Ecological impacts of grazing and community-based herder management:

Initial results from 2011 and 2012

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Robin

Outline

1. Our research objectives
2. Where we sampled and our sampling design
3. How we measured vegetation and soils
4. Effects of ecological sites
5. Effects of grazing
6. Effects of community-based organizations
7. Conclusions

Robin

Three overall ecological objectives

1. To compare the effects of different *ecological sites* (soils, landform) on plants and soils
2. To understand the *long-term effects* of grazing on rangelands in the desert steppe, steppe and mountain / forest steppe
3. To measure the *effect of community-based organizations* in the desert steppe, steppe and mountain / forest steppe

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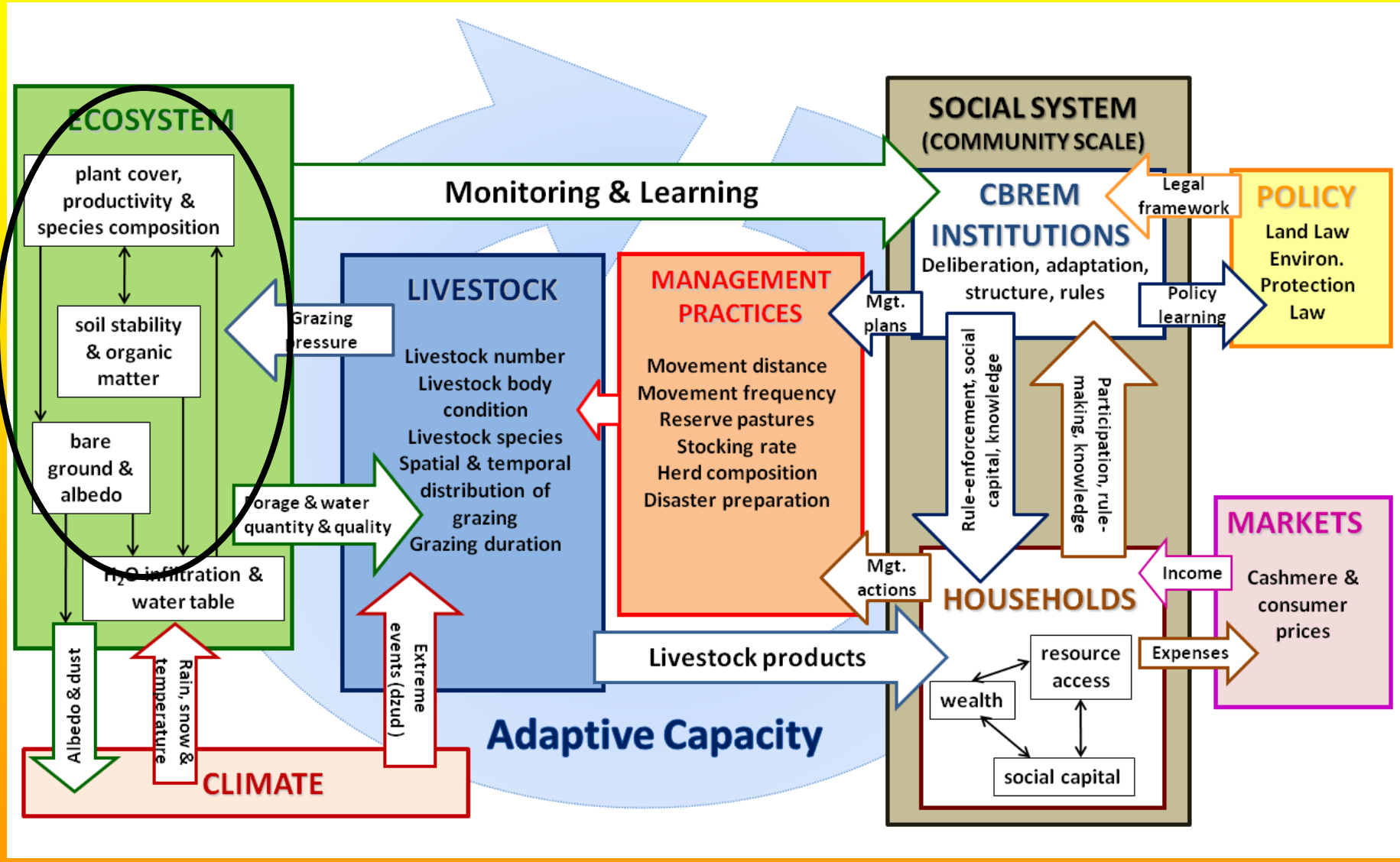
Where this fits in the MOR2 conceptual model



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Some ecological hypotheses

Hypothesis 1: Households that belong to community-based organizations will use more sustainable management practices than households who do not belong to community-based organizations

Hypothesis 2: Better management will result in better pasture conditions, including:

- **More vegetation cover, less bare ground**
- **Shorter open gaps between plants**
- **More vegetation biomass**
- **More plant species**
- **More palatable plants**
- **More species with conservation value**
- **More stable soil**

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Study Design: Central and Eastern Mongolia

- 4 ecological zones (mountain/forest steppe, steppe, eastern steppe, desert steppe)
- In each zone, paired soum with and without formal community-based rangeland management organizations (CBRM vs non CBRM)
- 36 soum (18 with CBRM and 18 without formal CBRM)
- About 162 CBRM groups / traditional herder communities (about 5 in each CBRM soum, 4 in non-CBRM soum)
- 428 ecological plots sampled

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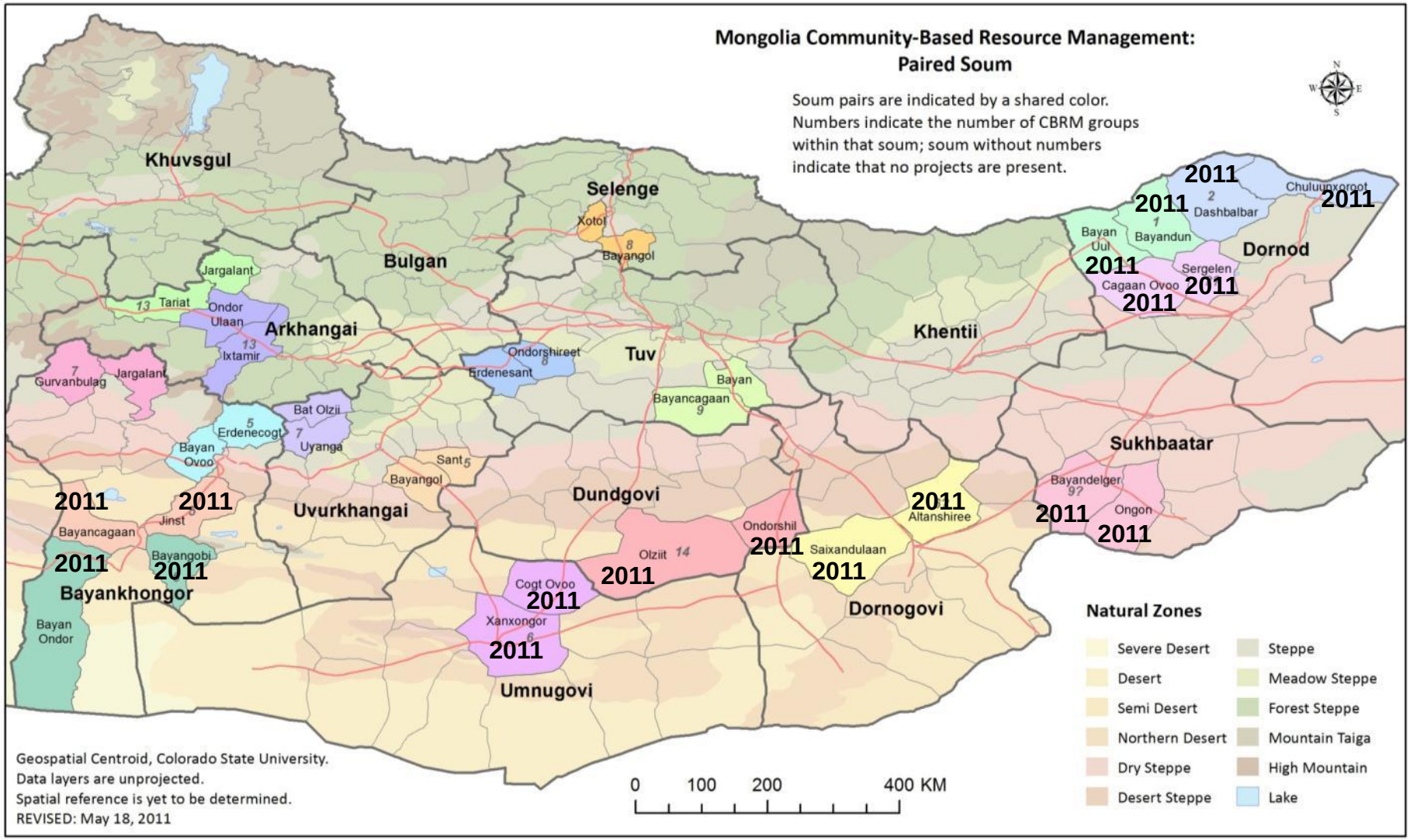
Project study soums sampled in 2011



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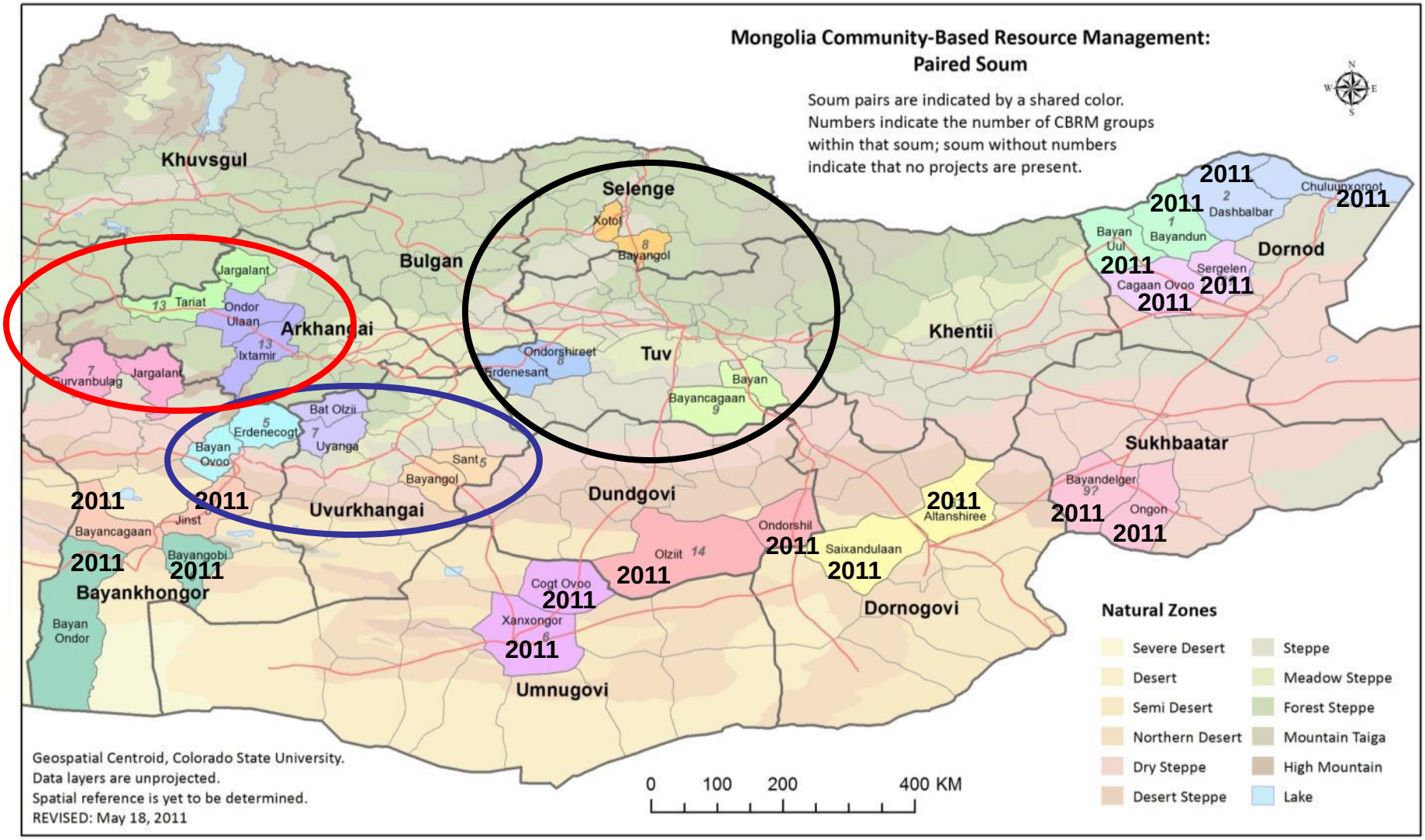
Where teams sampled in summer 2012

Blue circle = team 1, Black circle = team 2, and red circle = team 3



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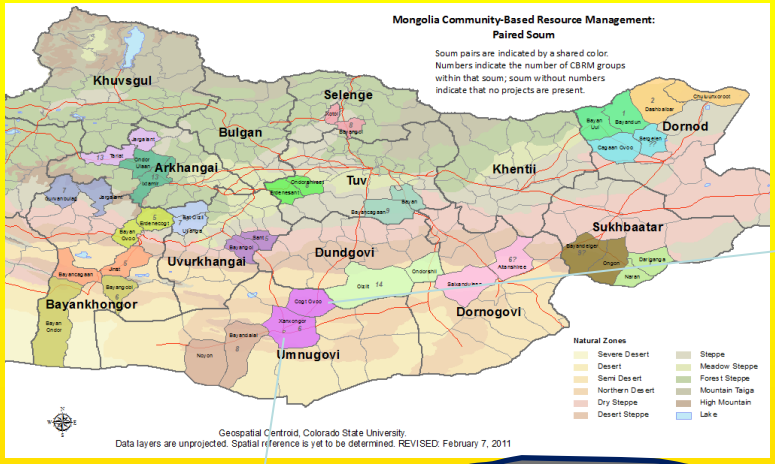
We sampled winter camps from 4-5 organizations in each study soum



CBRM Org.

Traditional neighborhood

Non-CBRM Soum

CBRM Soum

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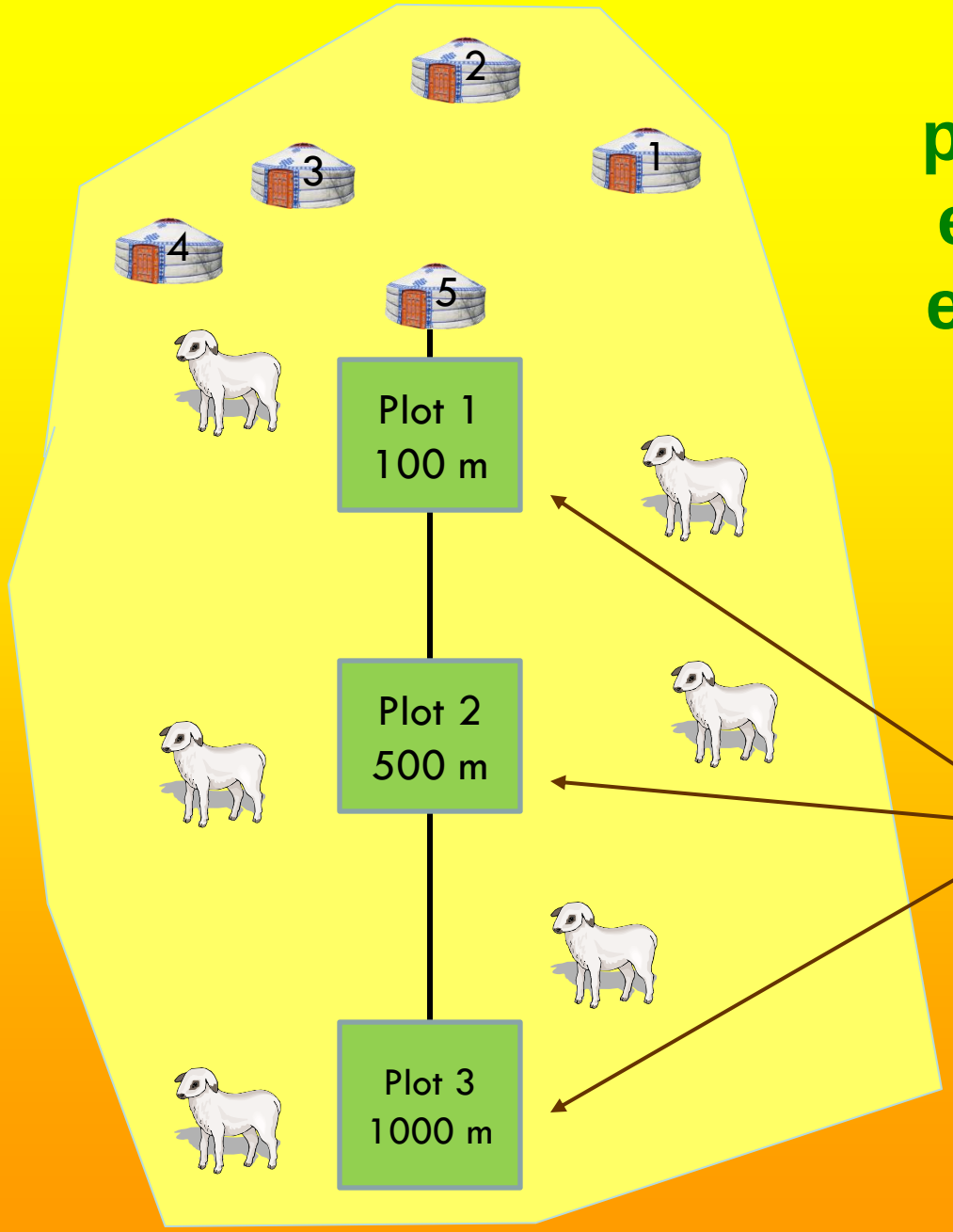

We sampled 3 plots on the same ecological site at each winter camp

We placed each plot on the same ecological site to compare the effects of grazing and not of different soils or landforms

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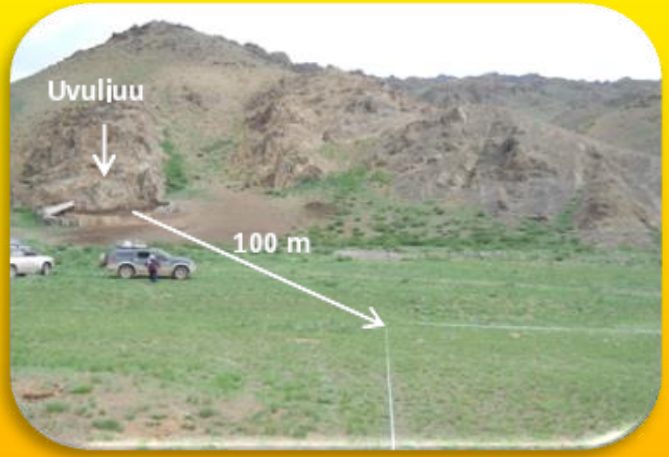
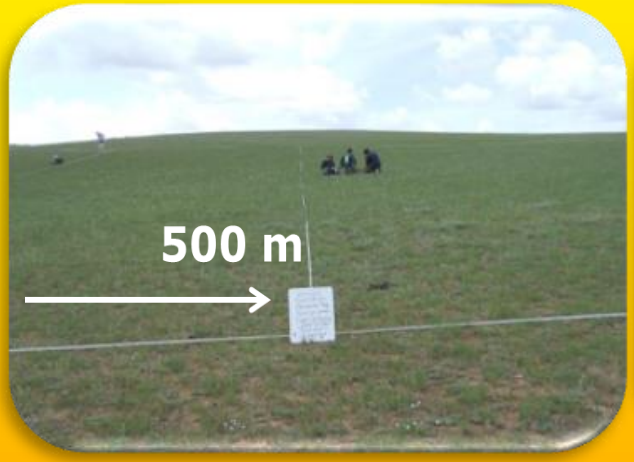
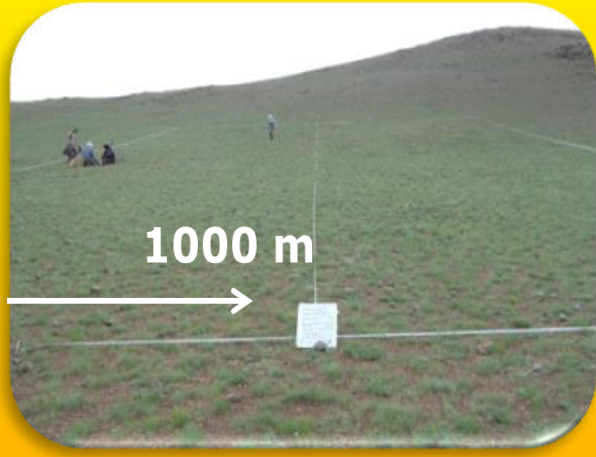
The grazing gradient at each winter camp







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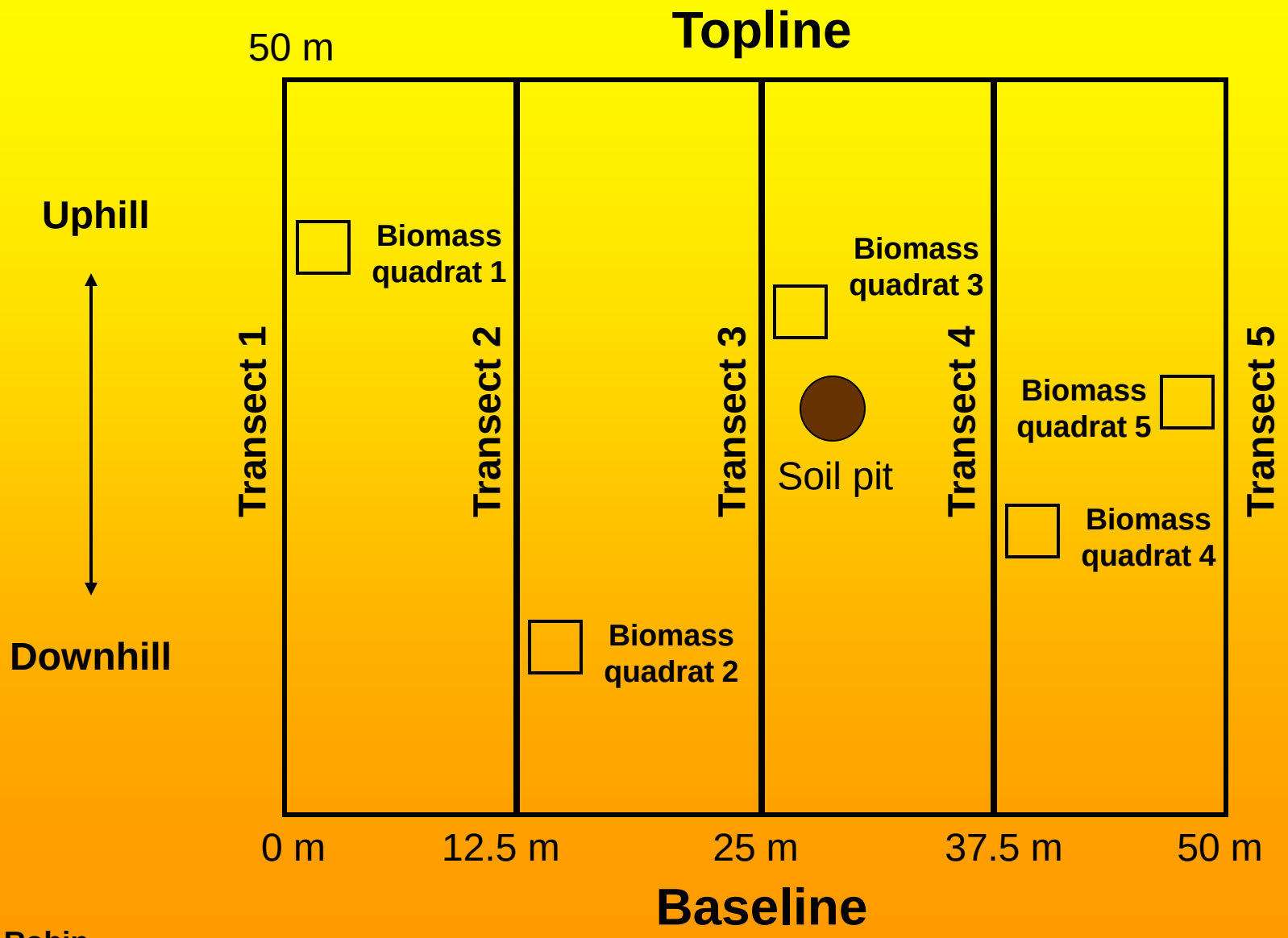
Plot lay-out for plant and soils sampling, 50 x 50 m



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What we measured in each plot

Overall

- Slope, aspect, elevation, landform, hillslope position, slope shape
- Dung by livestock species, types of livestock grazed

Plants

- Foliar cover of plant species
- Biomass of plant functional groups
- Basal gaps between plants
- Numbers and types of species

Soils (by horizon)

- Depth, color, structure, grade, size
- % rock fragments, % clay
- Calcareous content (effervescence, carbonate stage)

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Analysis methods

Current analyses

- Log or square root transformation of variables to create normal variables with equal variance
- Analysis of variance ANOVA model III, with ecological site, distance to winter camp and CBRM status

Future analyses

- Classifying plots by species using ordination methods (PC-ORD) to determine strong species association in response to ecological site and grazing
- Comparison of trends in satellite imagery (MODIS) and observations of herders

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Objective 1.

Effects of ecological sites on vegetation

Comparing across the desert steppe, eastern steppe, steppe and mountain/forest steppe

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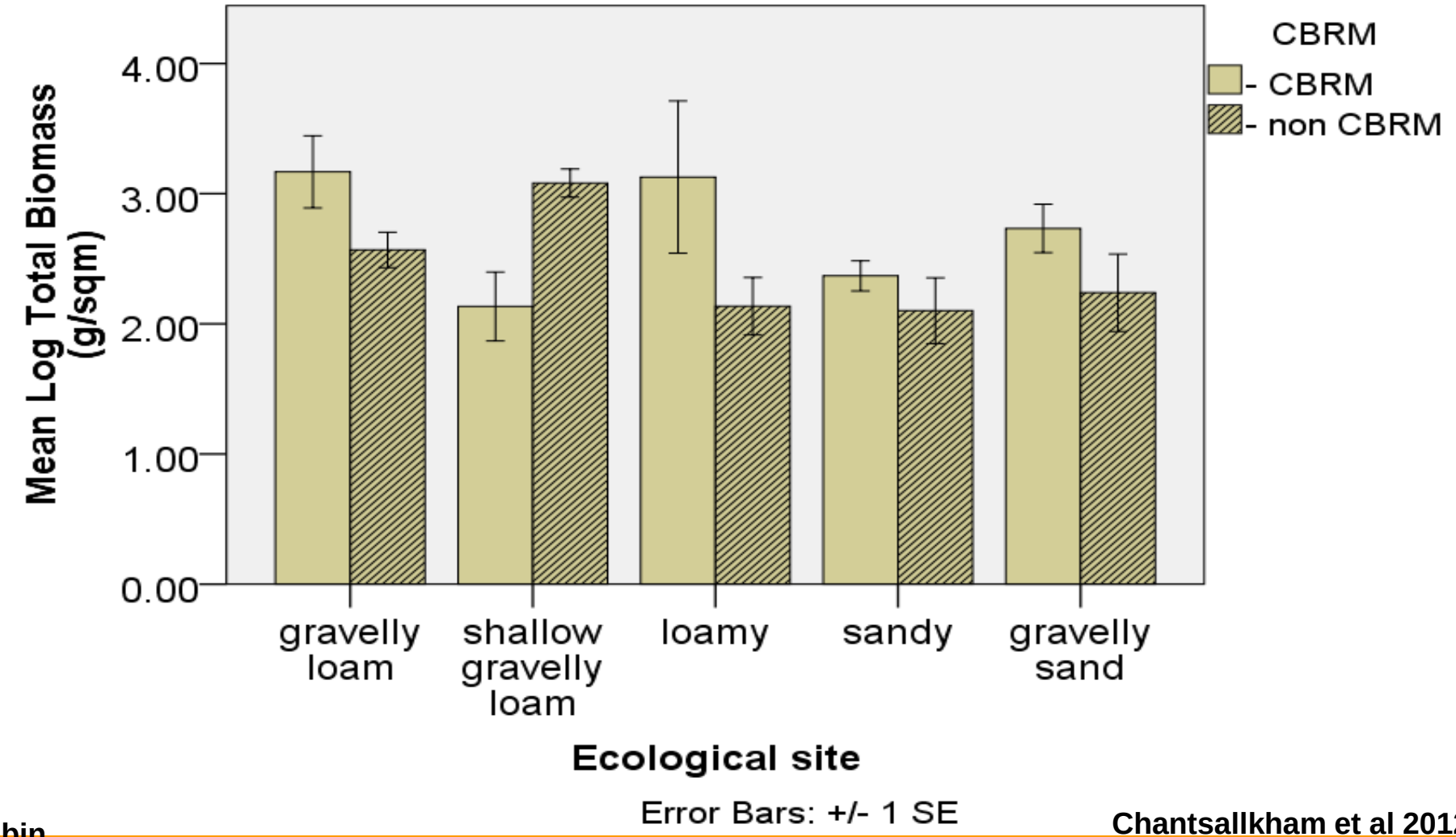
In the desert steppe, pastures of community-based groups produced more biomass on ***loams and gravelly soils*** than coarser soils (sands)



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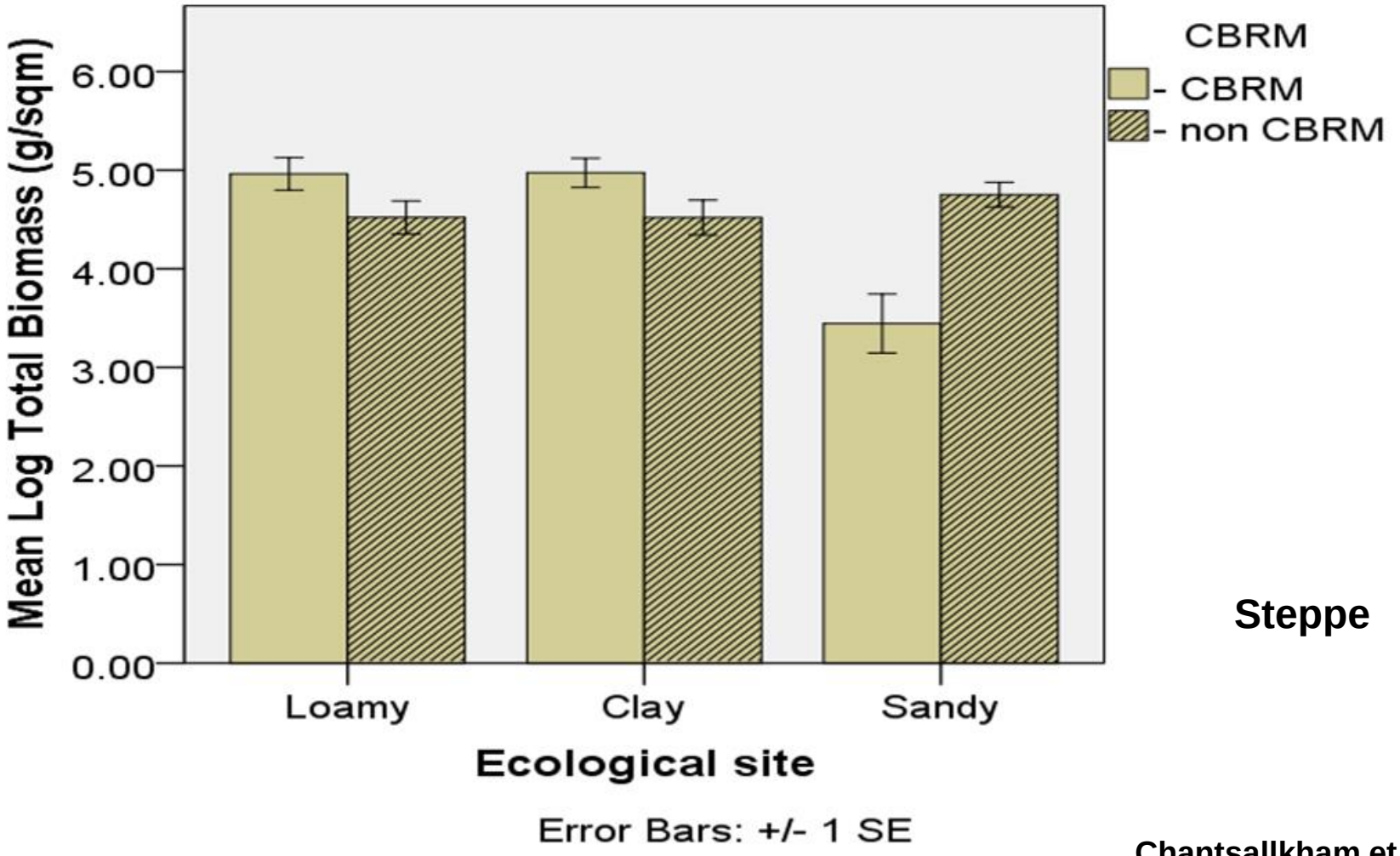
Chantsallkham et al 2012

In the steppe, pastures of community-based groups produced more biomass on *finer soils (loams and clays)* than coarser soils (sands)



Steppe

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Chantsallkham et al 2012

Objective 2.

Long-term effects on vegetation and soils (as measured at winter shelters)

Comparing across the the desert steppe, eastern steppe, steppe and mountain/forest steppe

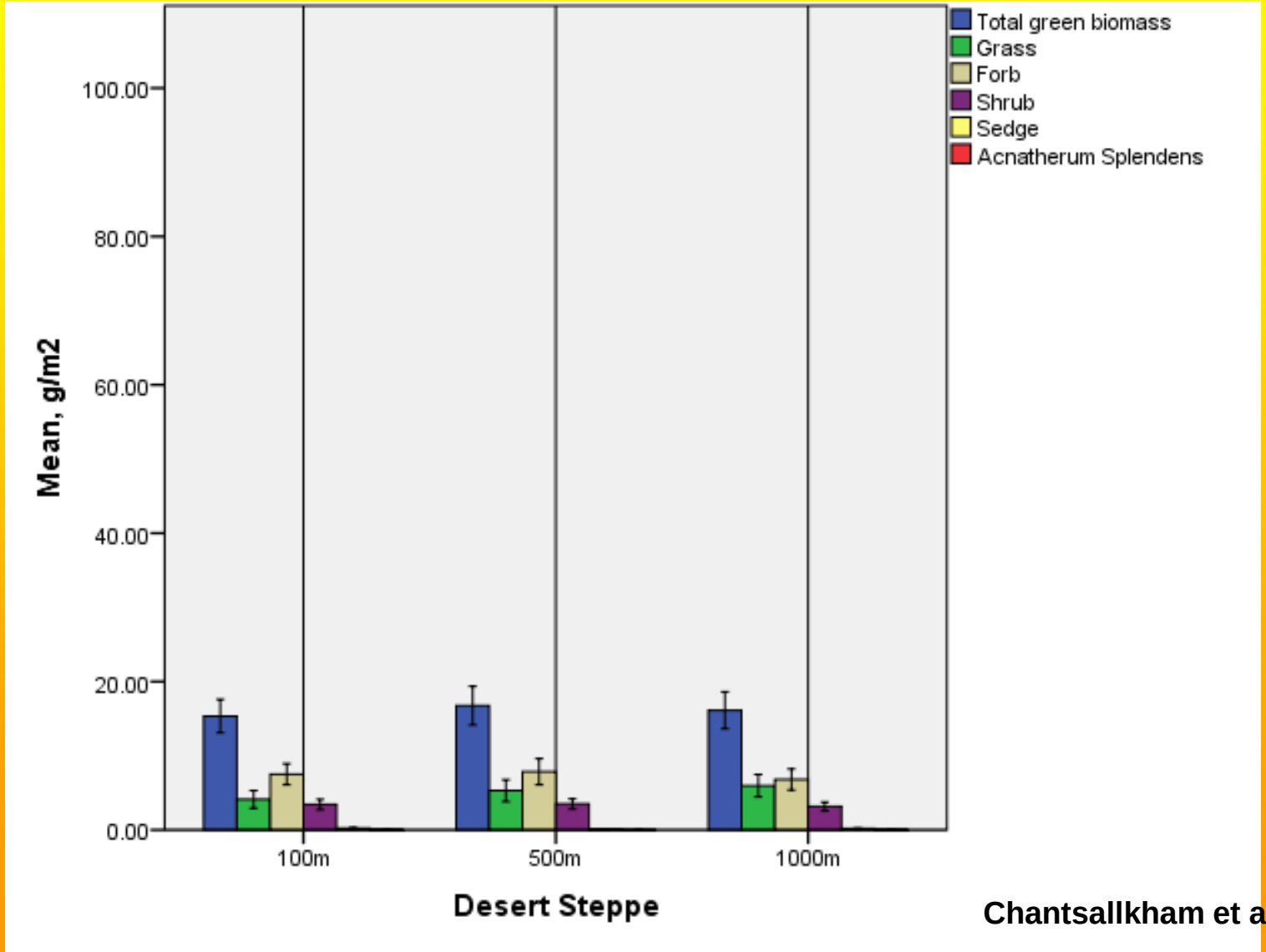
Overall

- **There was no difference in *biomass and plant foliar cover* in the 100, 500 and 1000 m plots in the desert steppe, eastern steppe, steppe or mountain/forest steppe**
- **Except, only in the desert steppe, there was more *litter biomass* far from the winter camp**
- **Thus, grazing had little effect on plant biomass in any location**

Chantsaa

Chantsallkham et al 2012 and 2013, Khishigbayar et al. 2013

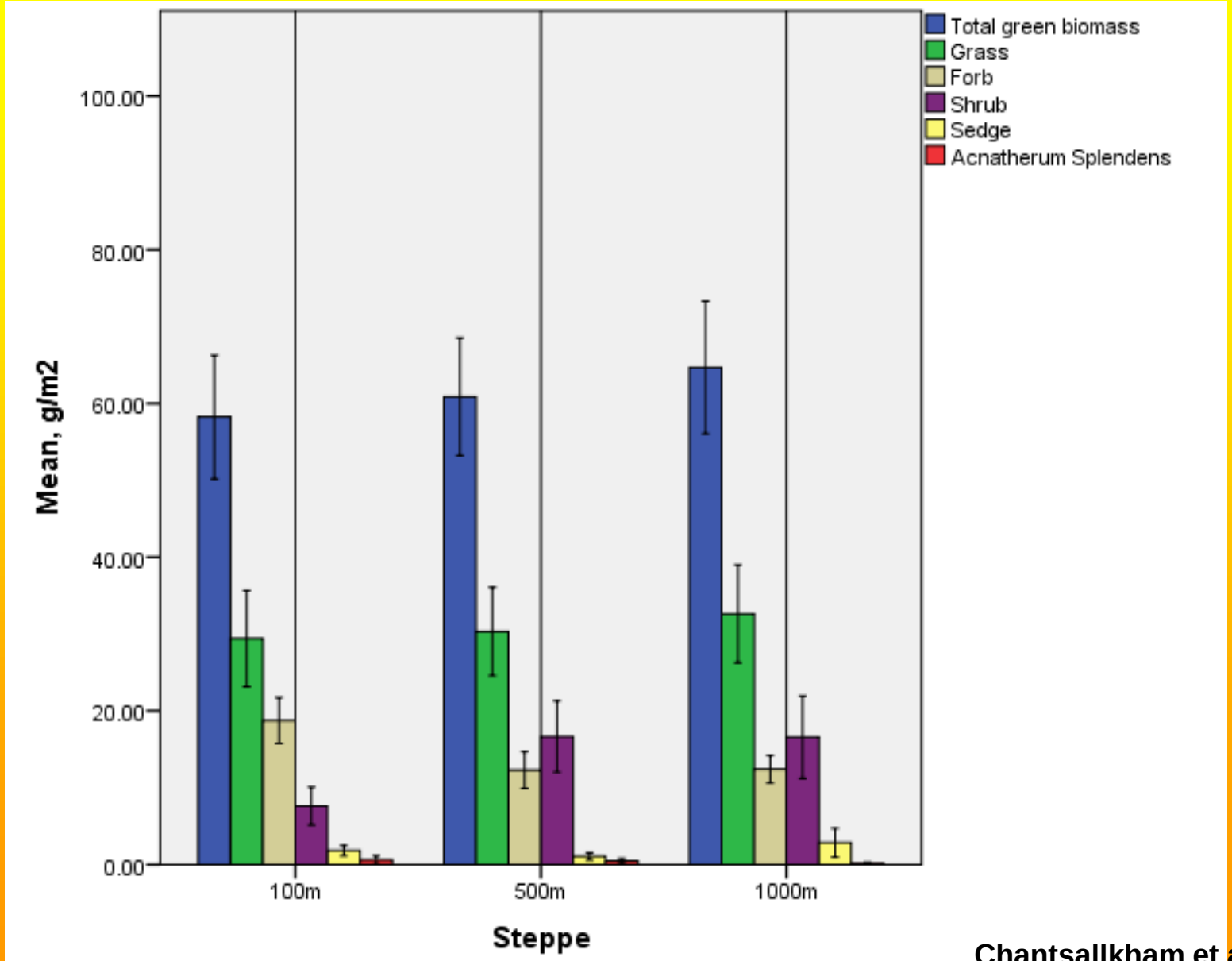
For example, in the desert steppe, grazing at the uvuljaa had *no effect* on the *biomass* of grass, forbs, shrubs, sedges or Acnatherum



Chantsaa

Chantsallkham et al 2012

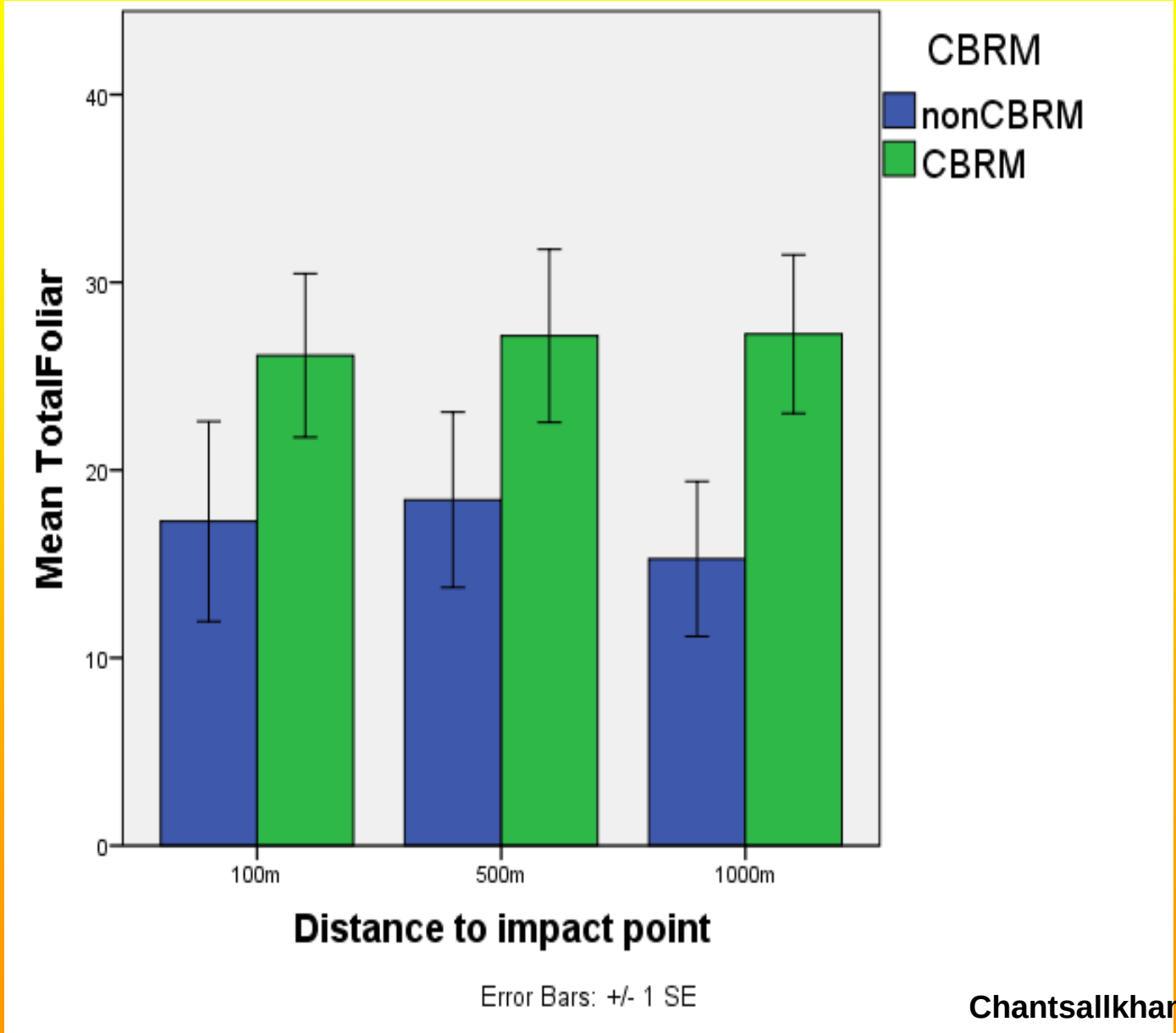
Similar results of no effect of grazing on *biomass* in the steppe



Chantsaa

Chantsallkham et al 2012

And there was no effect of grazing on *plant foliar cover* in the desert steppe (or eastern steppe)



Chantsaa

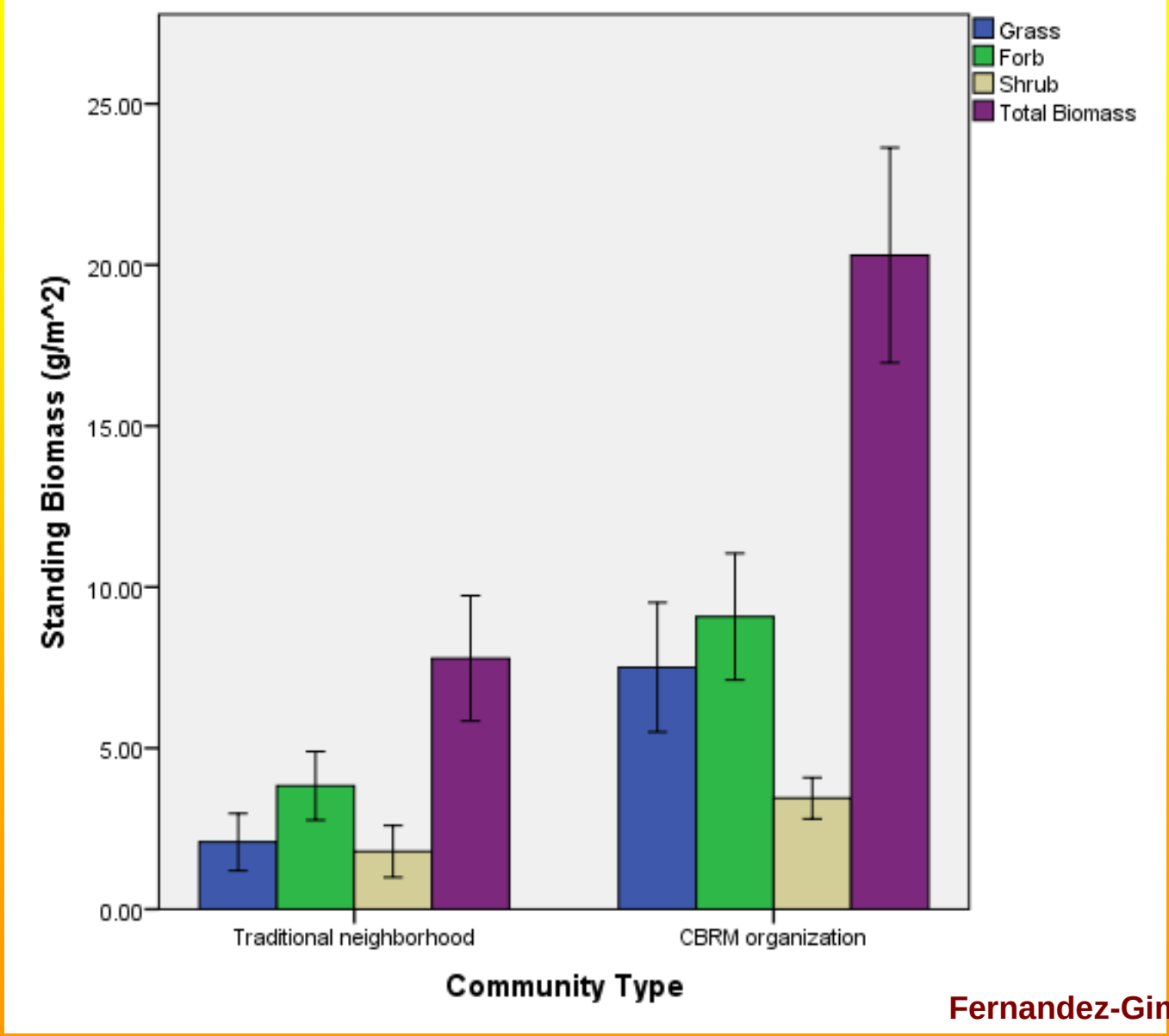
Chantsallkham et al 2013

Objective 3.

Effects of community-based organizations on vegetation and soils

Comparing across the the desert steppe, steppe and mountain steppe

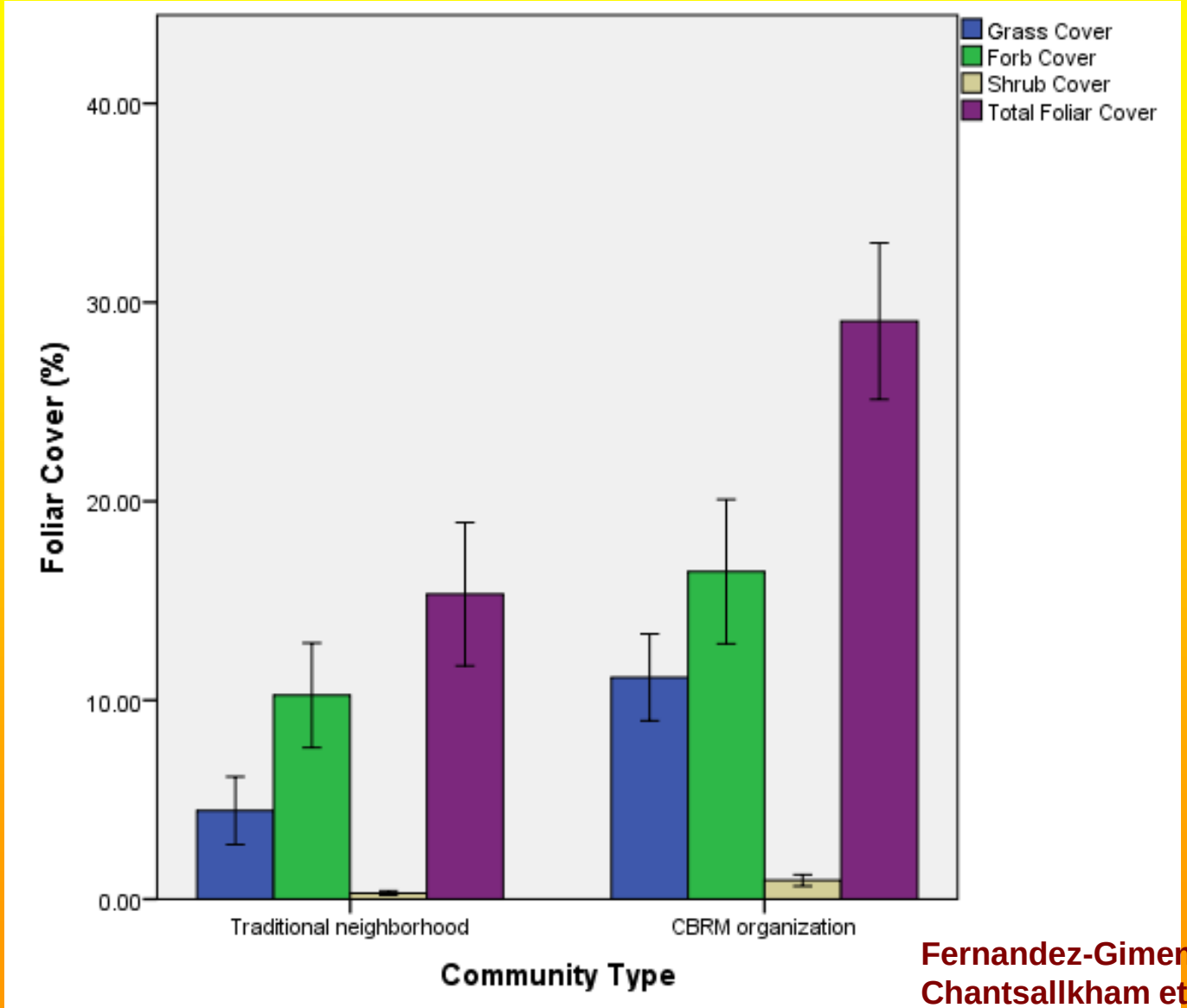
In the desert steppe, community group pastures had twice as much *biomass* as traditional neighborhood pastures



Khishig

Fernandez-Gimenez et al 2012

In the desert steppe, community group pastures had more *foliar cover of all plants, forbs and perennial plants* as traditional neighborhood pastures



Khishig

Fernandez-Gimenez et al 2012, Chantsallkham et al 2013

Steppe, mountain/steppe and eastern steppe

- **In the steppe, community herder groups had *3 times more shrub biomass and ¼ the sedge biomass* than traditional neighborhood pastures**
- **In the mountain/forest steppe, community pastures had *50% more forb biomass* than traditional neighborhood pastures**
- **In the eastern steppe, community herder pastures had *15 times more standing dead biomass and twice as much litter cover* than traditional neighborhood pastures**

Khishig

Fernandez-Gimenez et al 2012

Conclusions

- Ecological sites affect plant production and cover, and need to be accounted for in our analyses
- Grazing appears to have little effect on the vegetation around winter camps over the long term in any ecological zone
- CBRM groups have moderately more healthy grasslands than non-CBRM groups
- All herders in CBRM groups have more grass or forbs or standing dead biomass for grazing over the winter

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Future work

- **The data on plant species and basal gaps will tell us much more about more subtle impacts**
- **Our forage and soils analysis will tell us if CBRM improves the quality of grasslands for livestock and the health of the soils**
- **We need to know if CBRM soums had more plant biomass than non-CBRM soums *before the groups were established* (Jay's remote sensing analysis)**

Robin