An attempt to foster resilience-based management in Mongolian rangelands

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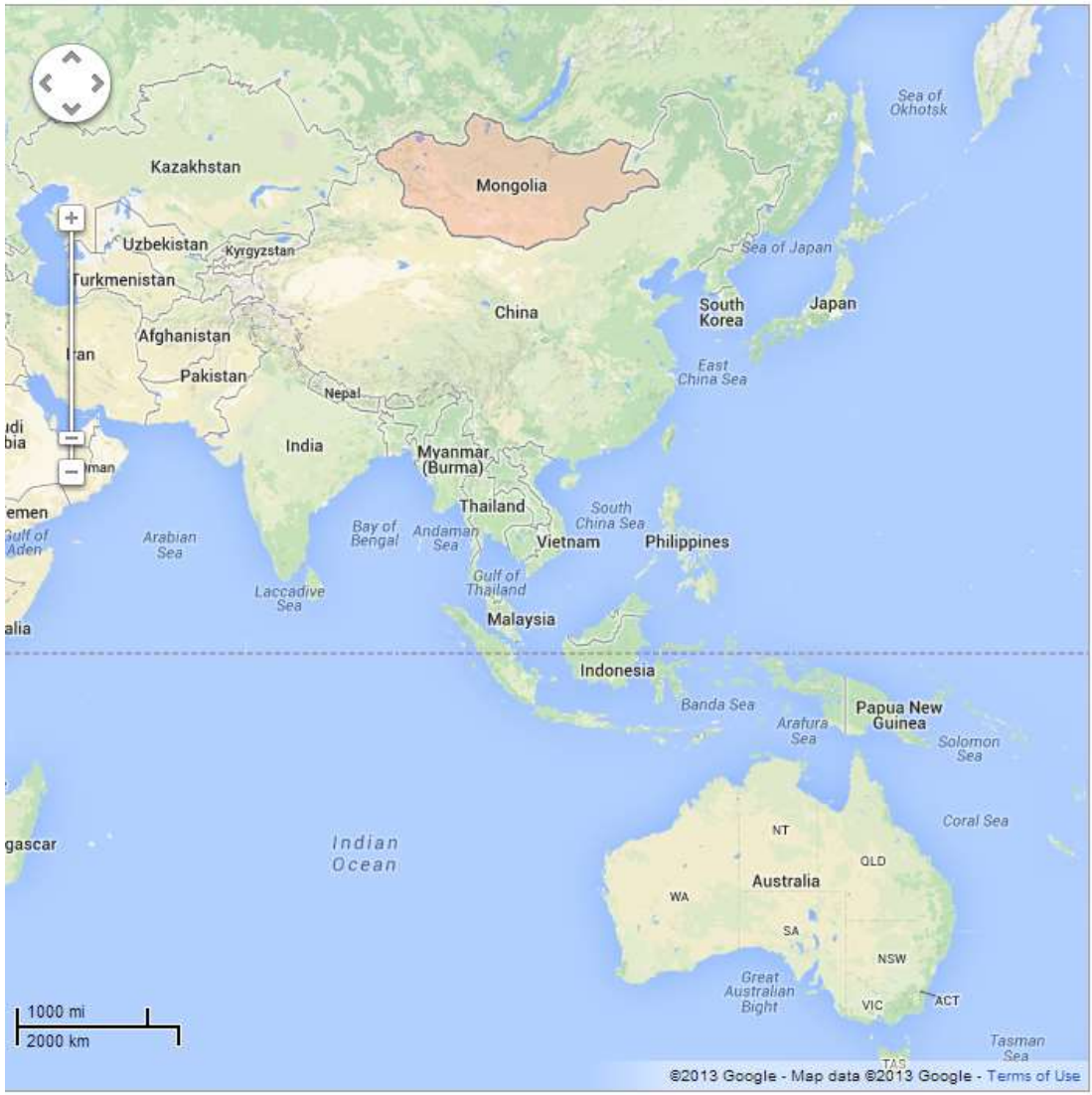
Mongolia is an arid-semiarid rangeland country

80 % of area is rangeland (steppe)

for 1/3 of the population livestock production will remain the principal livelihood



Mongolian rangelands are believed to be undergoing desertification

Desertification affects 77% of Mongolia—UB Post, September 20, 2013

Overgrazing believed to be the cause—Global Change Biology, in press

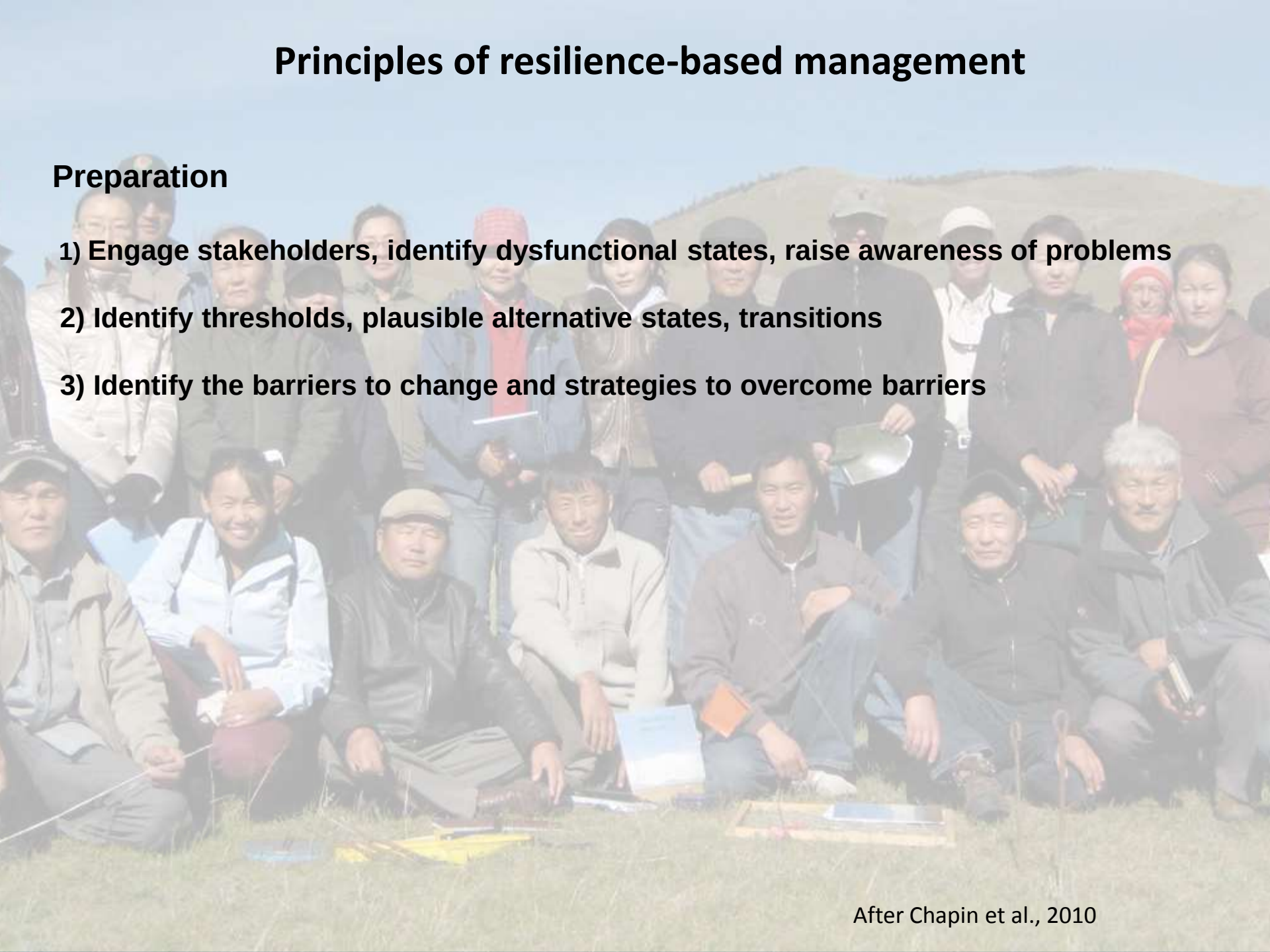
NPP predicted to continue to decline with climate change (5-30%)

Livestock numbers continue to increase (36% since 2002)

Extreme climatic events having huge effects (44,000 households lost all livestock in 2010 dzud)

How can we restore grasslands and sustaining pastoral use?

Principles of resilience-based management



Preparation

1) Engage stakeholders, identify dysfunctional states, raise awareness of problems

2) Identify thresholds, plausible alternative states, transitions

3) Identify the barriers to change and strategies to overcome barriers

After Chapin et al., 2010

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Changing management

4) Use crises as opportunities to initiate change

5) Build institutions that facilitate cross-organizational/stakeholder interactions

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Building resilience of new management regime

6) Create incentives, infrastructure, and foster values to support new management

After Chapin et al., 2010

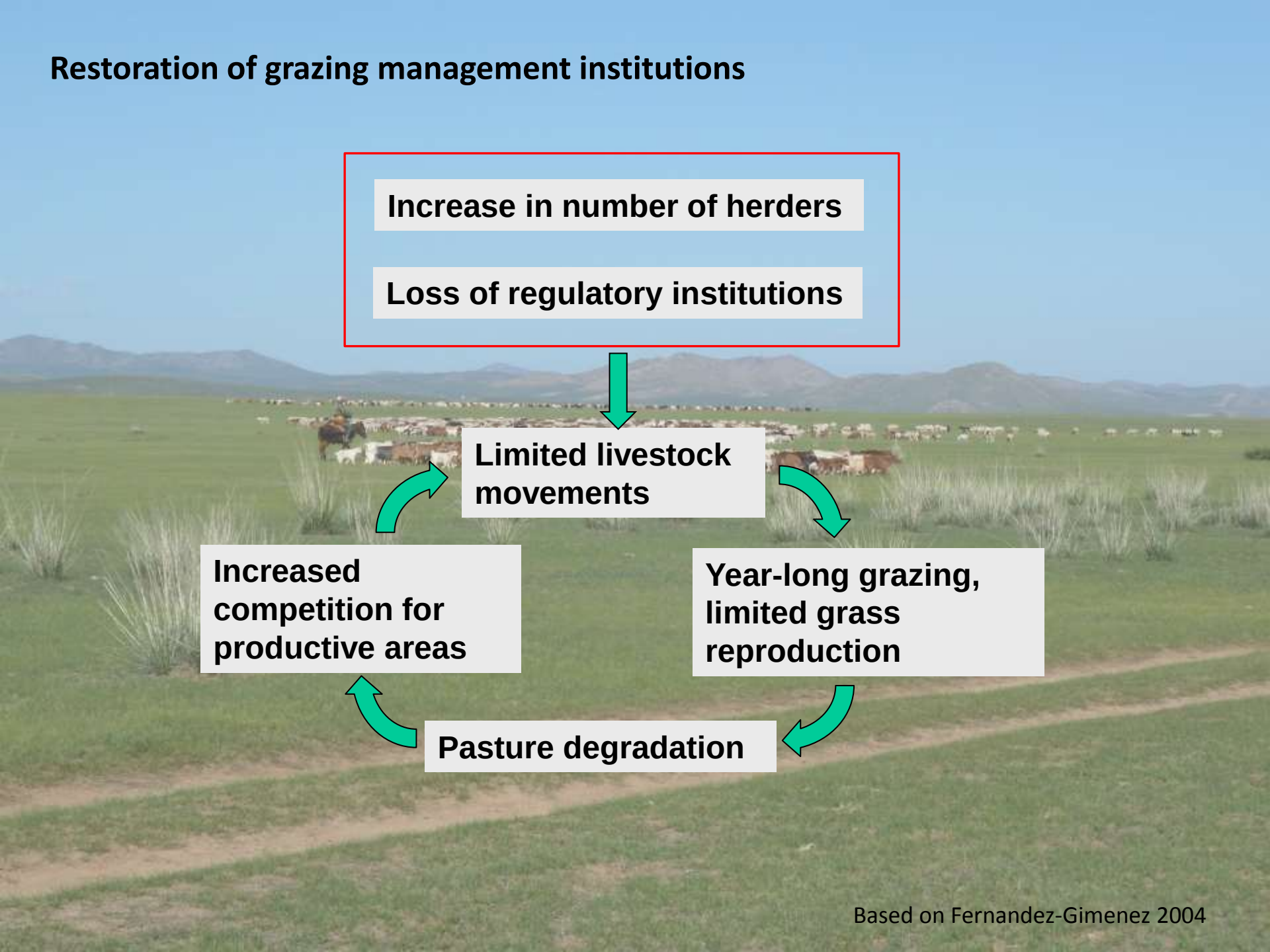
Step 1: “Boundary organization” is a Swiss development agency, partners are in several government agencies at the national level

Well connected, open to new approaches, and big investment (21 million CHF)

“Green Gold” Pasture Ecosystem Management Program of the Swiss Development Corporation

http://www.greengold.mn

Restoration of grazing management institutions

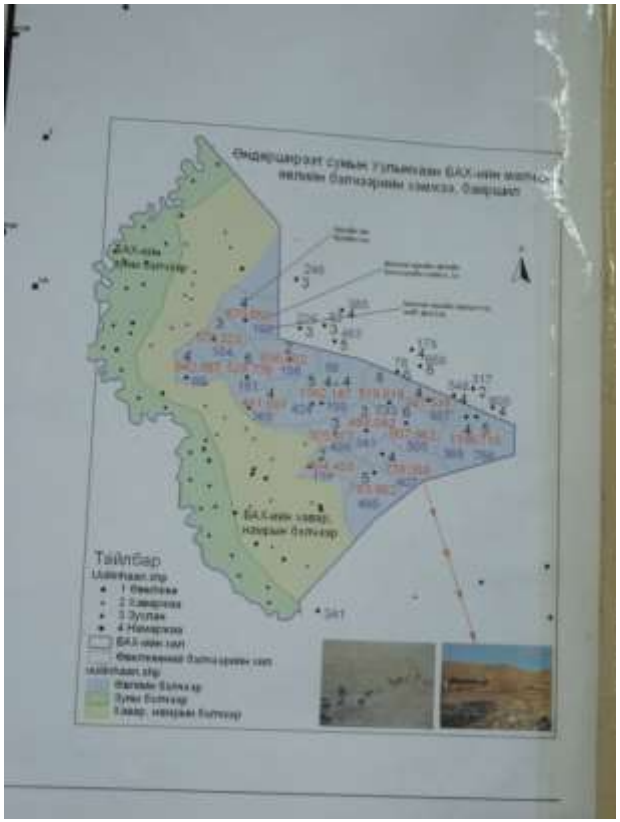


Based on Fernandez-Gimenez 2004

Pasture-users groups (PUGs) promoted as a solution to local governance of grazing

Preserves capacity for broad-scale livestock movements, but is organized

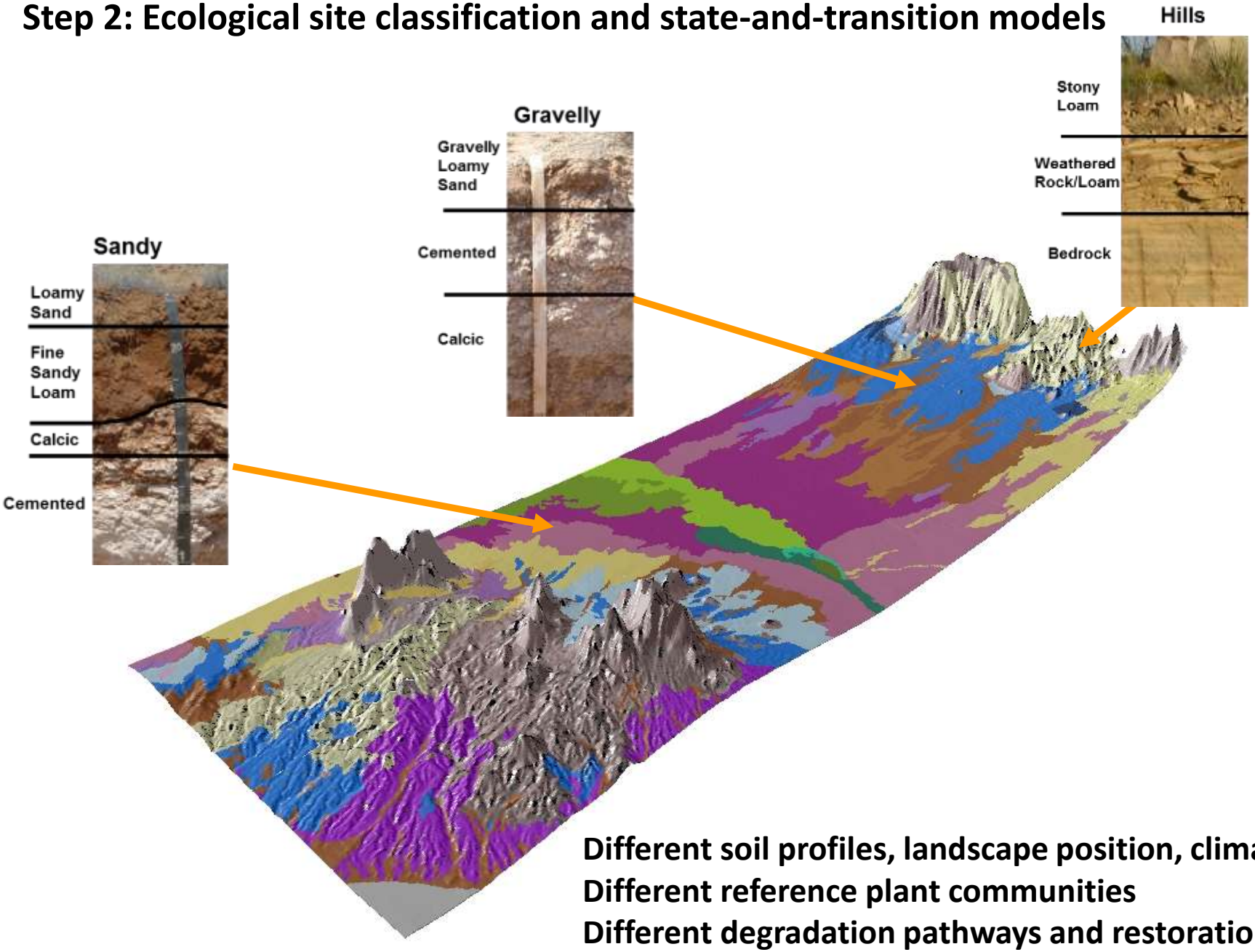
--information on grazing management needs lacking
--national government cannot pass law giving grazing rights to PUGs
--difficult to enforce movements and no mechanism to limit livestock numbers



What do herders and local government want from ecologists?

Scientific support for a grassland restoration strategy that empowers PUGs to create and enforce norms governing grassland use

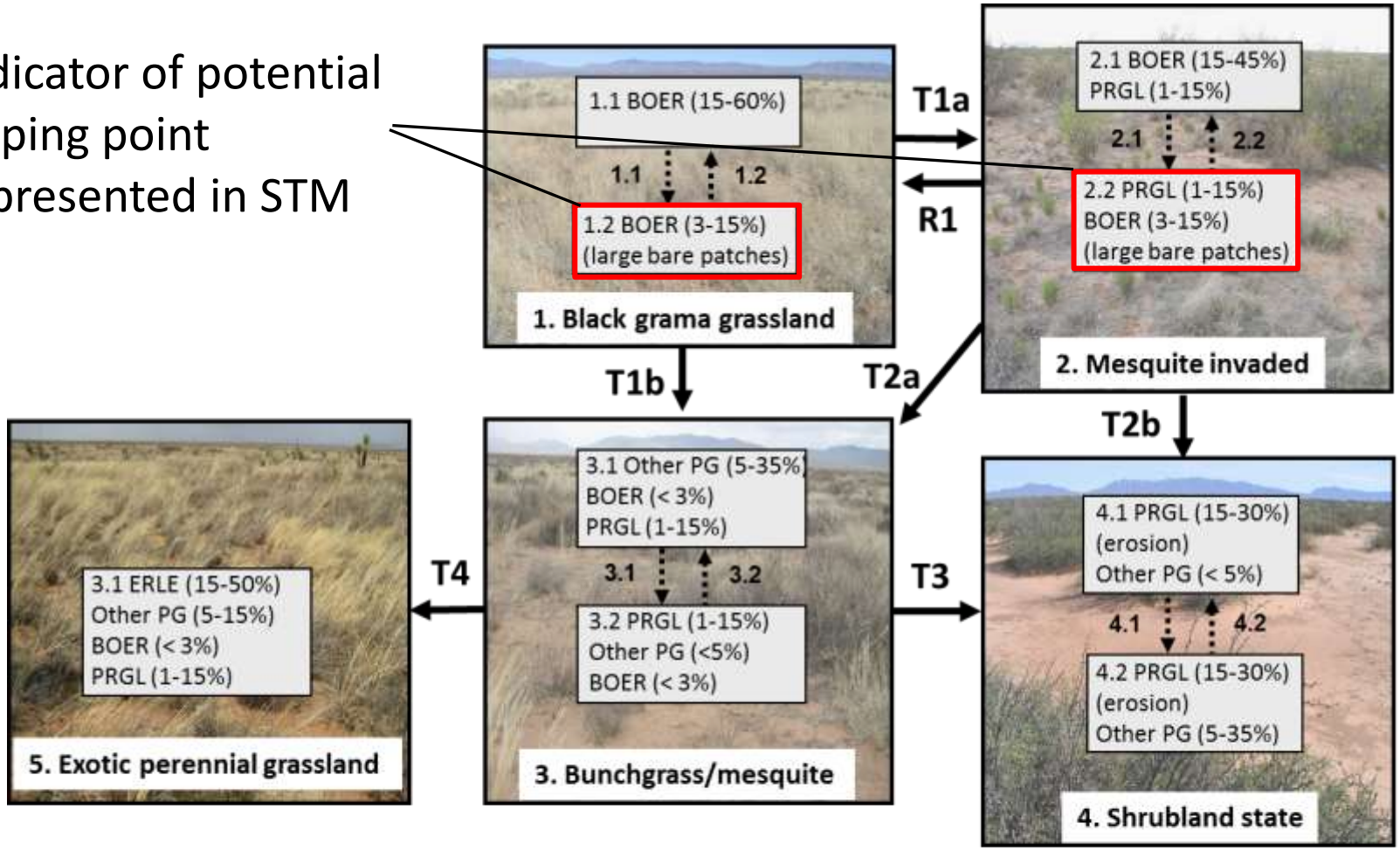
Step 2: Ecological site classification and state-and-transition models



Different soil profiles, landscape position, climate
Different reference plant communities
Different degradation pathways and restoration needs

State-and-transition models: possible alternative states, thresholds, indicators

Indicator of potential tipping point represented in STM



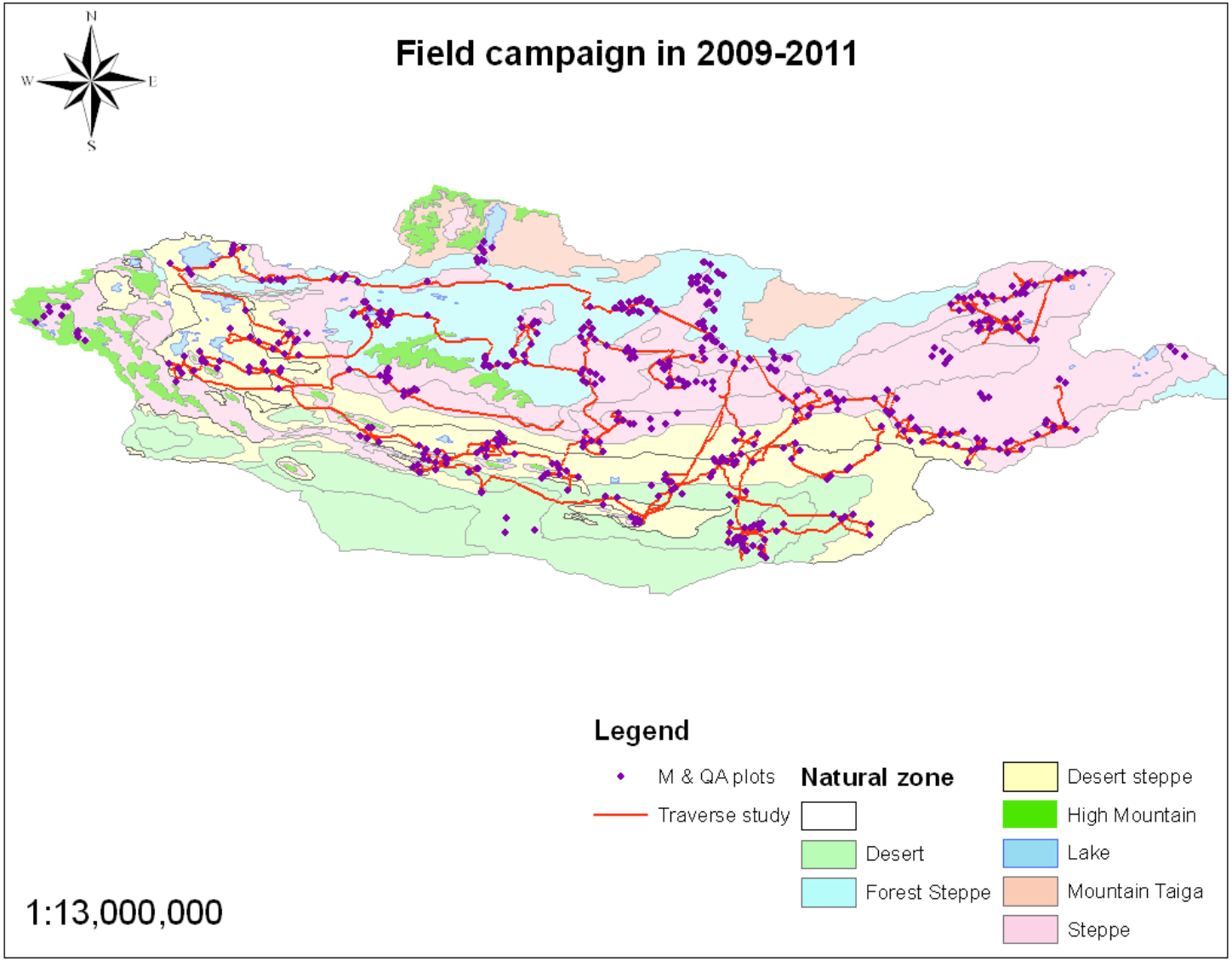
T1a. Mesquite establishment facilitated by seed transport by cattle, bare patches > 50 cm, and relatively wet springs
R1. Shrub removal via herbicide or fire followed by black grama recovery to > 15%
T1b, T2a. Black grama is reduced below ca. 3% cover by heavy grazing in drought
T2b, T3. At perennial grass cover < 5%, wind and storm events, trigger deep, spreading soil erosion
T4. Invasion by Lehmann's lovegrass, dominance increased by fire

Build national capacity to gather measurements of vegetation, surface soil properties, and soil profiles

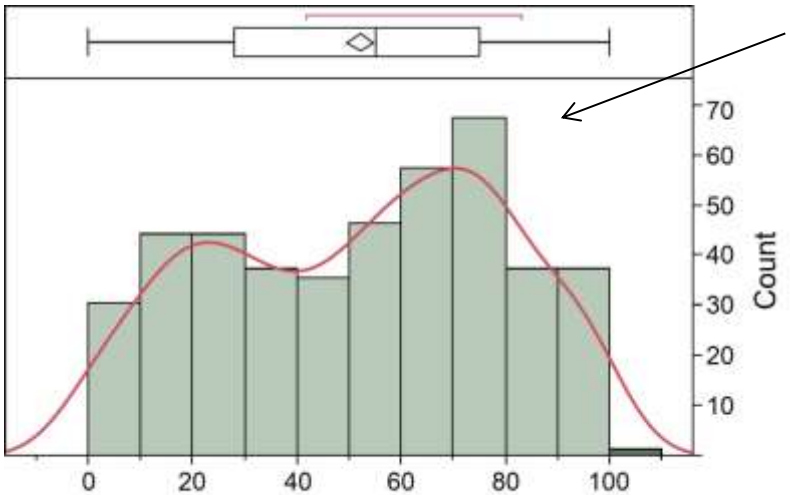
Training for national monitoring agency

Manuals for plant measurements, soil indicators, plant identification, monitoring database (in Mongolian)

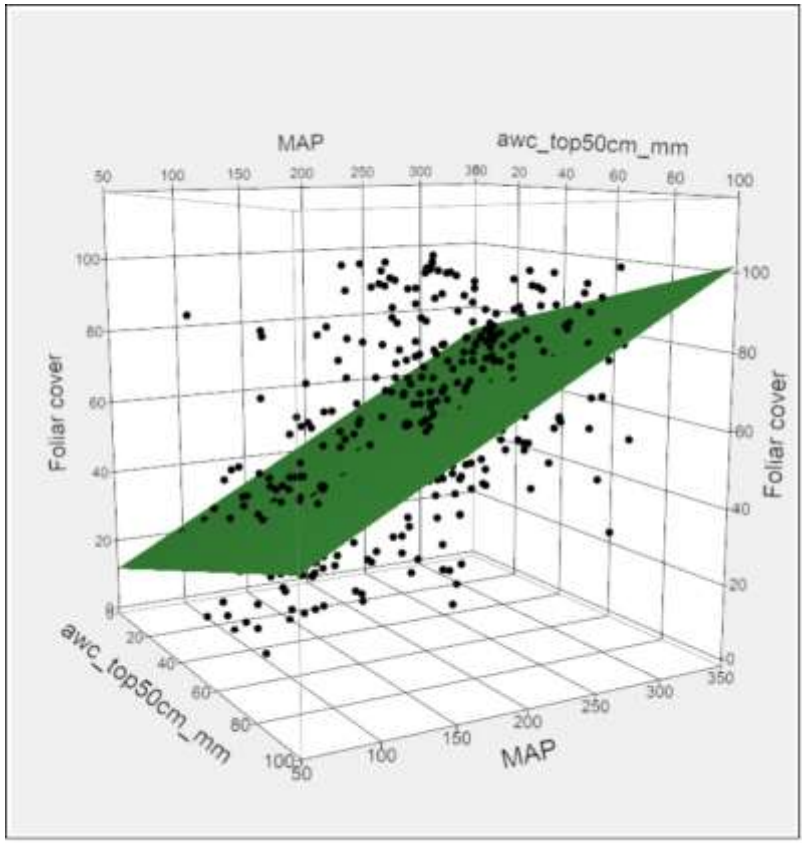
Generate data on vegetation conditions and soils at a national scale using standardized methods; link to interviews

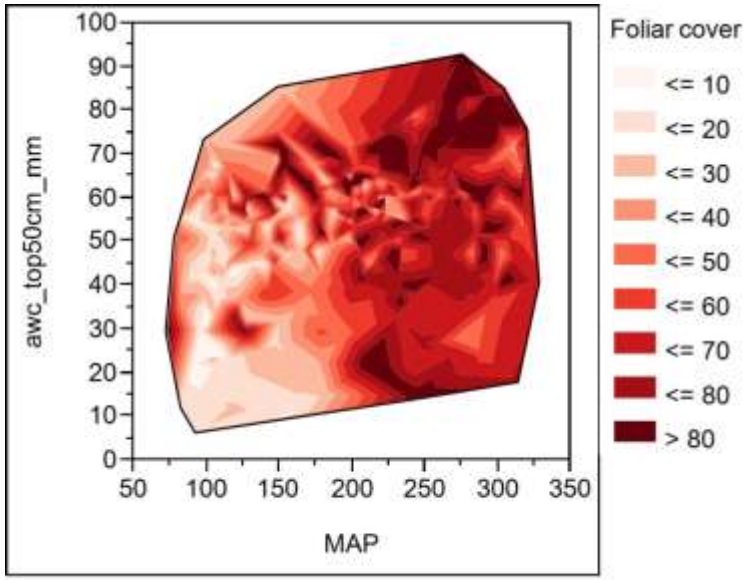


Not much field-based evidence for desertification



Some bimodality in cover, but most observations are 40-70% foliar cover





Cover strongly related to precipitation, available water holding capacity, and minimum winter temperature; explains 61% of variation.

Irreversible soil degradation is occurring on sensitive ecological sites

Most common ecological change: loss of NPP and forage quality associated with loss of dominant perennial grasses

1984 kg/ha—35% cover *Stipa krylovi*

Yearly, heavy summer grazing

Seasonal deferment

1199 kg/ha—6% *Stipa krylovi*

Heavy grazing

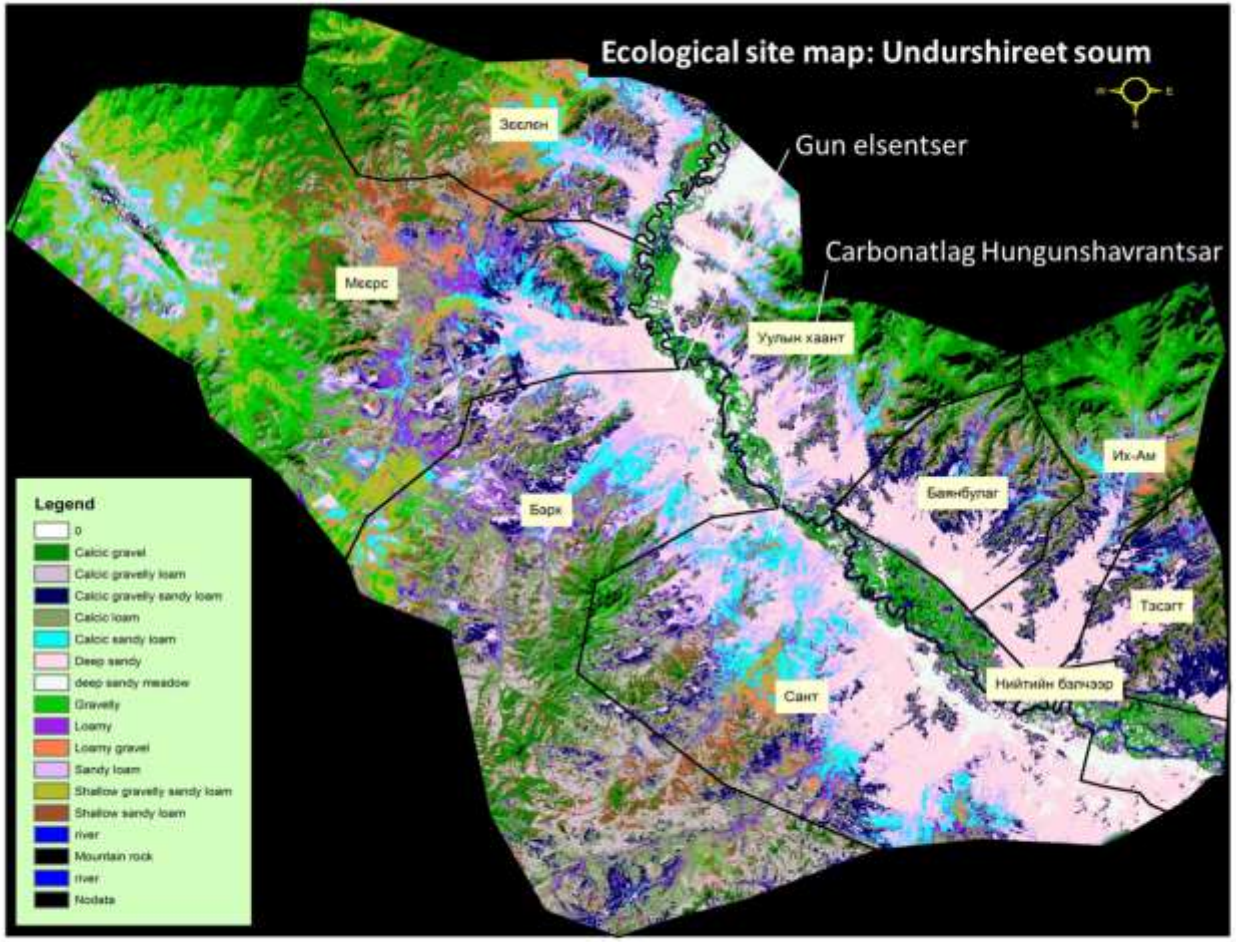
Decadal recovery, long-term deferment

494 kg/ha—0% *Stipa krylovi* (mostly Carex)

Step 3: Lessons from the ecological work

- **Reference vegetation composition and production of most sites is recoverable with rest and changes in stocking rate and season of use**
- **While climate change may play a role, the high degree of landscape-scale variation—on the same soils—suggests a strong impact of variations in grazing use**
- **True desertification is often associated with shallow, mountain soils or steep slopes, but is spatially limited**
- **Different soils and states feature large differences in production, require different management**

Step 4-5: Strategies to overcome social barriers to change



Simple STM-based extension materials linked to spatially-explicit management recommendations

Work with herder group leaders to compare recommendations to existing plans

Plans may match in some cases but the problem is enforcement of trespass grazing and livestock numbers

Can we use financial incentives? "Rangers"?

Expand system of exclosures to test and demonstrate possible plant community responses

A learning experience

- **Great care in understanding the social-ecological system is required before science efforts are designed**
- **Involve as many institutions as possible in the science, preferably let them lead it**
- **A good boundary organization can make or break the effort**
- ***How to develop and link science-based recommendations to innovative policy and outreach tools to overcome "societal thresholds"***