxa League

Alxa:

Area : 270,000 km²

Population : 20,000

Position:

106.52ºE,

37.21º97.10º- - 42.47ºN

Three large deserts:

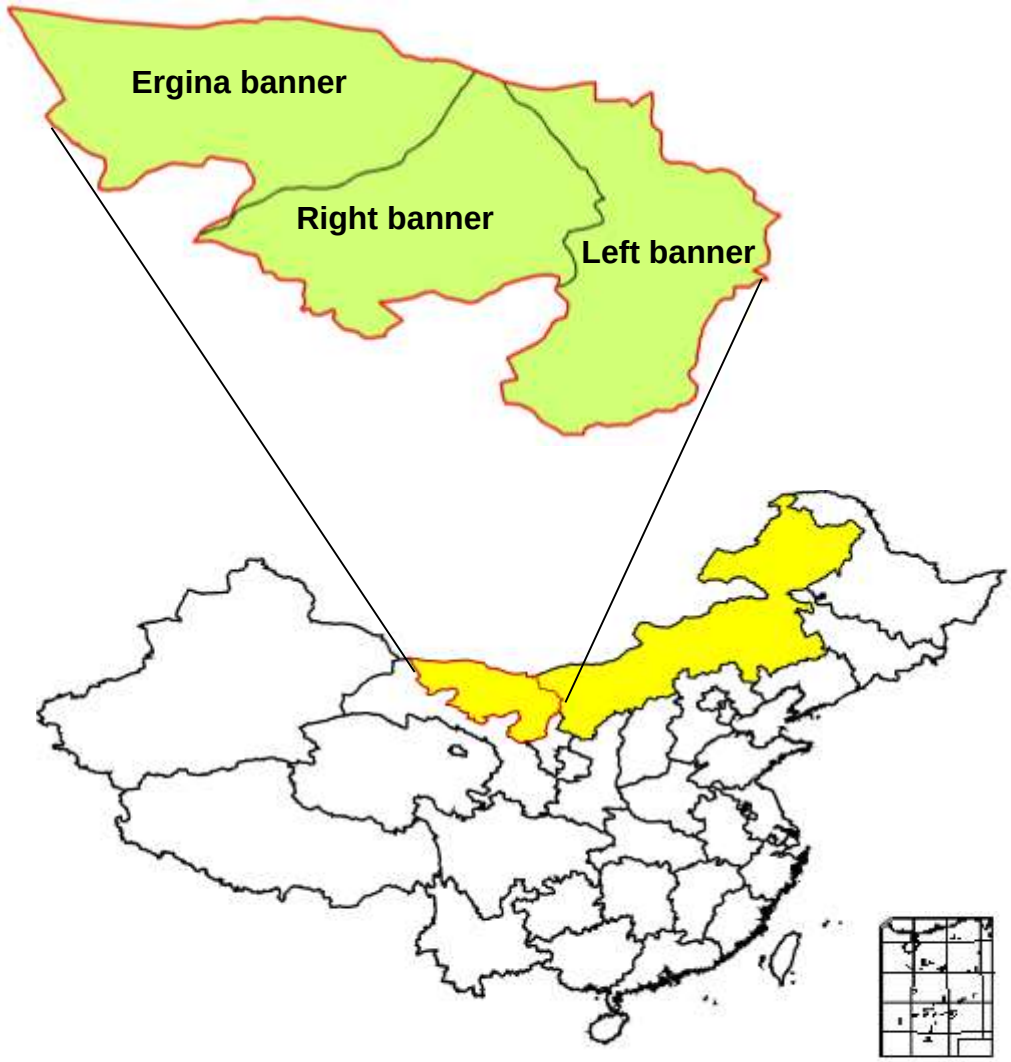
Badanjirin

Wulanbuhe

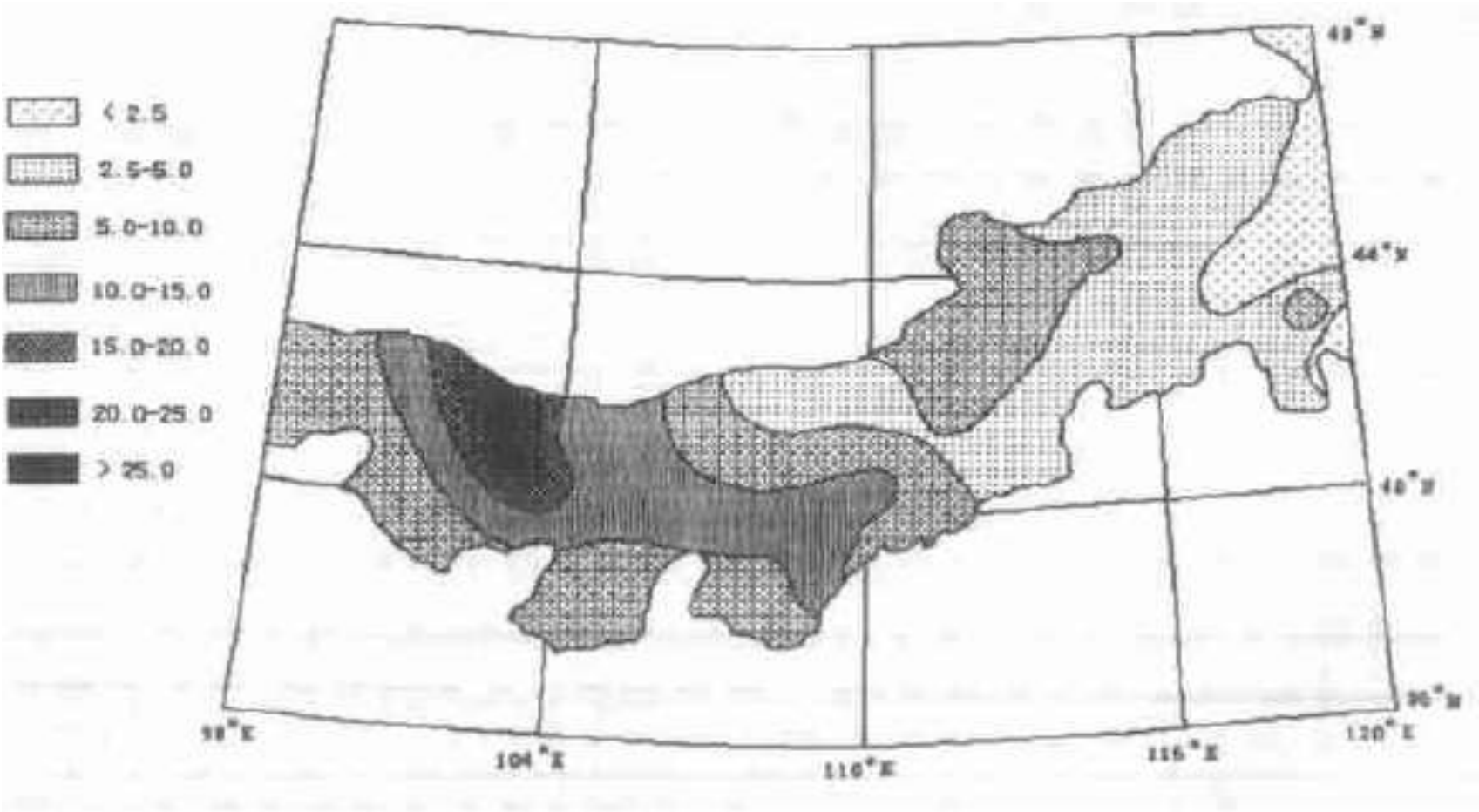
Tengli

The most important source

Of dust -storm in China

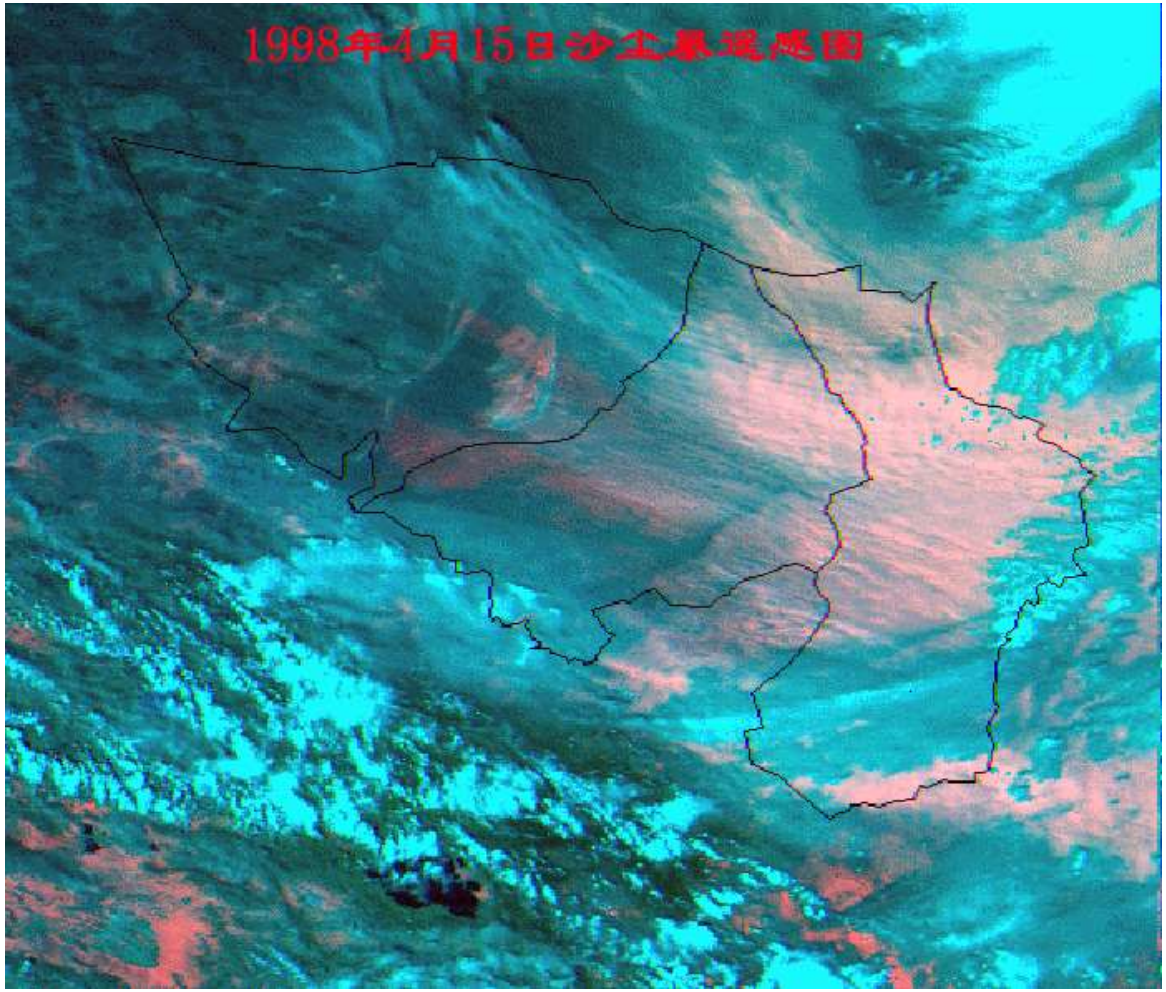


Duststorm days for 40-year average



Dust storm in western Inner Mongolia

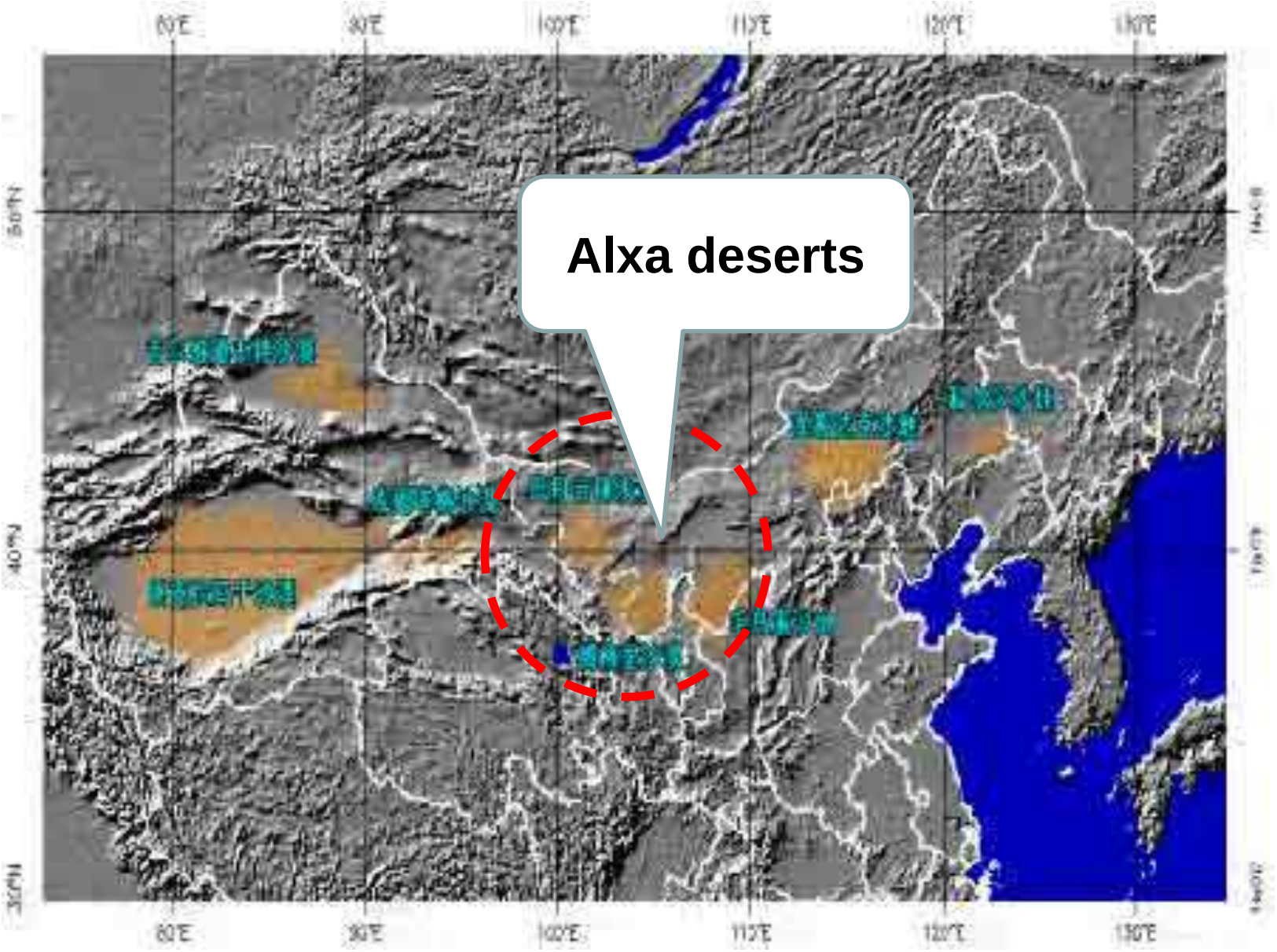
Dust storm in western Inner Mongolia



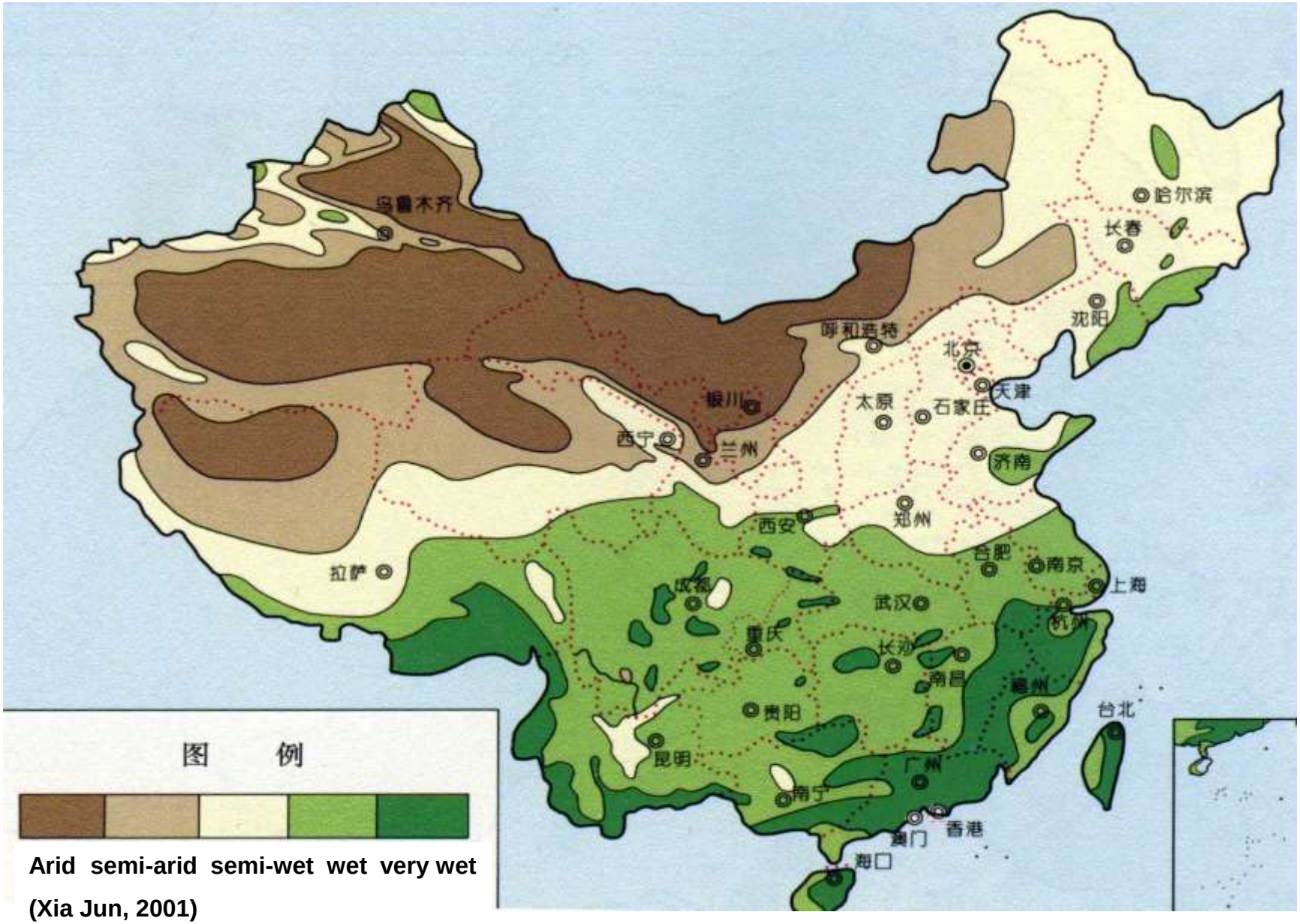
1993年5月5日席卷阿拉善盟大部地区的特强沙尘暴

2001年4月9日巴彦浩特沙尘暴

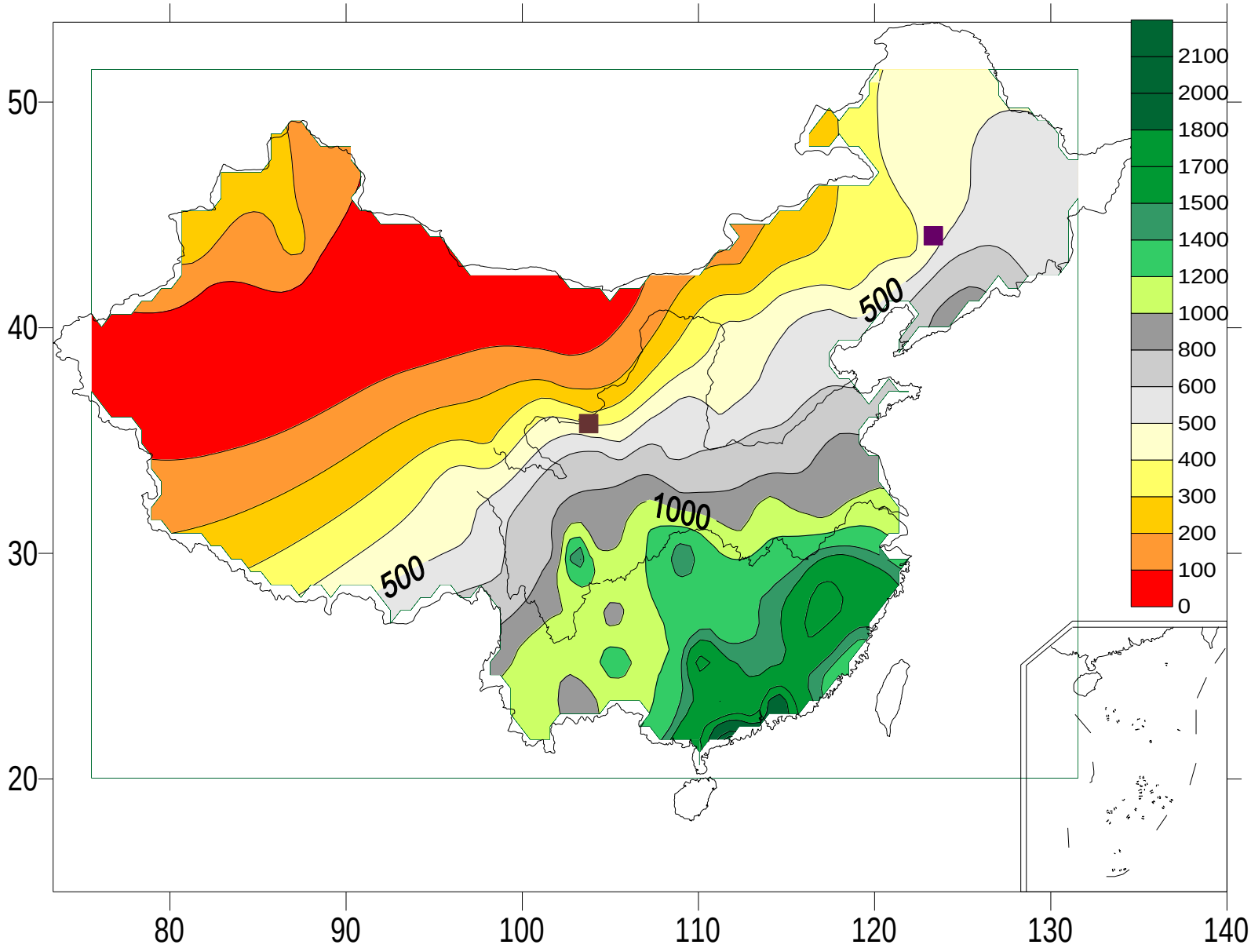
Large Deserts in China



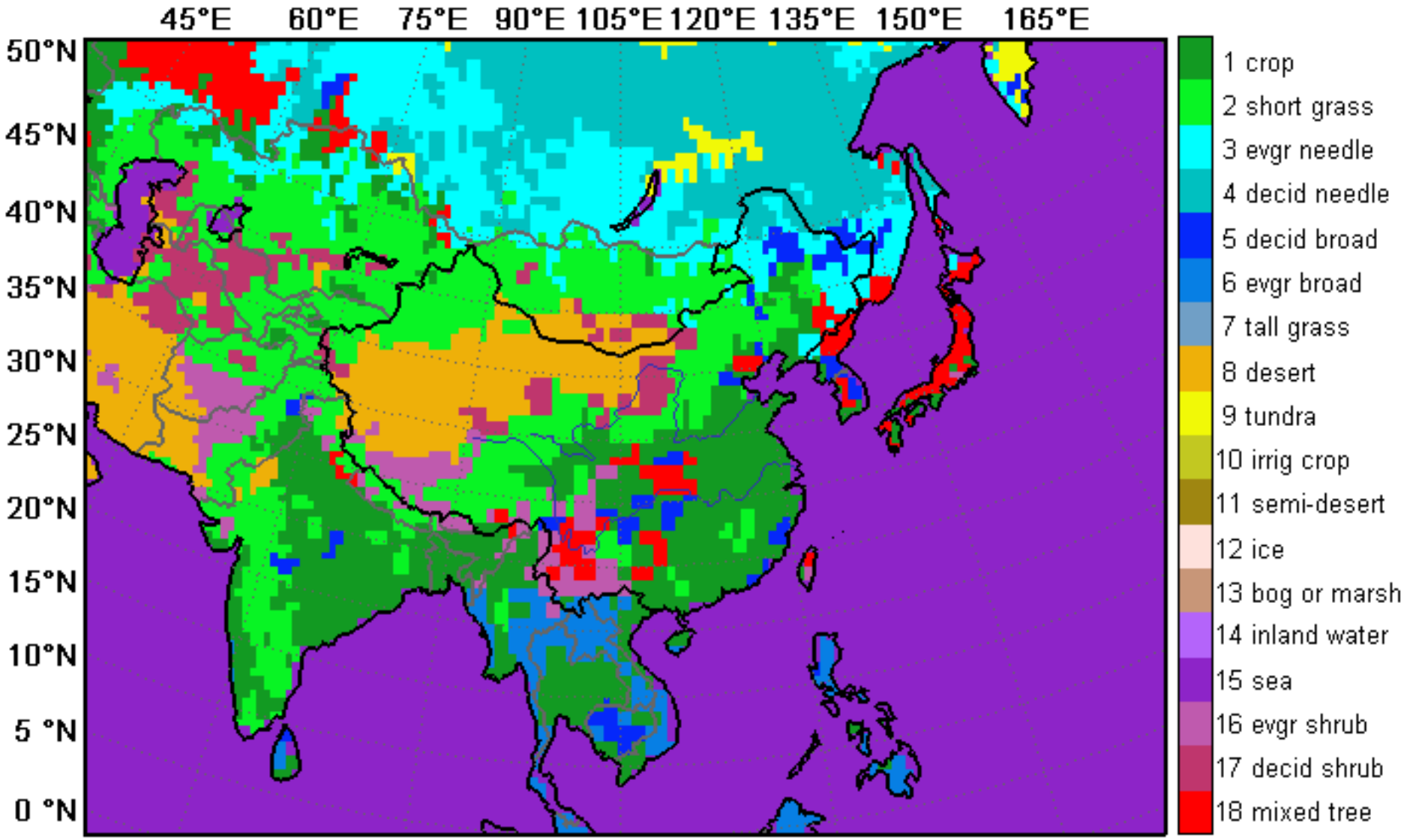
Climate zones in China



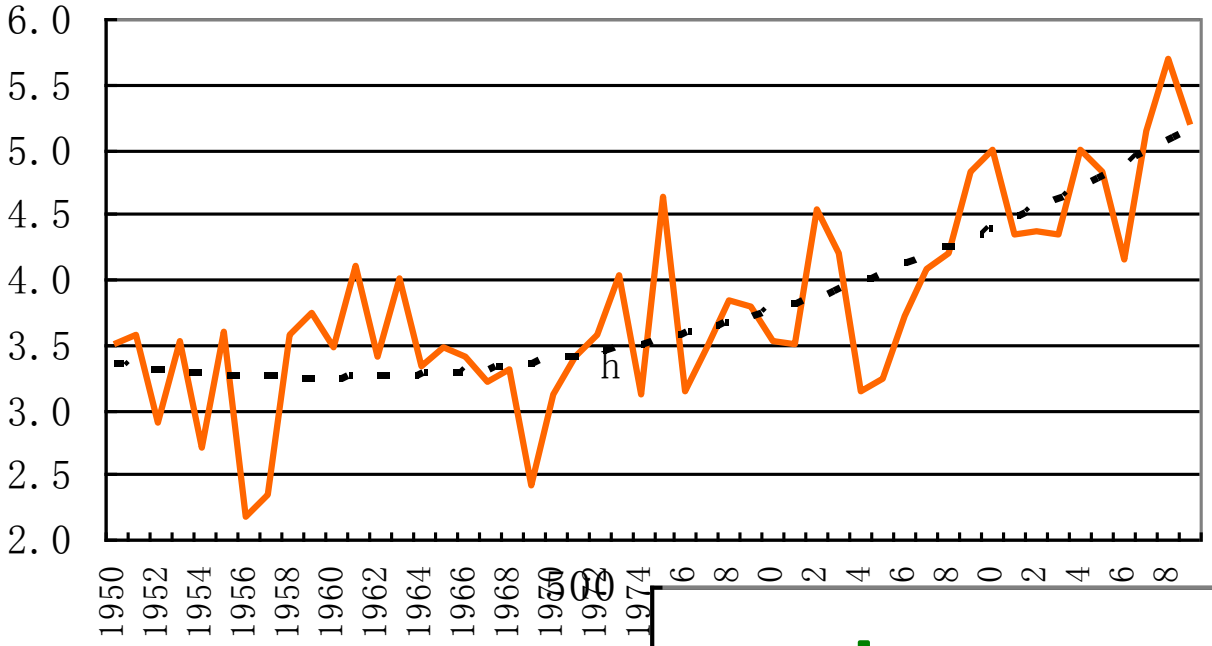
Climate precipitation for China

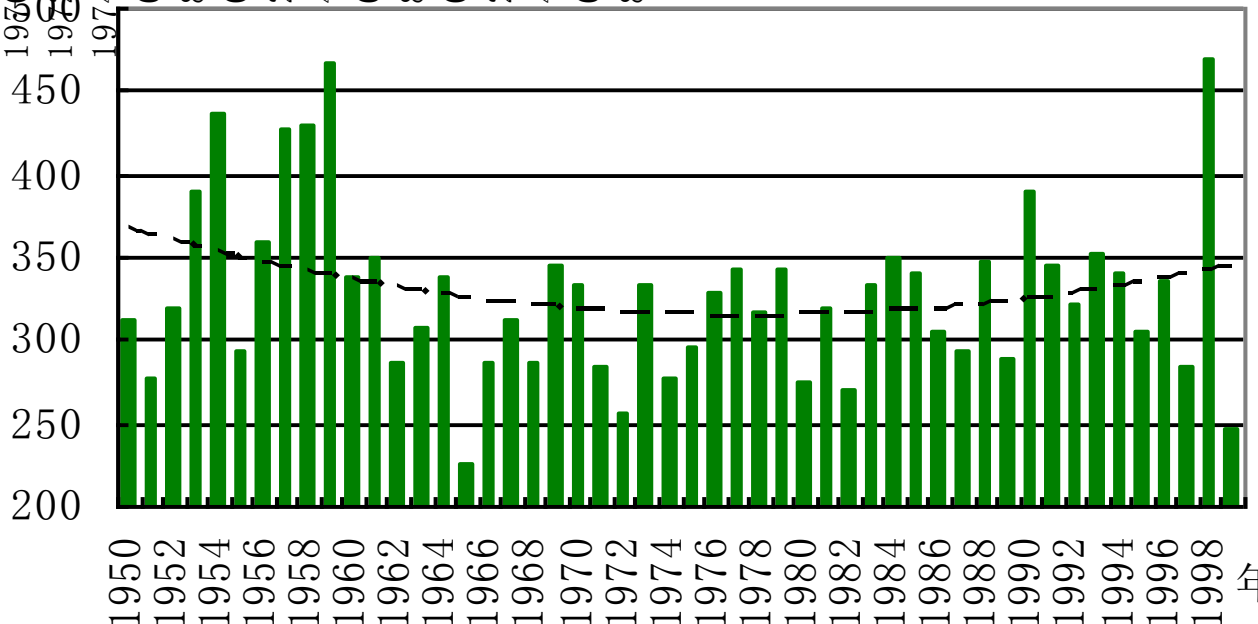


Land-cover for summer

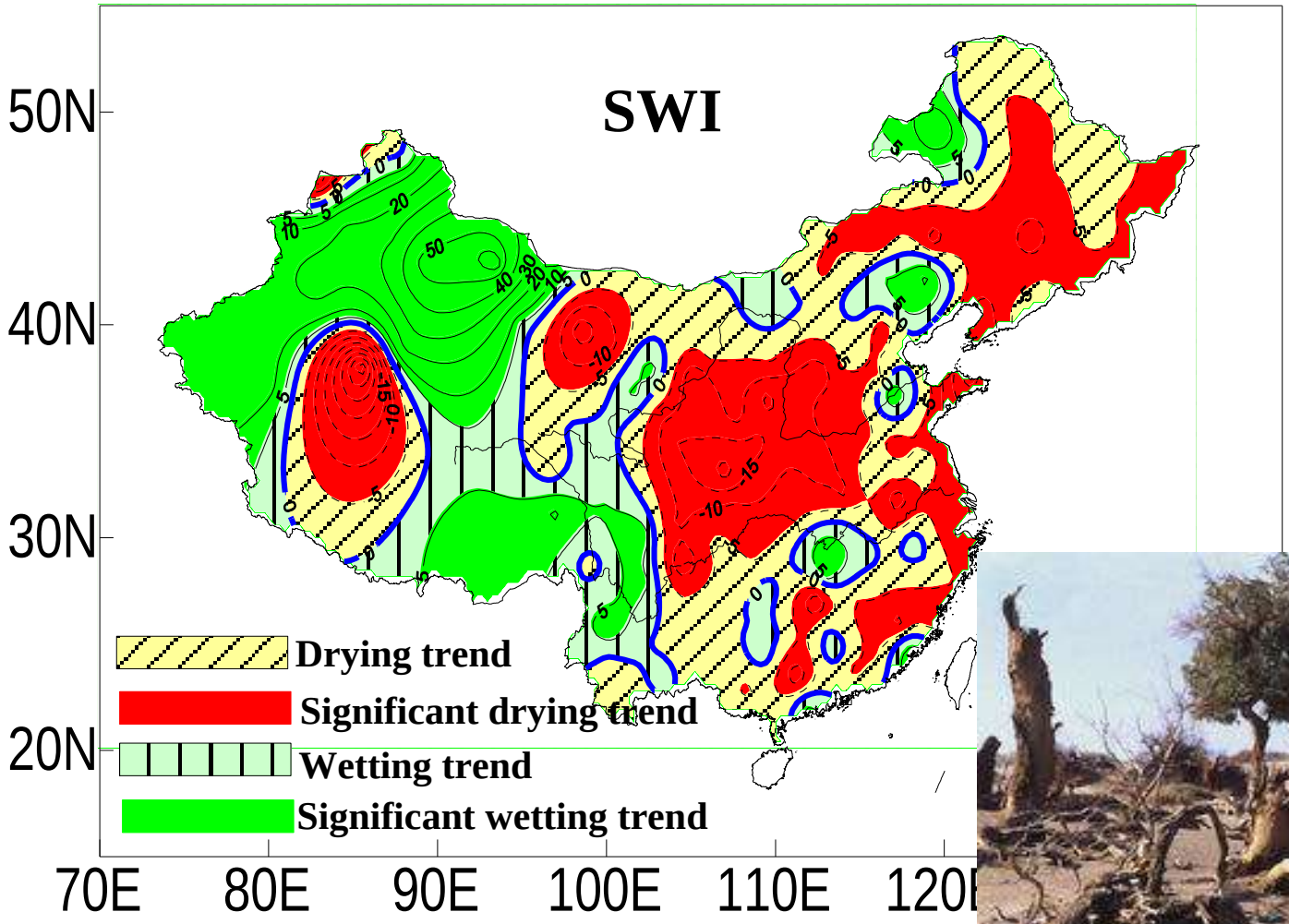


Alxa Climate Variation





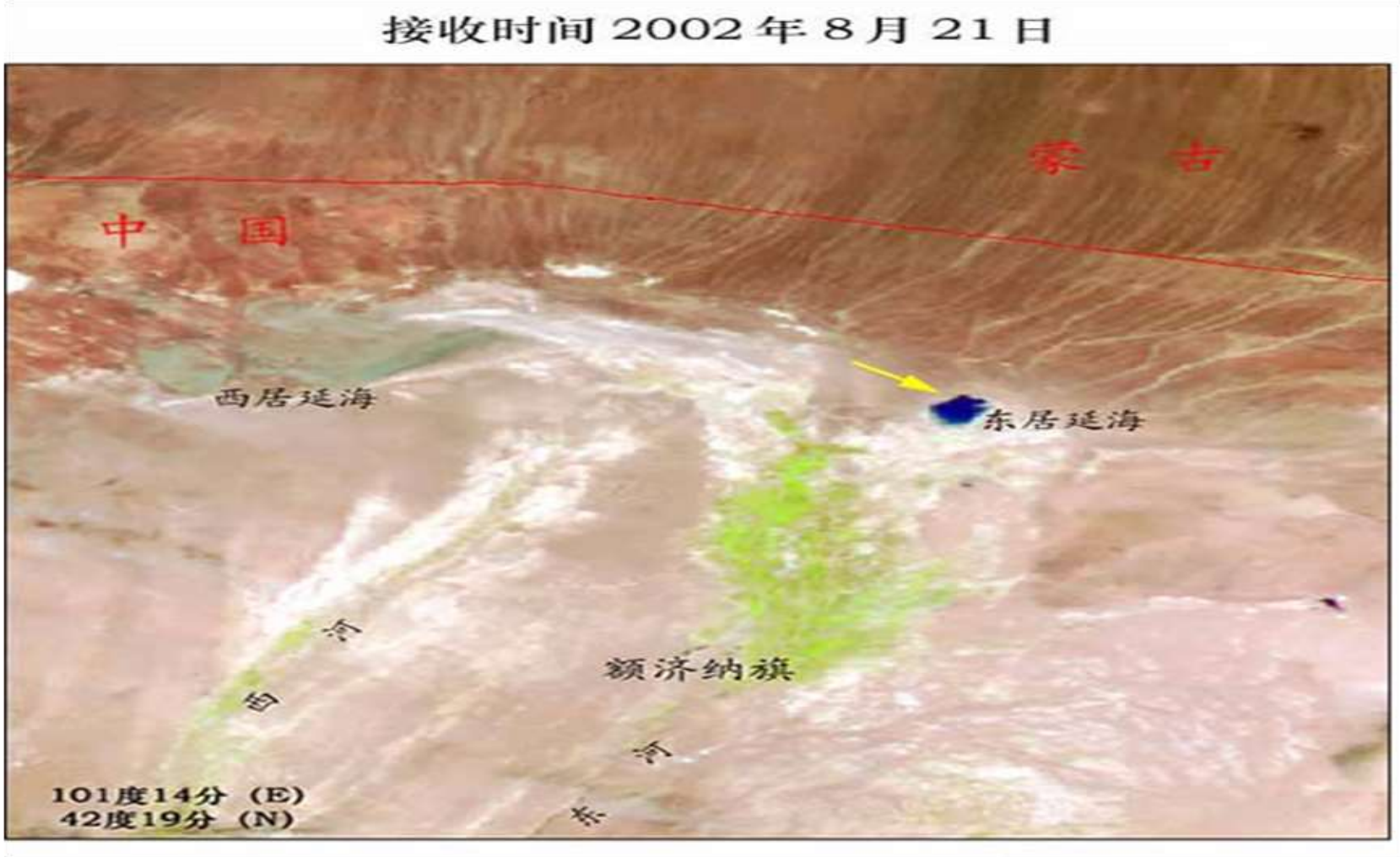
Trend of Surface Humid Index (SWI) : 1991 - 2006



$$SWI = \frac{P}{P_e}$$

Western Alxa: west and east Juyan Lakes

West Lake: dried out from mid-1960-2013
East Lake: dried out from 1992-2001



Field Work on

Climate Change impacts and Adaptation Measures

Interview in Depth

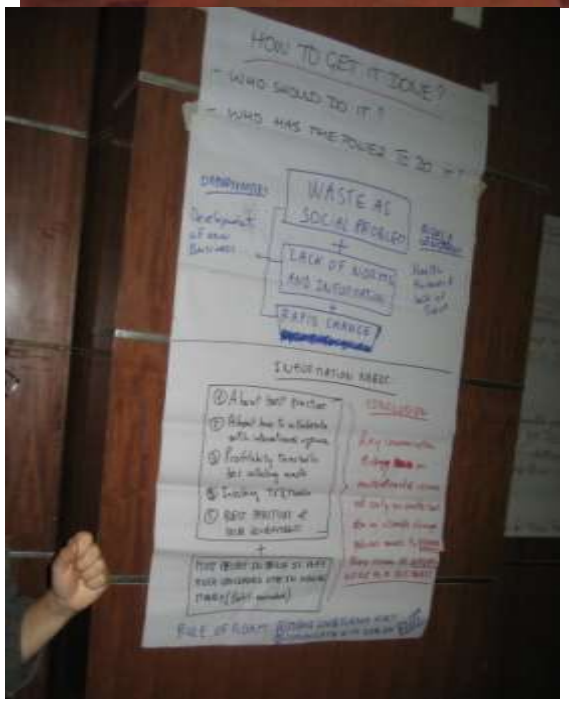
Visit immigrant village

Water Management Service

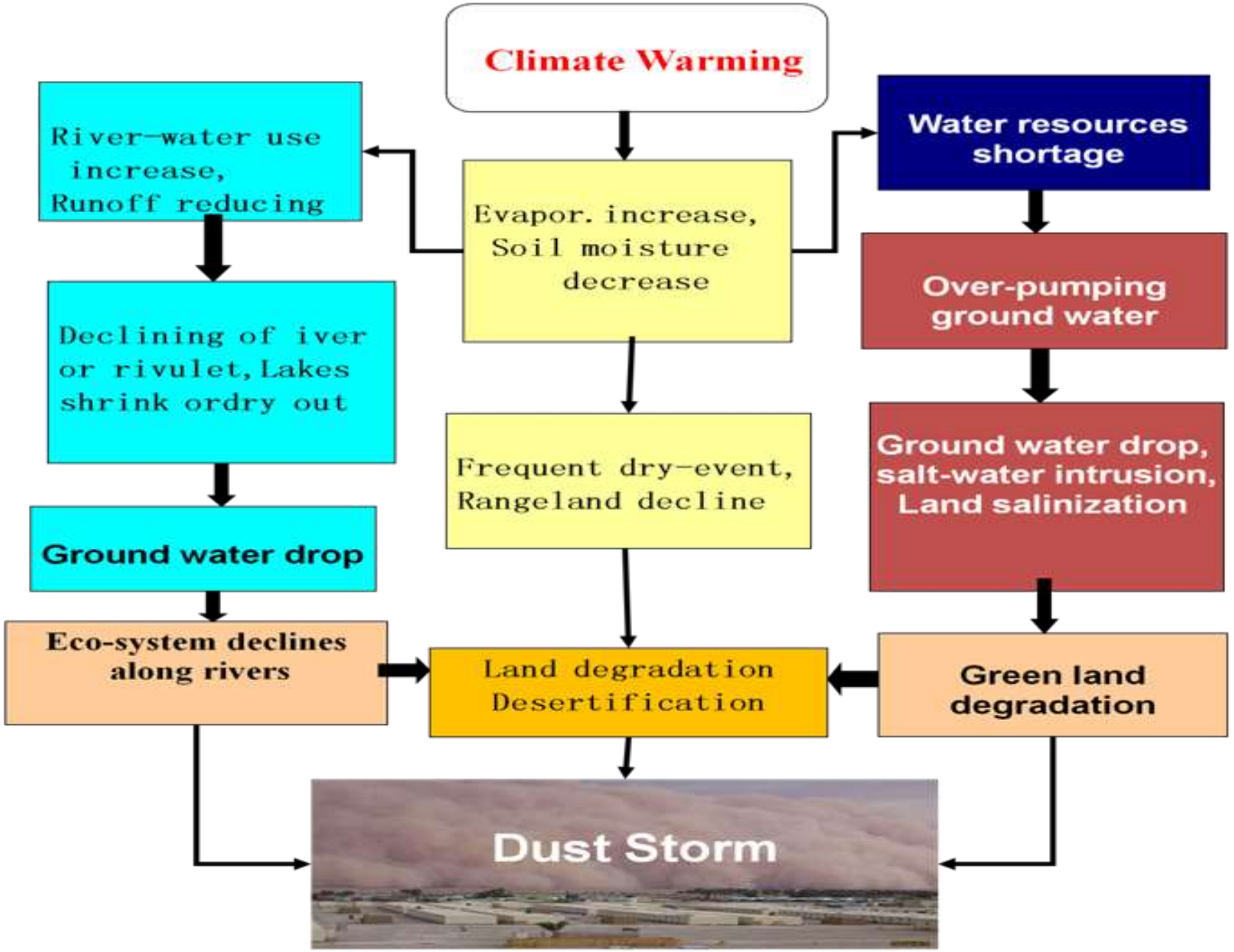
NGO SEE office in Alxa

Stakeholders Meeting

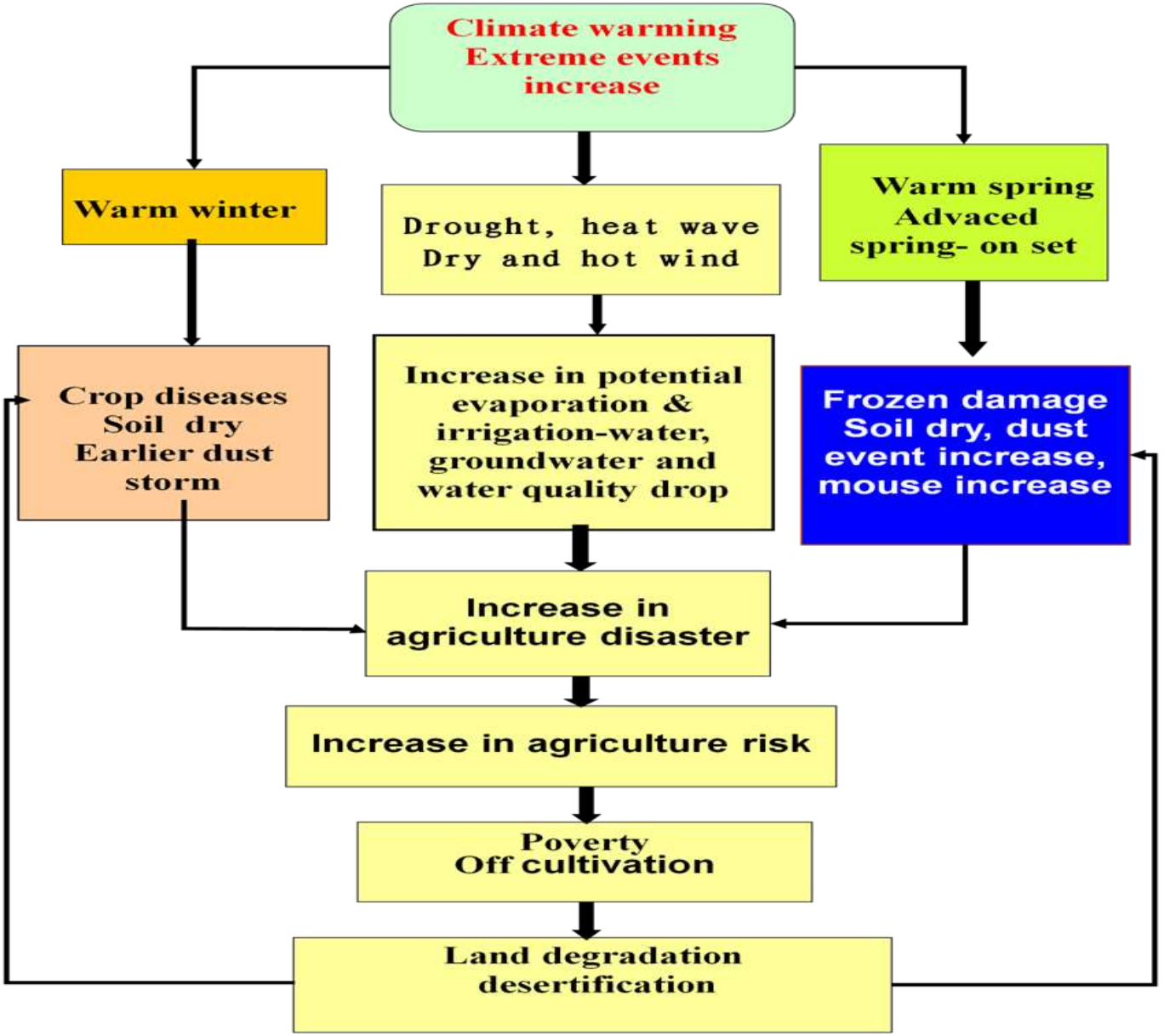
Stakeholders Meeting



Climate Change Impacts on Eco-system and Water Resources



Climate Change Impact on Agriculture



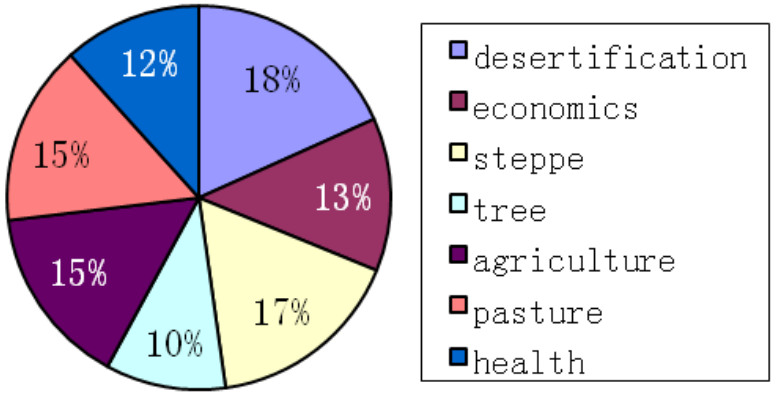
Adaptation Measures of Alxa

- **Grazing-ban, seasonal grazing**
- **Control grazing**
- **No goat-grazing**
- **Enclosure, stall-fed animals**
- **Grass-ring construction**
- **Forage grass base construction**
- **Transfer strategy**
- **Supply job other than relieve**
- **Develop industry and mine**
- **Aerial seeding**
- **Artificial rainfall enhancement**
- **Grain for green**
- **Conservation zones**
- **Shelterbelt woodland**
- **Birth-control policy**

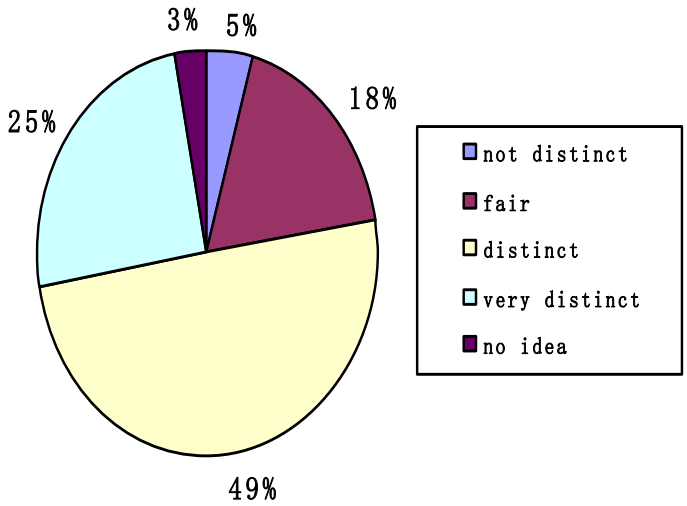
- **Migration strategy— immigrant town**
- **Control emigrant outside**
- **Multi-family-organized free grazing**
- **Camel conservation zone**
- **Natural forest conservation**
- **Hydro-engineering construction**
- **Updating irrigation system**
- **Greenhouse construction**
- **Plastic film mulching in farmland**
- **Drop irrigation, ground pipe-line net**
- **No water-consumption crop**
- **No water-consumption facilities**
- **Adaptation water price**
- **Water-use permission policy**
- **Recycling water use**
- **Heihe River water-reallocation project**

Questionnaire for Inner Mongolia Case (132 sheets)

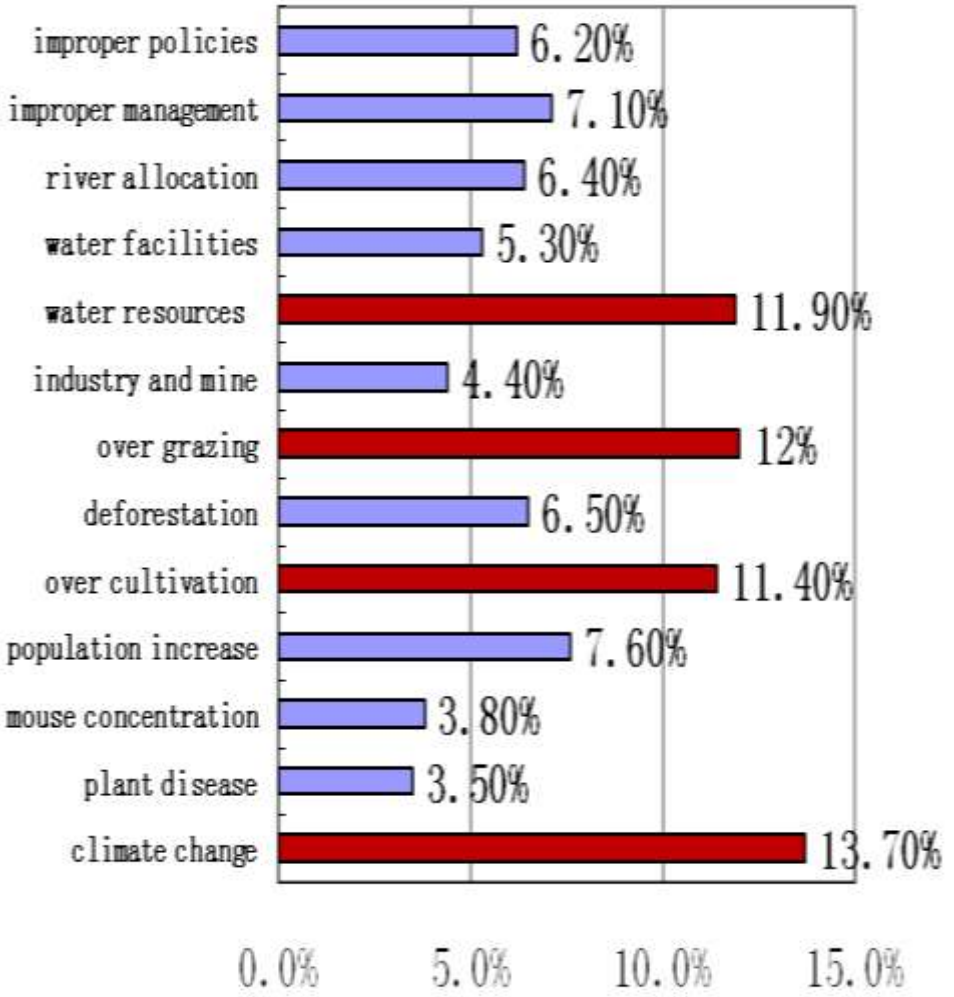
Climate Change impacts on



Effect of Grazing-ban



Reasons of land degradation



Adaptation Strategy

Climate change impacts	Adaptation strategies	Policy options
Drought	Water-Saving technique	Drought-resistant varieties Plastic film mulching, insurance,
Land degradation	Curb land degradation	Migration, restrict reclamation,
Ecological deterioration	Restoration ecosystem	Grazing ban, enclosure, migration,.....
Sandstorm	Curb desertification	Grain for green, aerial seeding, shelterbelt woodland, ...
Hot-and-dry waves	Change varieties	

New Problems after Adaptation

1. **Grazing-ban—> brush decline, increased in mouse population, frequent wide fire in Helan mountain due to absence of grazing;**

2. **Migration led to a new land degradation and ground water drop near Immigrant town;**

3. **Worried about sustainable policy making**

Simulation of Grazing Strategy for Alxa Rangeland using FORSPACE Model

Motivation

- To explore local NPP evolution under different grazing pressures (animal number)

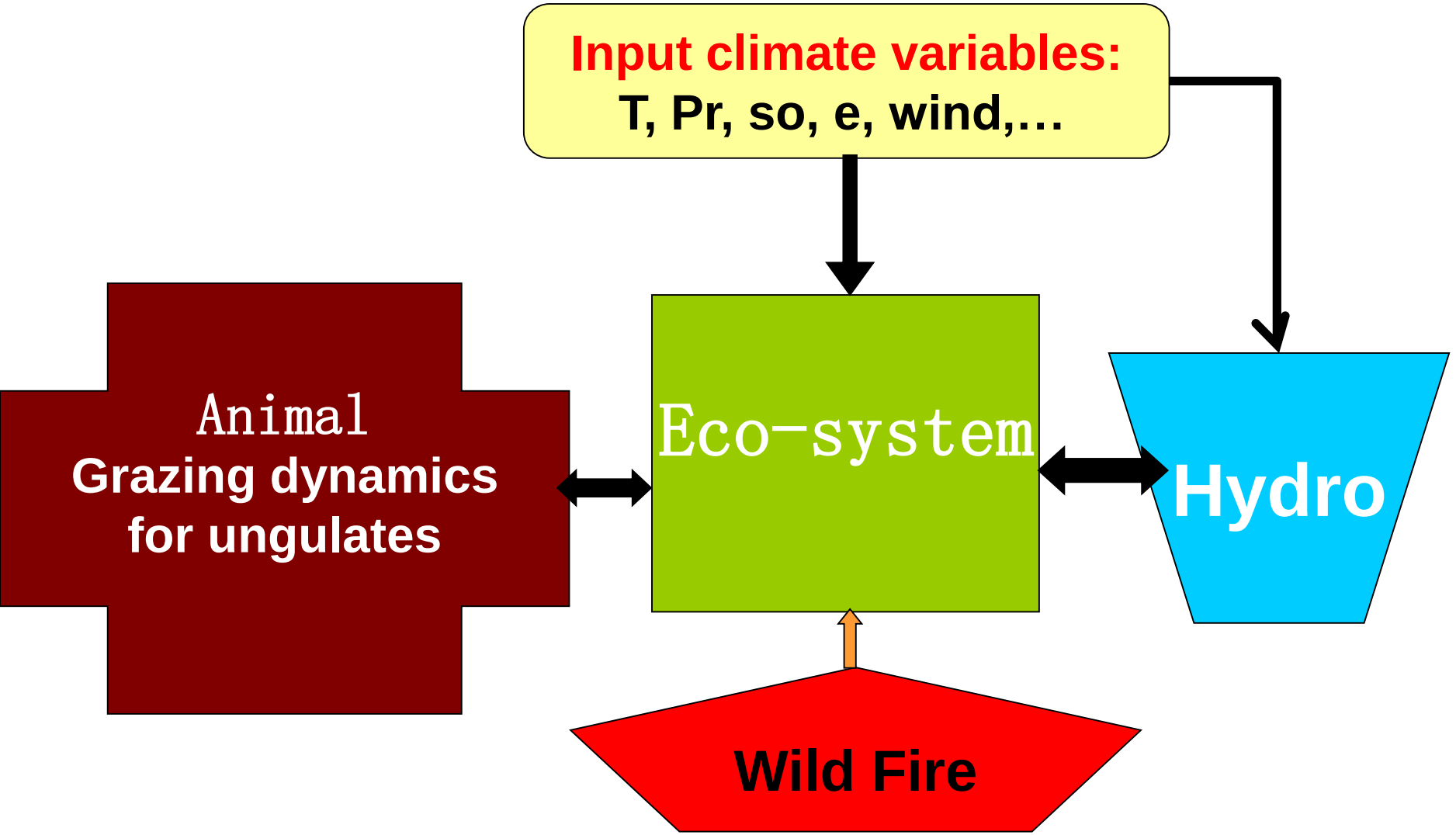
- To make assessment on local policies for rangeland management

- To produce future policy-options for adaptation.

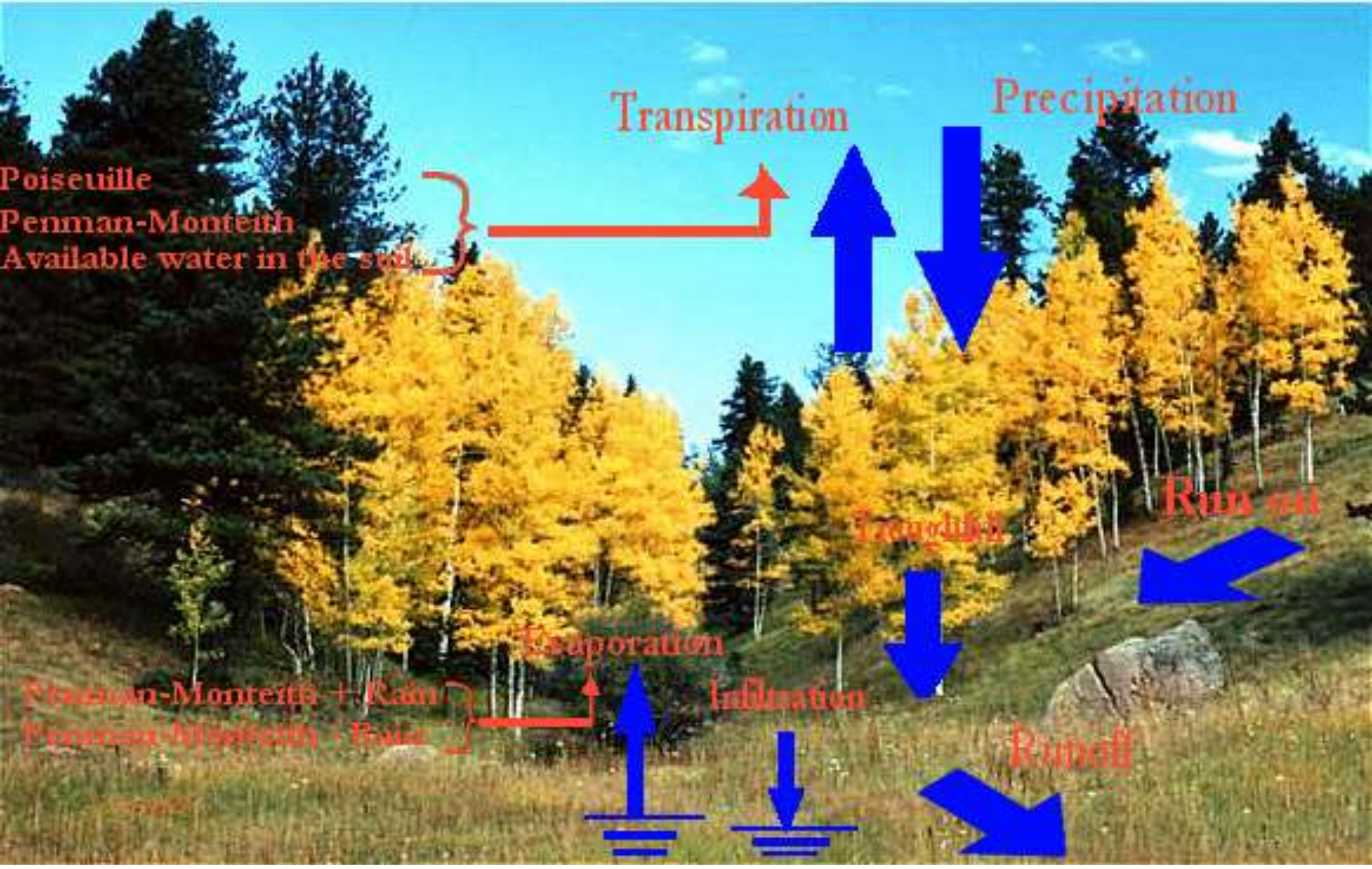
Dr. Koen Kramer
Wageningen Univ.

FORSPACE: a forest gap-dynamics model that includes a mechanistic description of ungulate grazing dynamics and a stochastic forest fire simulator

ForSpace Frame: including climate record input , ecological, hydrological and animal grazing sub-models



Water Cycle in Hydro-model



Modelling grazing dynamics: ungulates

The ungulate populations are described by the weight and number of both juvenile and adult cohorts for each ungulate species. The mean body weight of the animals within these cohorts is derived by dividing the cohort weight by the number of animals in it.

The maximum number of animals is the total weight of the cohort divided by the minimum body weight. Mortality occurs if this maximum is less than the actual numbers. Second, mortality occurs if the maximum age is reached. The number of young born annually depends on the maximum number of young produced by the reproductive age individuals, and the fraction of the total adult cohort that is pregnant.

Grazing Strategy for Ungulates

The selection of plots by the ungulate follows a ‘top-down search’:

All high quality plots that contain most energy are selected first, thus assuming that the animals maximize their energy intake rate.

Native Vegetables, Brushes and Ungulates for Numerical Simulation

Reaumuria soongorica

Lysimachia violascens Franch

sheep

Step breviflora

Zygophyllum xanthoxylum (beancaper)

goat

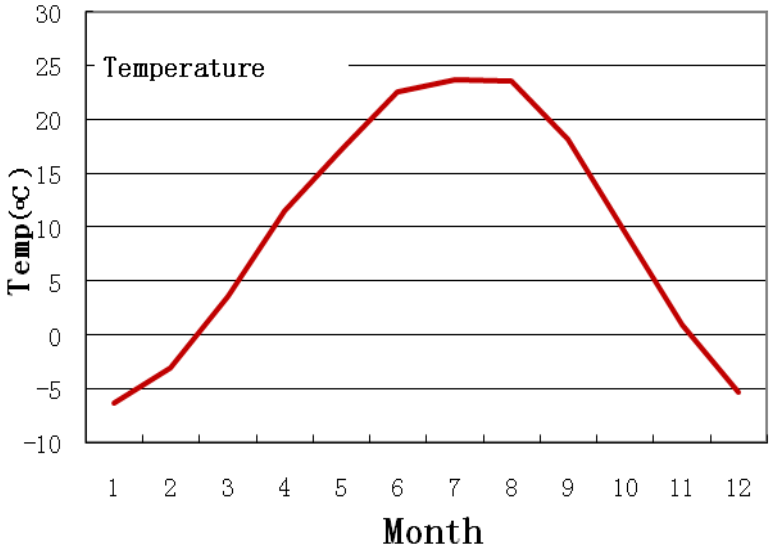
Sample parameter tests for ForSpace

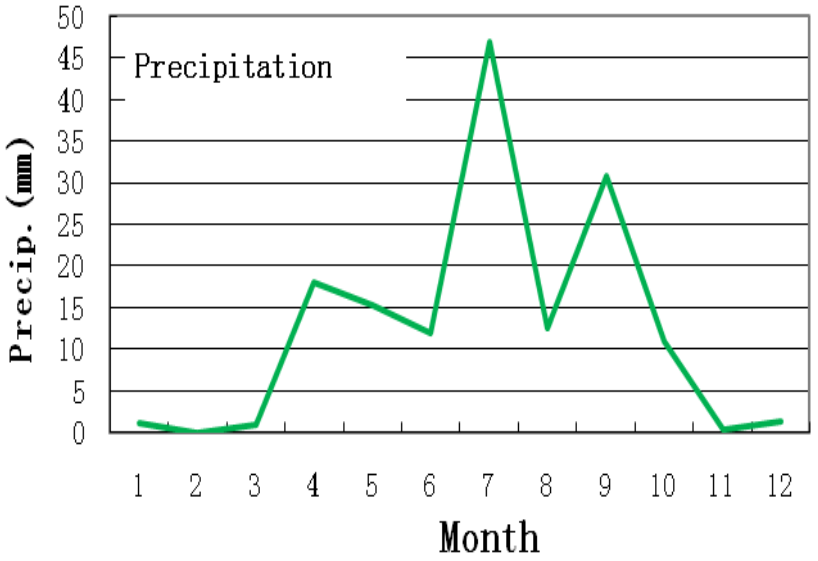
Veg. parts	Specy	Lignin	Fibrin	Semi-fibrin

Four species:

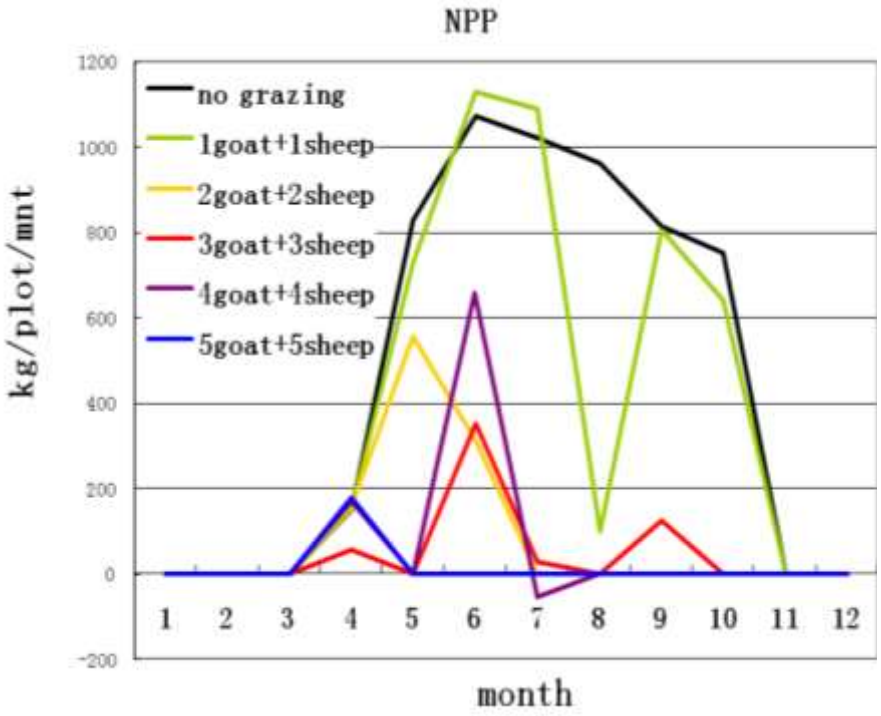
Step breviflora (grass)
Zygophyllum xanthoxylum (small brush)
Reaumuria soongorica (small brush)
Lysimachia violascens Franch (small brush)

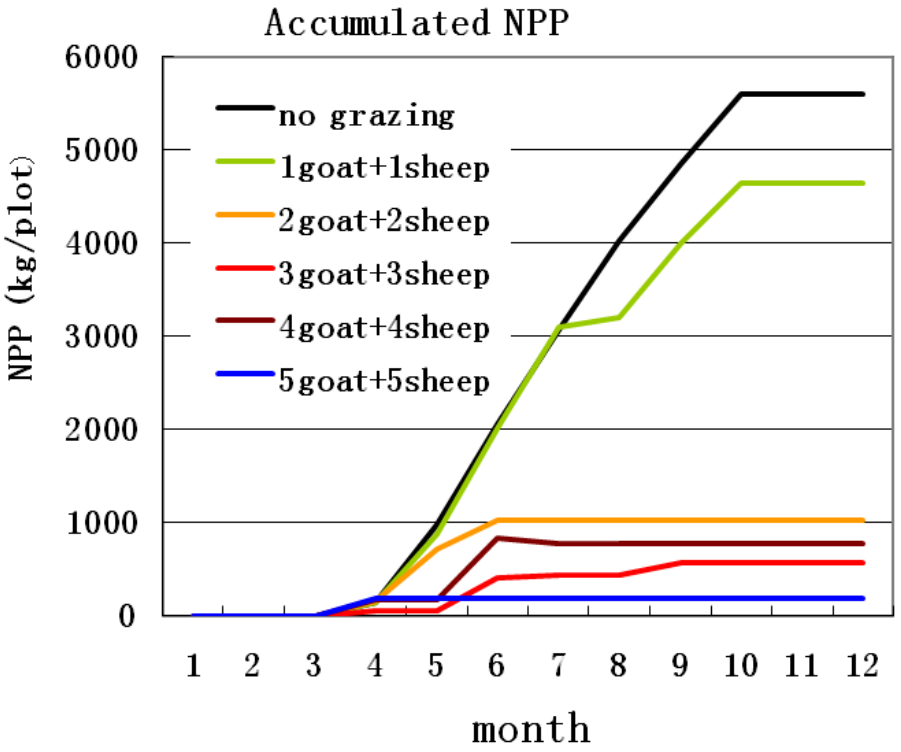
Climate of Eastern Alxa



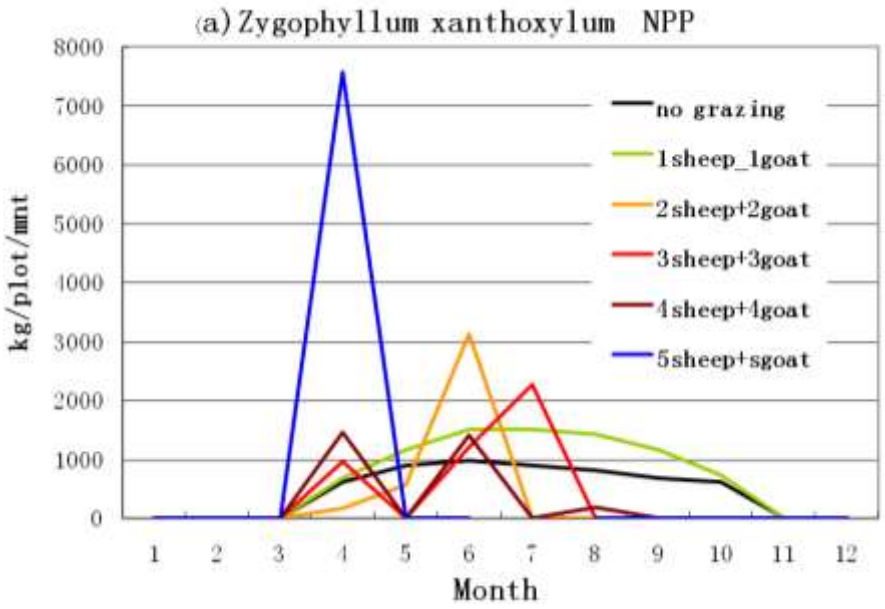


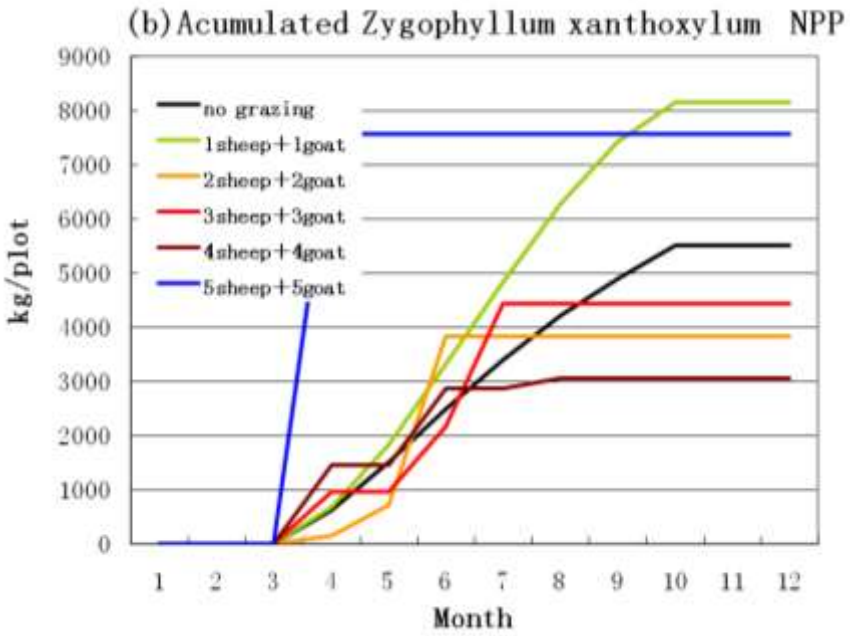
Simulated Evolution of Stipa breviflora NPP under different Grazing Pressure



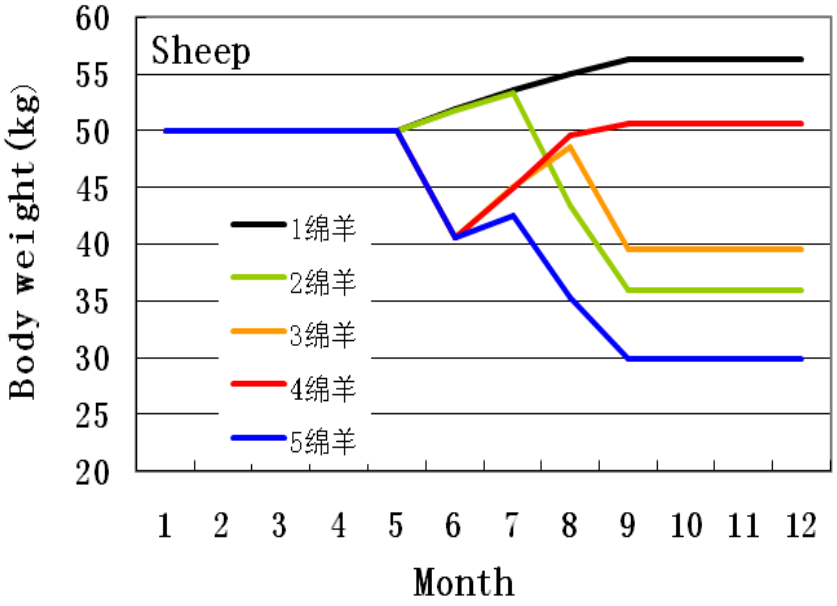


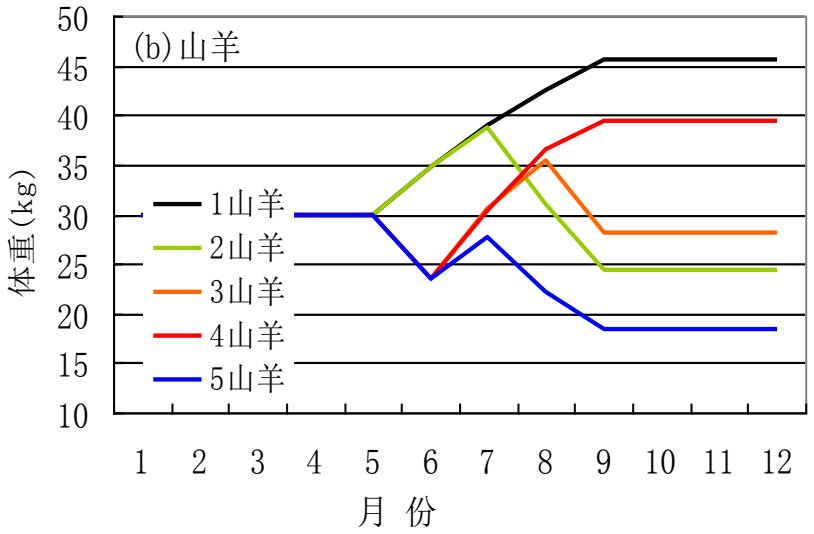
Simulated Evolution of NPP for Zygophyllum xanthoxylum





Animal Body-Weight Evolution





Conclusion and Suggestions

1. **Proper grazing is necessary for local plants of rangeland, and grazing-ban is only suitable for heavy degradation steppe.**
2. **Migration was not a sustainable strategy against desertification or land degradation.**
3. **Sustainable strategy should be considered in future policy making.**
4. **We should make a trade-off between adaptation and make a trade off between adaptation and improvement of living level of local habitants**


Thank you !
Welcome to Inner-Mongolia