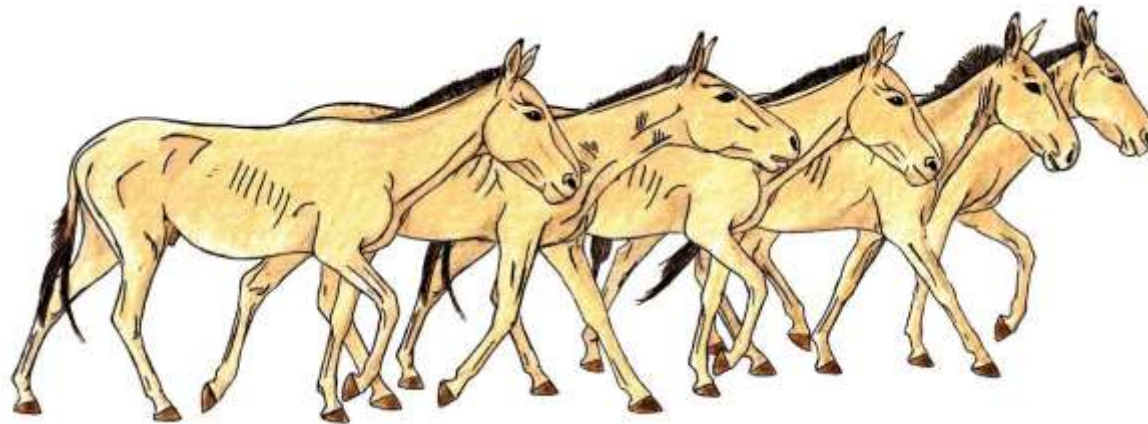




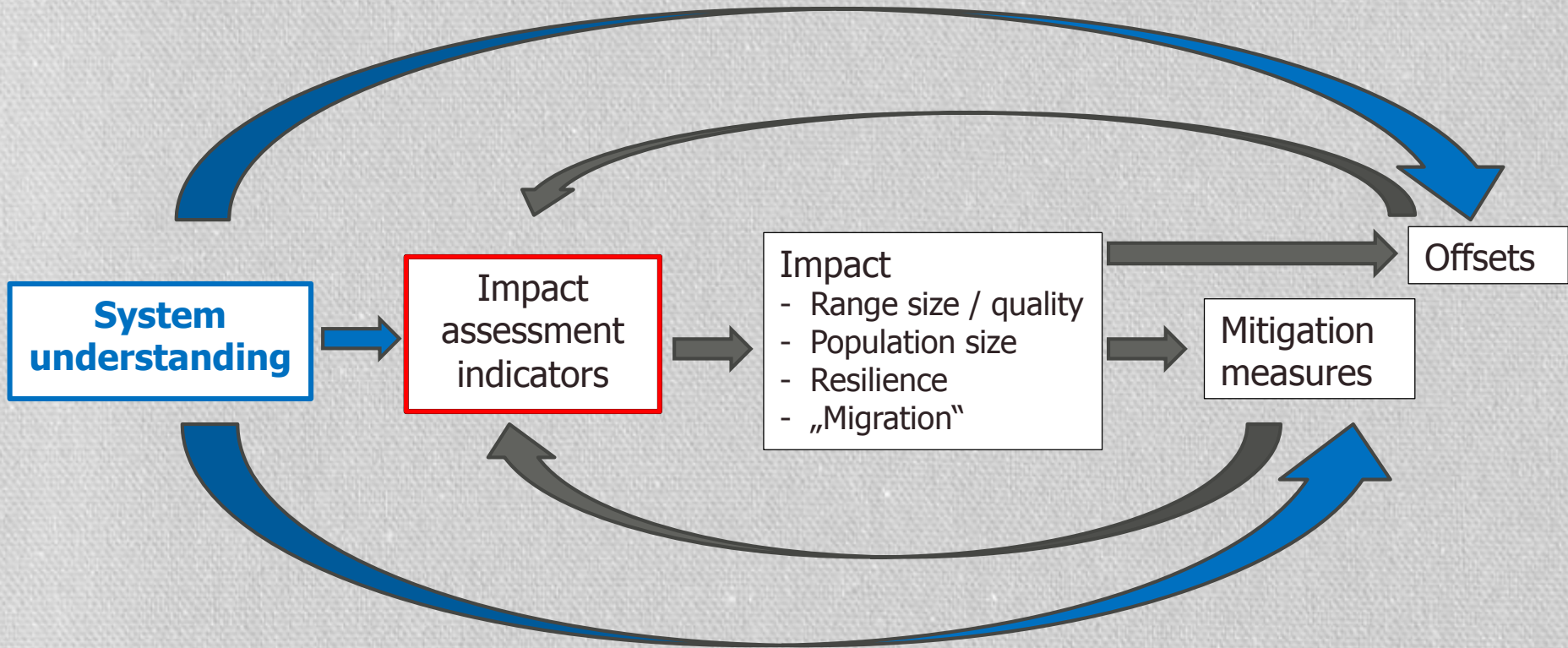
Pre-and post construction monitoring of khulan movements in the Mongolian Gobi – lessons learnt and future challenges

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Impact assessment (e.g. NNL or NPI)



Free love

*has a fission-fusion
Social organisation*

Family animal

*lives in stable family groups
(harems)*

Nomadic

*rooms over huge areas
(in der Gobi über 5,000-
50,000 km²)*

Resident

*shows high site fidelity
to a home area
(in the Gobi ~500 km²)*



Oportunistic
eats what is available

Red List species
*only Mongolia still has a
large population
(~40,000 Tiere)*

Asiatic wild ass
(Equus hemionus)

Fussy over food
*prefers the most
productive pastures
(grass steppes)*

Went almost extinct
*today ~500 free-ranging
individuals live in
Mongolia & China*

Przewalski Pferd
(Equus przewalskii)

System understanding

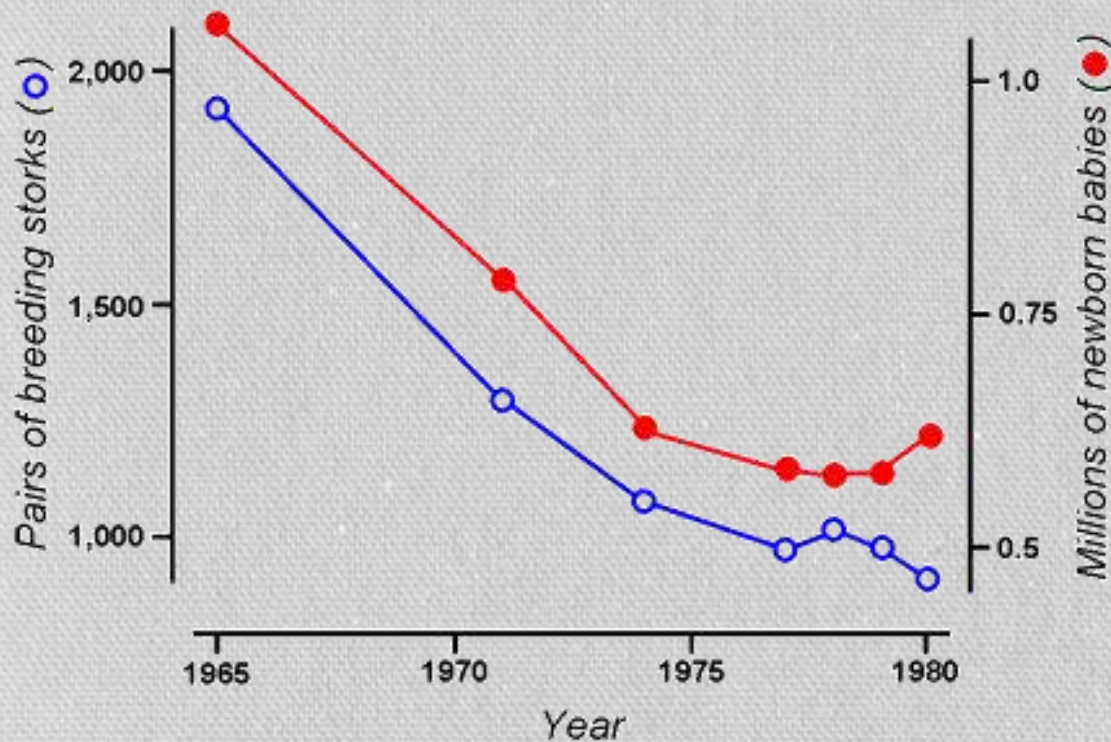
- Where to expect impacts (focus, monitoring design)?
- At what spatial scale to expect impact (area)?
- Over what time period to expect impact (time horizon)?

Pre-construction data

- Baseline -> assess change and impact
- Add to system understanding, which will help to disentangle change caused by impact or other environmental variables
- Ideally monitoring starts well before construction starts
 - long living species
 - environmental stochasticity
 - extreme events
- Experimental set up rather than only status assessment or correlative evidence

Correlation data

– storks and babies in Germany



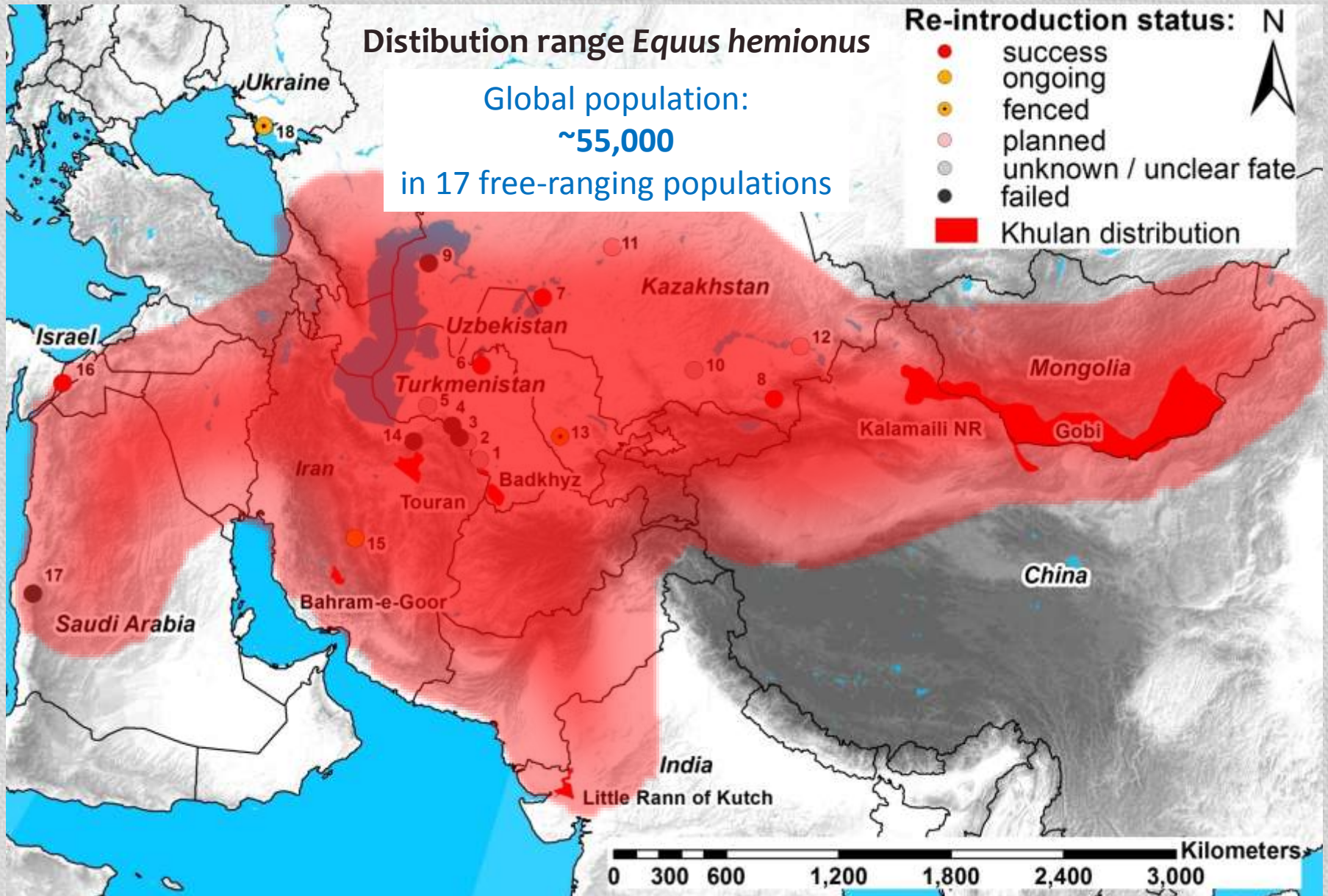
Historic data

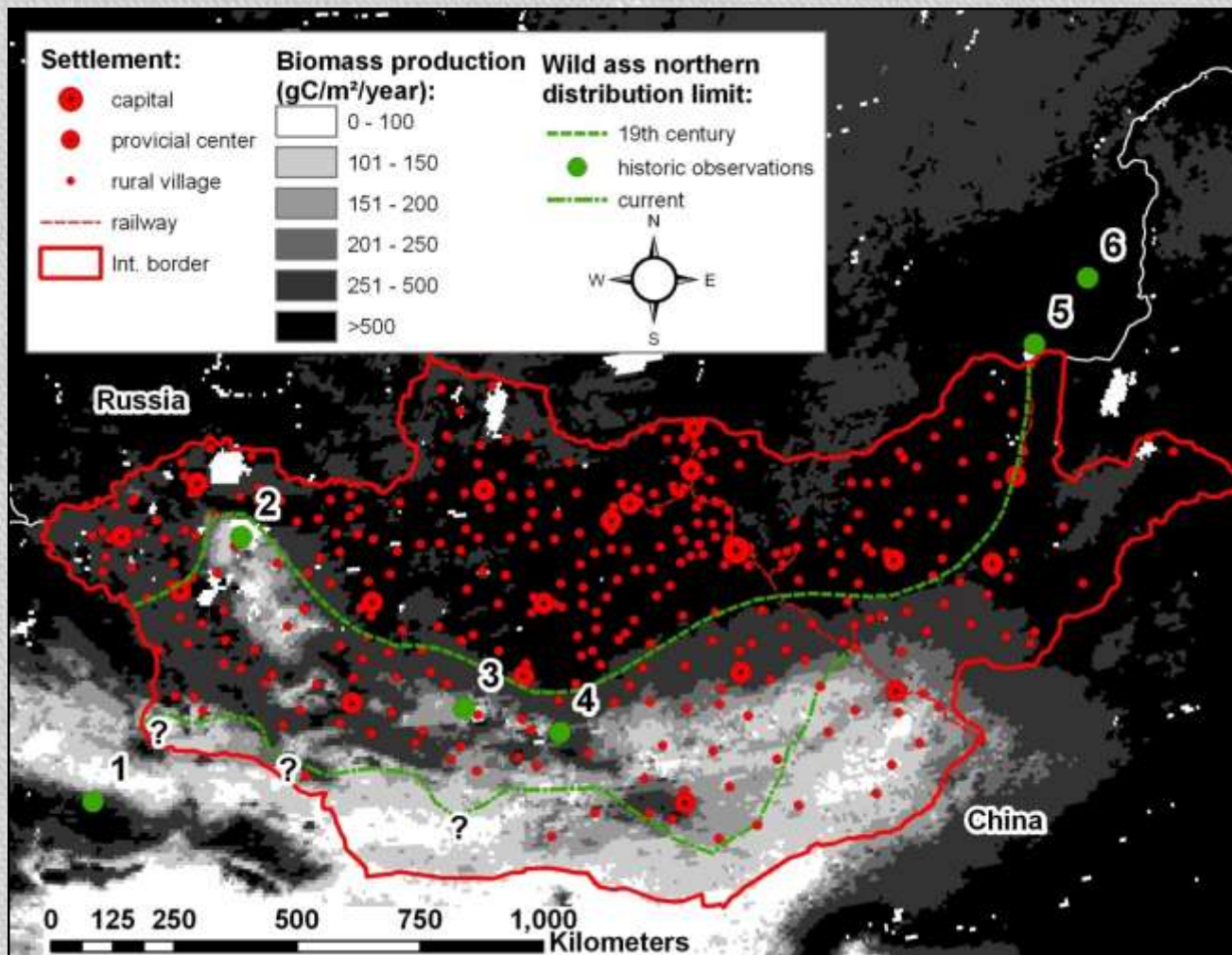
Distribution range *Equus hemionus*

Global population:
~55,000
in 17 free-ranging populations

Re-introduction status: N

- success
- ongoing
- fenced
- planned
- unknown / unclear fate
- failed
- Khulan distribution





Historic point observation provided in Denau and Denzau, 1999:
1 = Carruhers 1894, 2 = Pevvov 1883, 3 = Murzaev 1941, 4 = Chapman Andrews 1922-1925, 5 = Pallas 1775, 6 = Radde 1855-1860.

Bannikov. 1981. The Asian Wild Ass. Lesnaya Promyshlennost, Moscow, Russia. [original in Russian, English translation by M. Proutkina, Zoological Society of San Diego].

-> based on the material collected by the author in Mongolia in 1942-45 & 1974

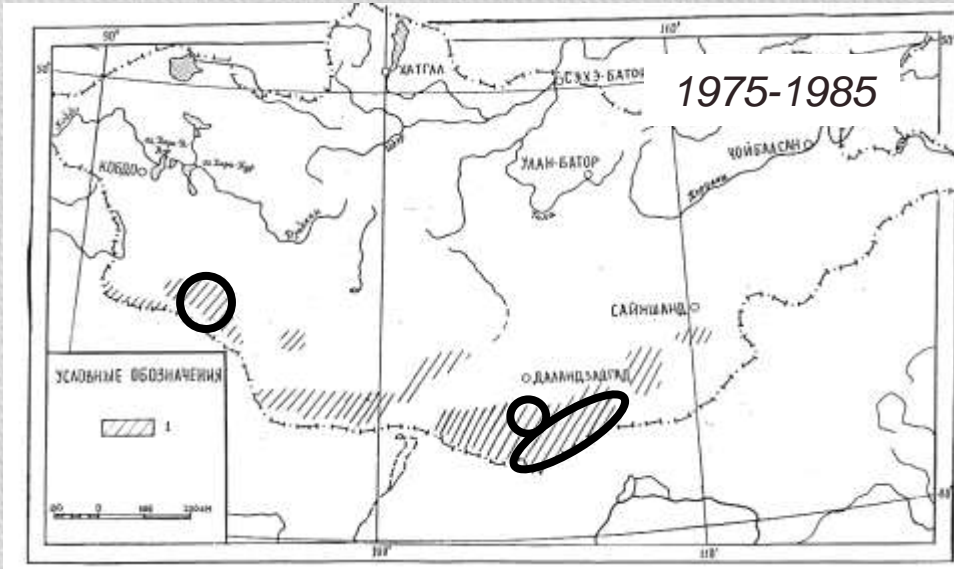
[...] **In the early 1940's the Wild Ass inhabited the SW part of Mongolia.** The northern boundary of the range passed along the southern slopes of the Mongolian and the Gobi Altai. [...]

[...] In the 1940's several **tens of thousands of wild asses** were found there. During the next 30 years the numbers noticeably declined due to the disappearance of the populations from the northern areas. [...]

[...] well **defined migrations were not observed** in Mongolia as a rule, but only a gradual transition of animals occurred. **Considerable migrations were only observed during the winters with a lot of snow** [...]

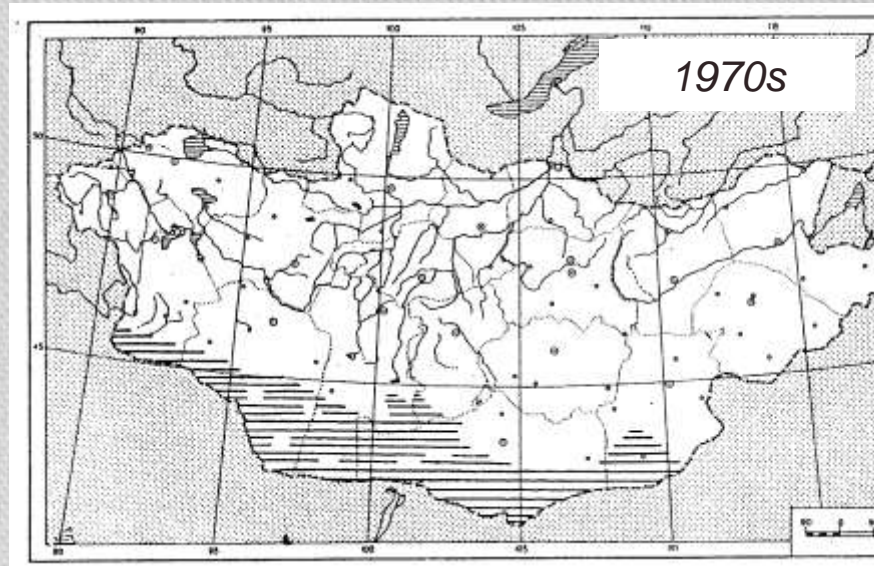
[...] Numerous herds of wild asses always gathered at the southern sides of the mountains in the spring months, and **in early June they left for the deserts or semideserts.** [...]

Historic data

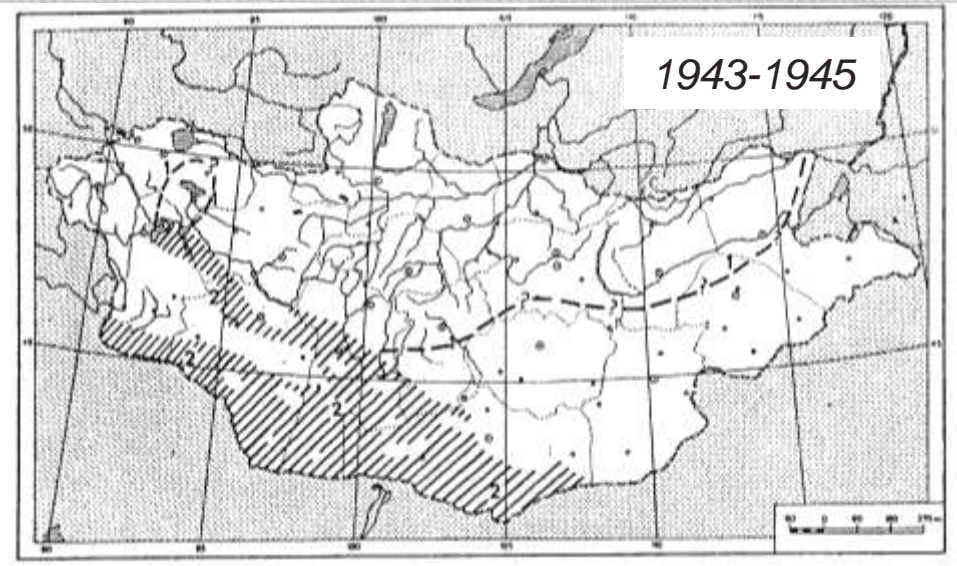


A. Lushchekina pers. comm.

- Observational
- Effort not recorded / documented



Zevegmid and Dawaa 1973



after Bannikov 1954 in Zevegmid and Dawaa 1973

1. Distribution & Population estimates

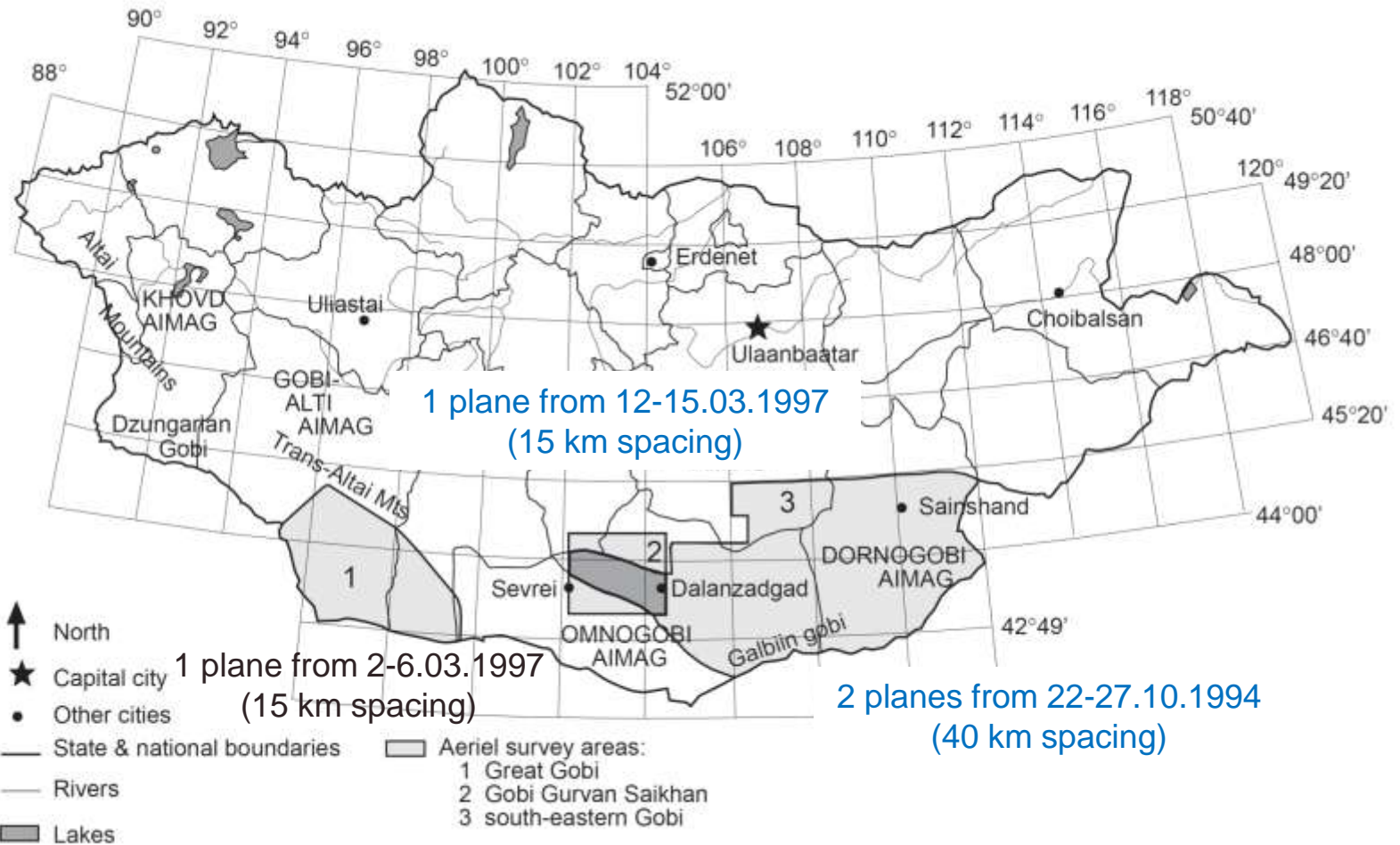
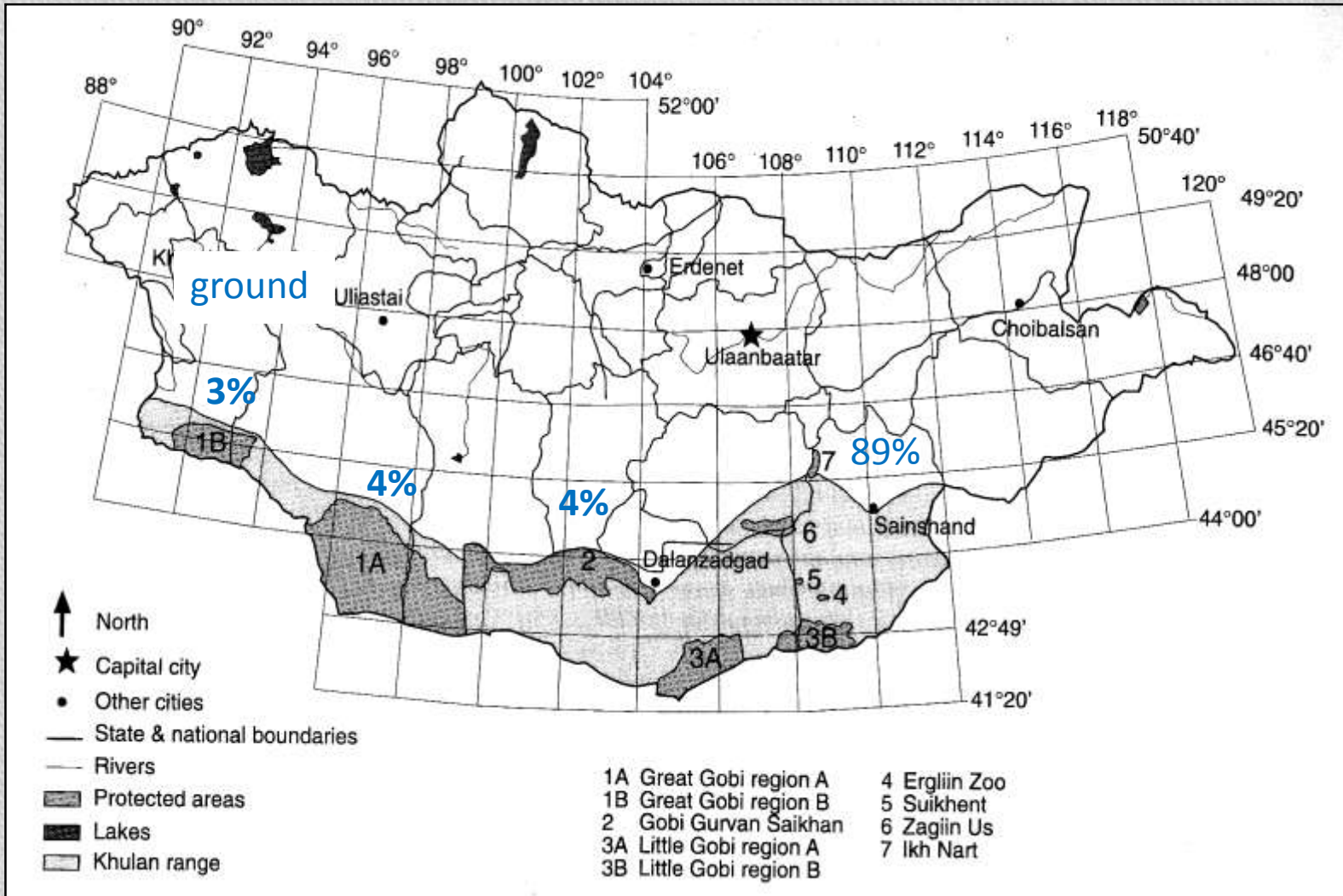


Fig. 1. Aerial survey areas for khulan *Equus hemionus* in Mongolia.

1994/97: 33,000-63,000 wild asses in Mongolia



SE Gobi – pre- and early post construction numbers:

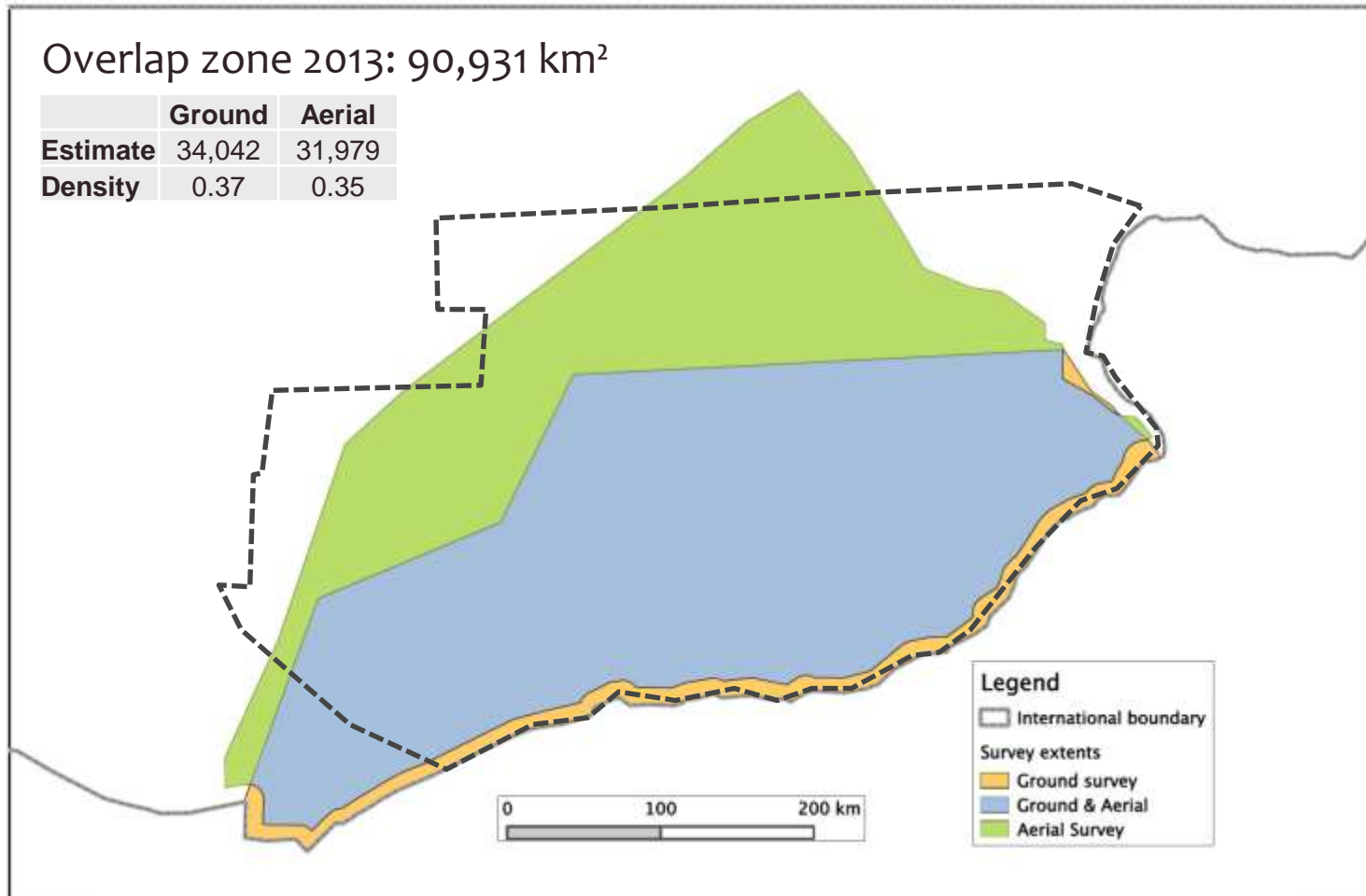
Reference	Survey type	Density approach	Year	Estimate	Survey area (km ²)	Density per km ²
<i>Pre-construction</i>						
Reading et al. 2001	aerial	distance sampling	1994 & 1997	39,991	209,000	0.19
<i>Post-construction</i>						
Norton-Griffiths et al. 2015	aerial	strip transect (photos)	2013	32,843	146,300	0.22
Buuveibataar et al. In prep.	ground	distance sampling	2013	35,899	78,717	0.46
			2014	39,998	78,717	0.51
			2015	36,298	78,717	0.46

Norton-Griffiths et al. 2015. Aerial Census of Wildlife and Livestock in the Oyu Tolgoi Area of the Gobi Desert, Mongolia May - July 2013. Final Report to Oyu Tolgoi LLC. 200 pp.

Buuveibatar et al. In prep. Assessment of population abundance and factors influencing distribution of ungulates in the Southern Gobi, Mongolia.

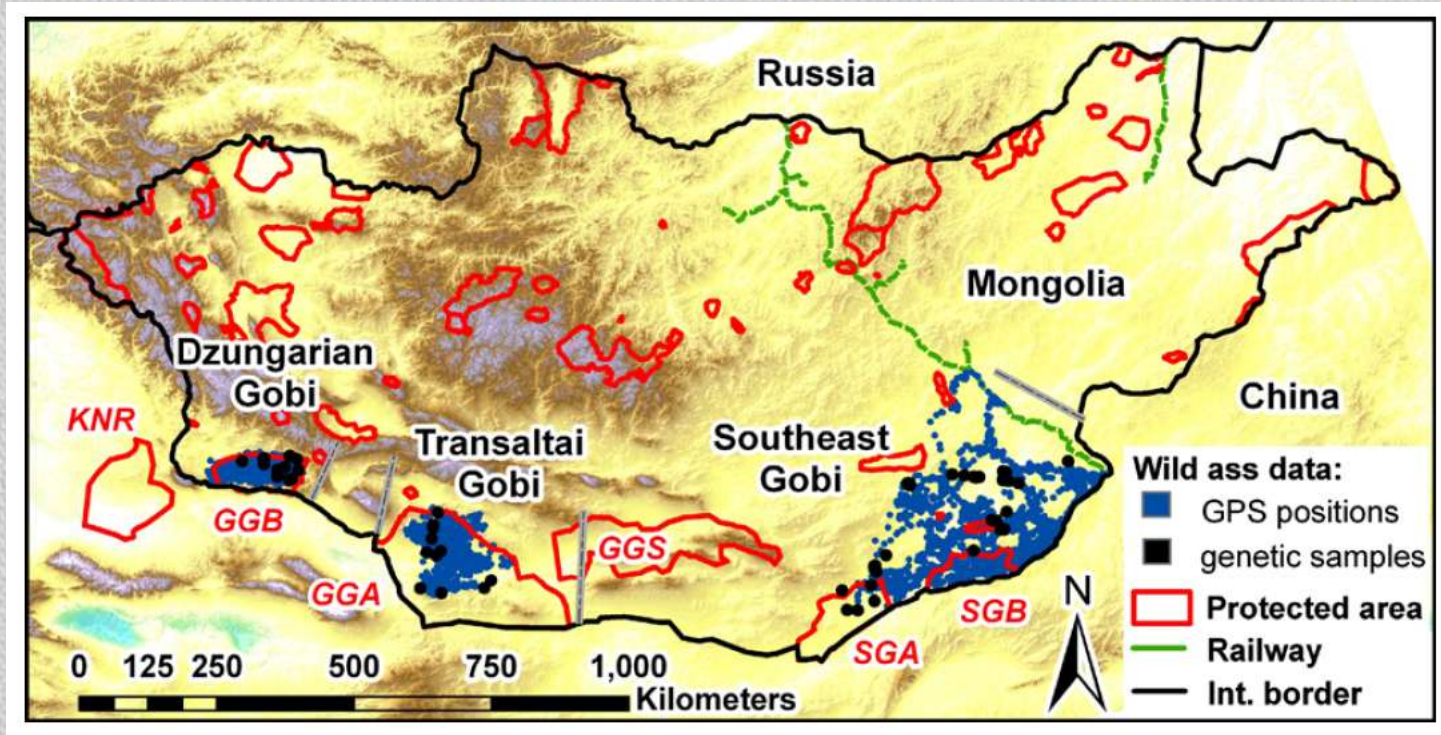
Figure 3.1 Overlap zone between the aerial and ground census, 2013

The area of overlap between aerial and ground surveys area measures 90,931 km².



2. Connectivity & Movements

Genetic & Movement data 2002-2007

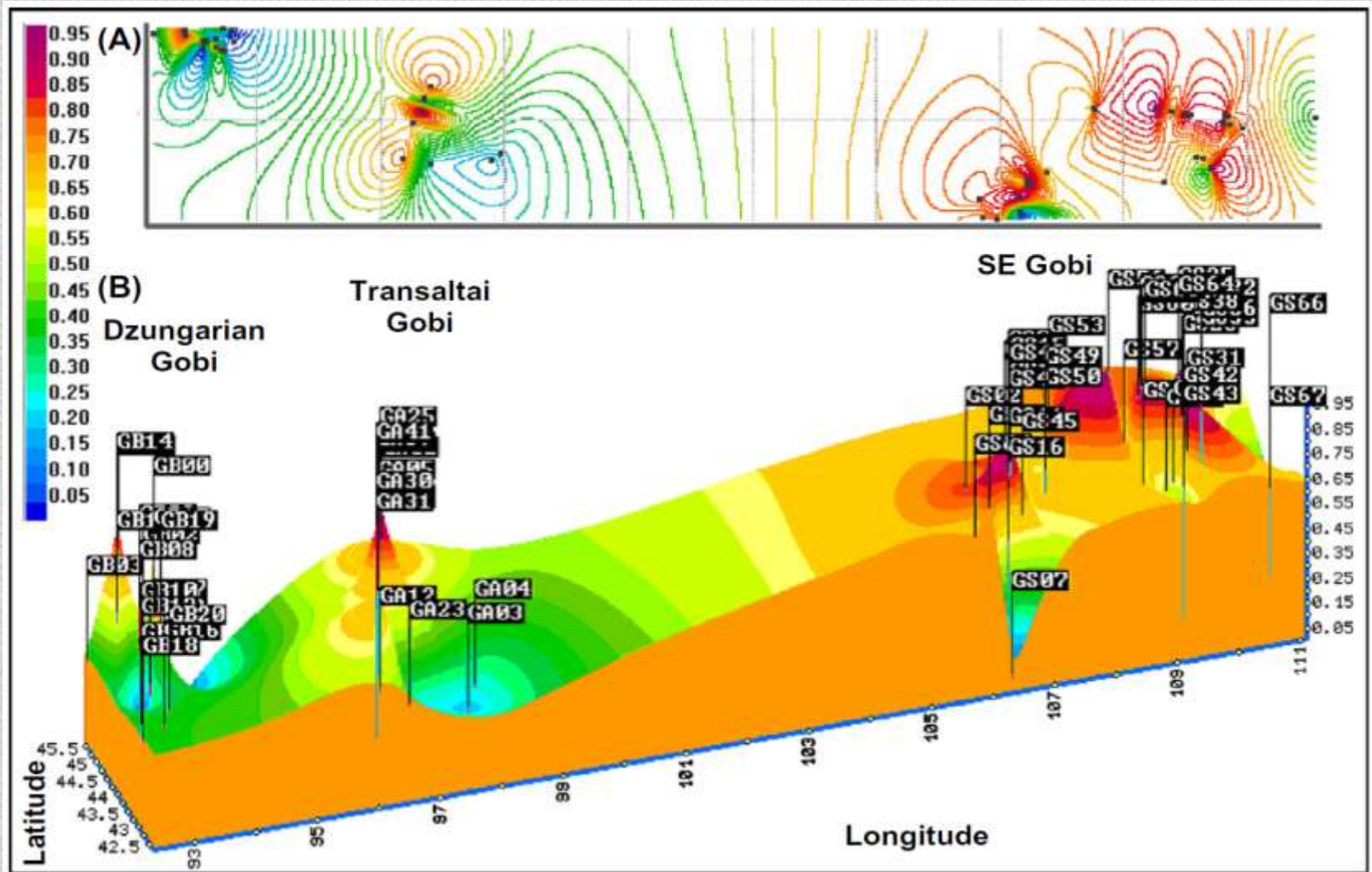


- 2 Research projects founded by the Austrian Science Foundation (FWF)
- 1 Management related project funded by the World Bank's NEMO project

Kaczensky et al. 2006. Room to Roam? The Threat to Khulan (Wild Ass) from Human Intrusion. Mongolia Discussion Papers, East Asia and Pacific Environment and Social Development Department. World Bank, Washington, D.C., USA.

Kaczensky et al. 2011. Connectivity of the Asiatic wild ass population in the Mongolian Gobi. *Biol Conserv* 144: 920-929.

Isolation by distance -> continuous population



- 80 samples (19 from Dzungarian, 18 from Transaltai, and 43 from SE Gobi)

Movements

Home range:

Ø 5,860 km²

14,695–16,907 km²

not in PA:

0.4-7.9%

0-4.5%

near fence:

0: 0 days

0: 0 days

Wild ass data:

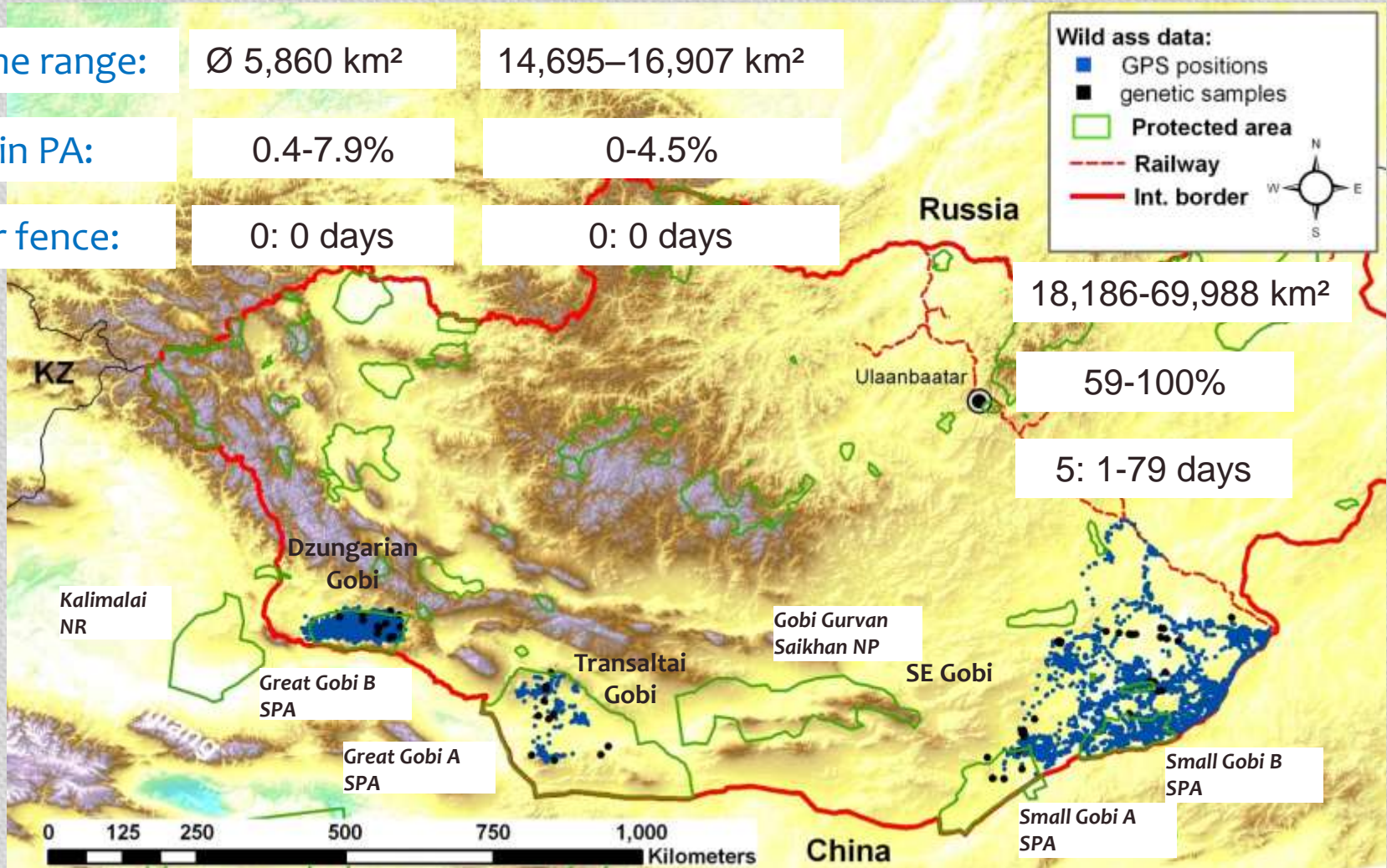
- GPS positions
- genetic samples
- Protected area
- - - Railway
- Int. border



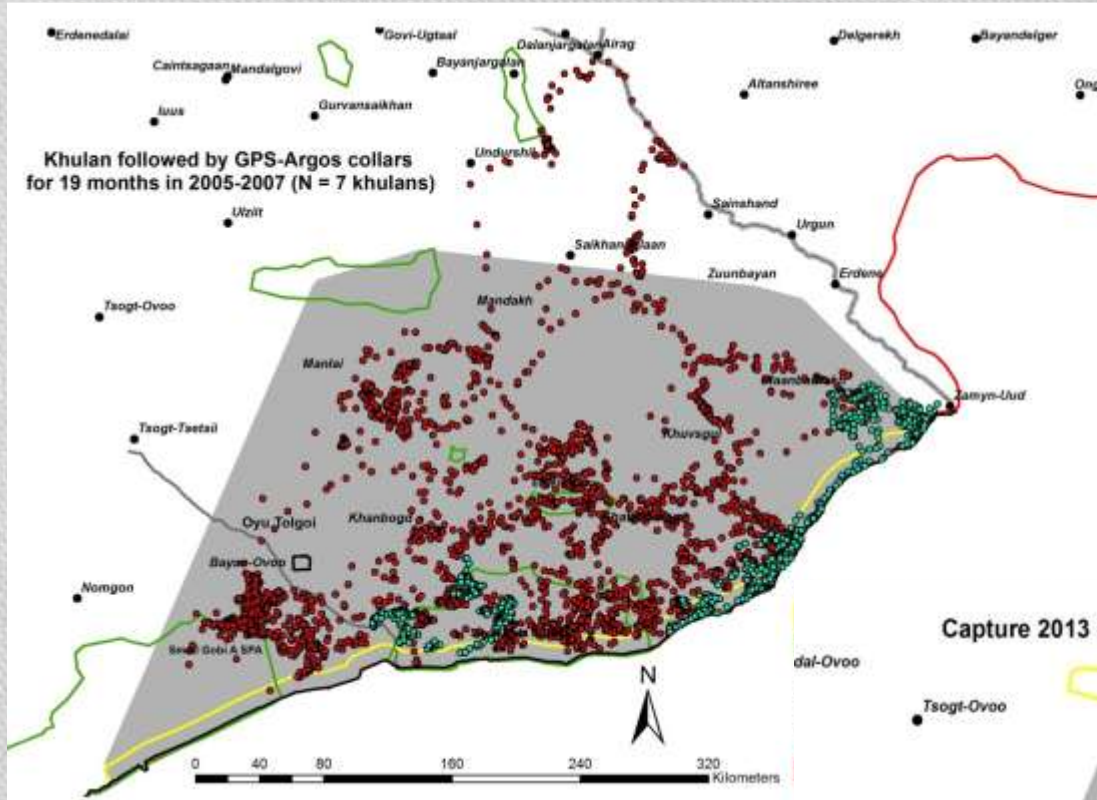
18,186-69,988 km²

59-100%

5: 1-79 days



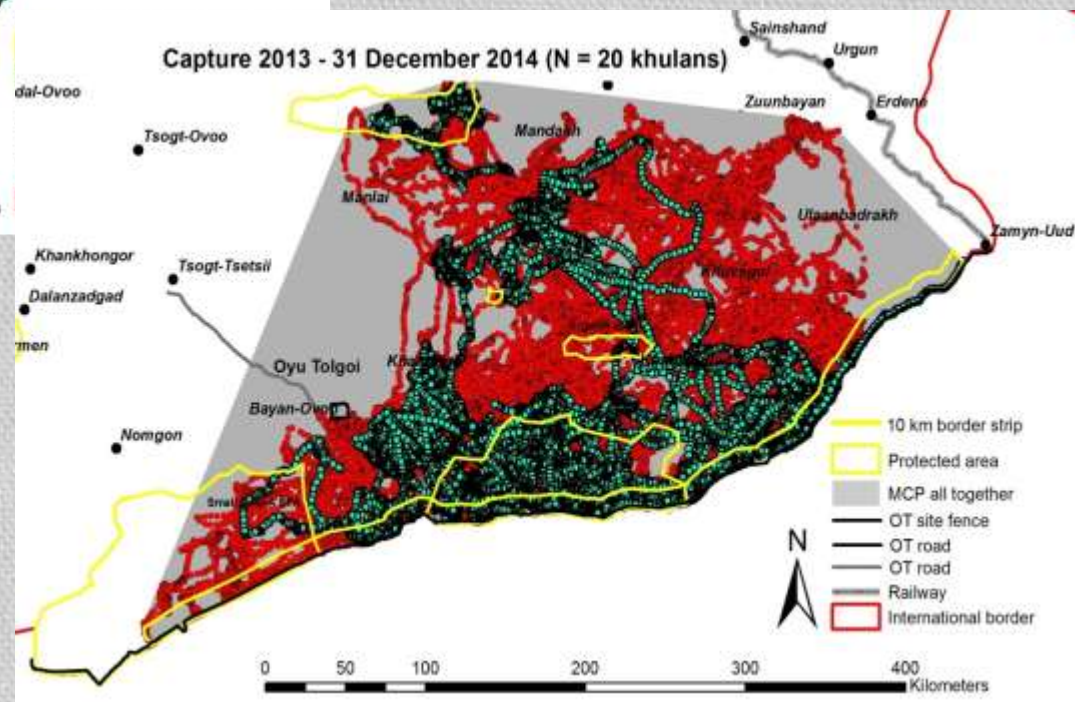
Pre and early post- construction



Khulan followed by GPS-Argos collars for 19 months in 2005-2007 (N = 7 khulans)

7 animals, 2005-2007

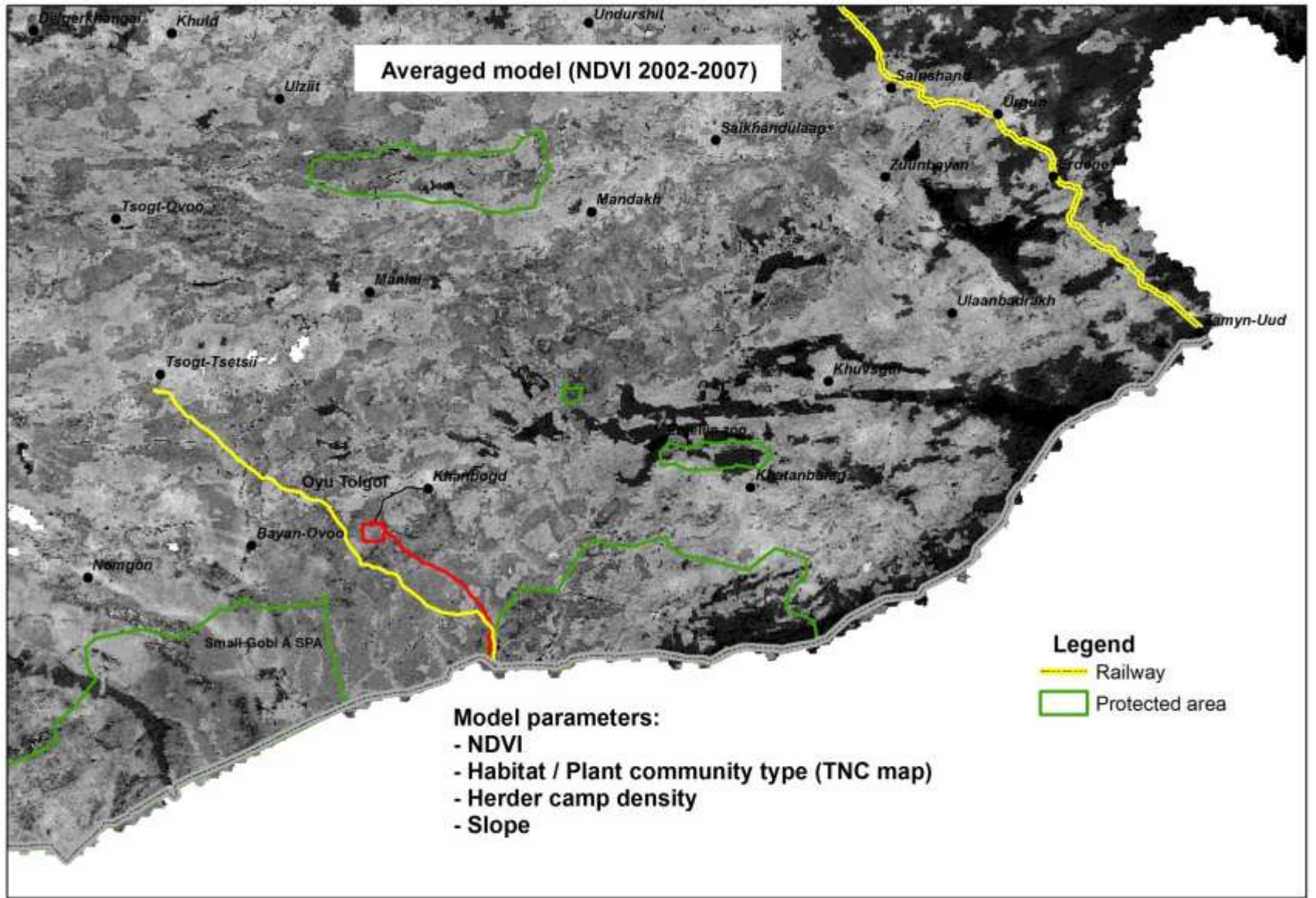
MCPs: 18,186-69,988 km²



Capture 2013 - 31 December 2014 (N = 20 khulans)

20 animals, 2013-2015

MCPs: 9,934-63,431 km²



3. Reproduction & Mortality

Foal rates

From	To	Total	Adults (>1)	% Adults	Foals	% Foals	Foals:adults (%)
21.09.2003	07.10.2003	1,830	1,488	81.3	342	18.7	23.0
03.07.2004	23.07.2004	3,387	2,776	82.0	611	18.0	22.0
07.07.2005	27.07.2005	1,399	1,274	91.1	125	8.9	9.8
24.07.2006	02.08.2006	1,539	1,431	93.0	108	7.0	7.5
10.07.2007	16.07.2007	199	176	88.4	23	11.6	7.4
08.10.2008	14.10.2008	1,935	1,704	88.1	231	11.9	13.6
29.06.2009	09.07.2009	941	800	85.0	141	15.0	17.6
06.07.2010	14.07.2010	718	675	94.0	43	6.0	6.4
22.07.2011	28.07.2011	1,280	1,080	84.4	200	15.6	18.4
23.09.2012	28.09.2012	1,001	865	86.4	136	13.6	15.7
		14,229	12,269	87.4	1960	12.6	14.1

Stubbe et al. 2012. Long term ecology of Asiatic wild ass (*Equus h. hemionus* Pallas) in Central Asia Exploration into the Biological Resources of Mongolia (Halle/Saale) 12, 61-76.

Mortality

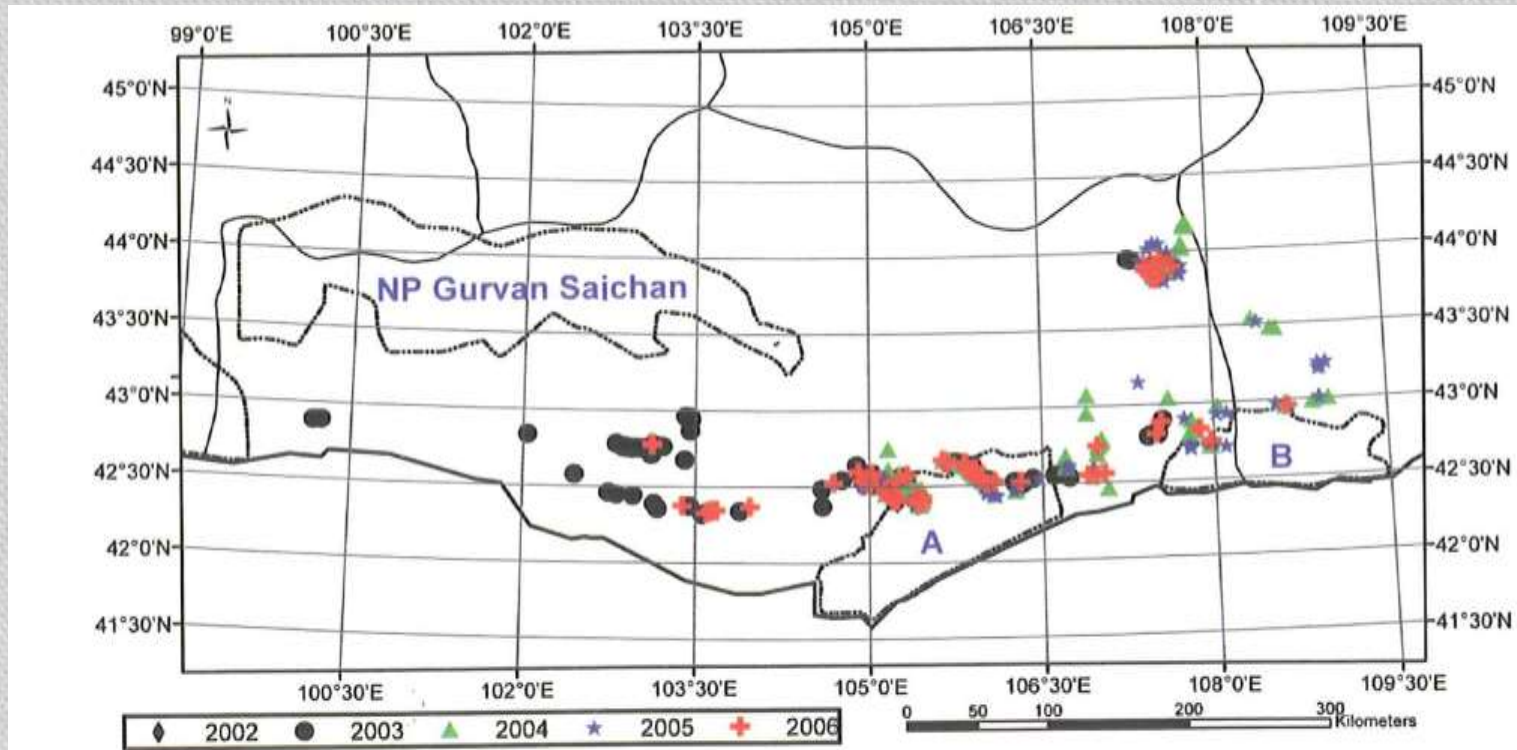
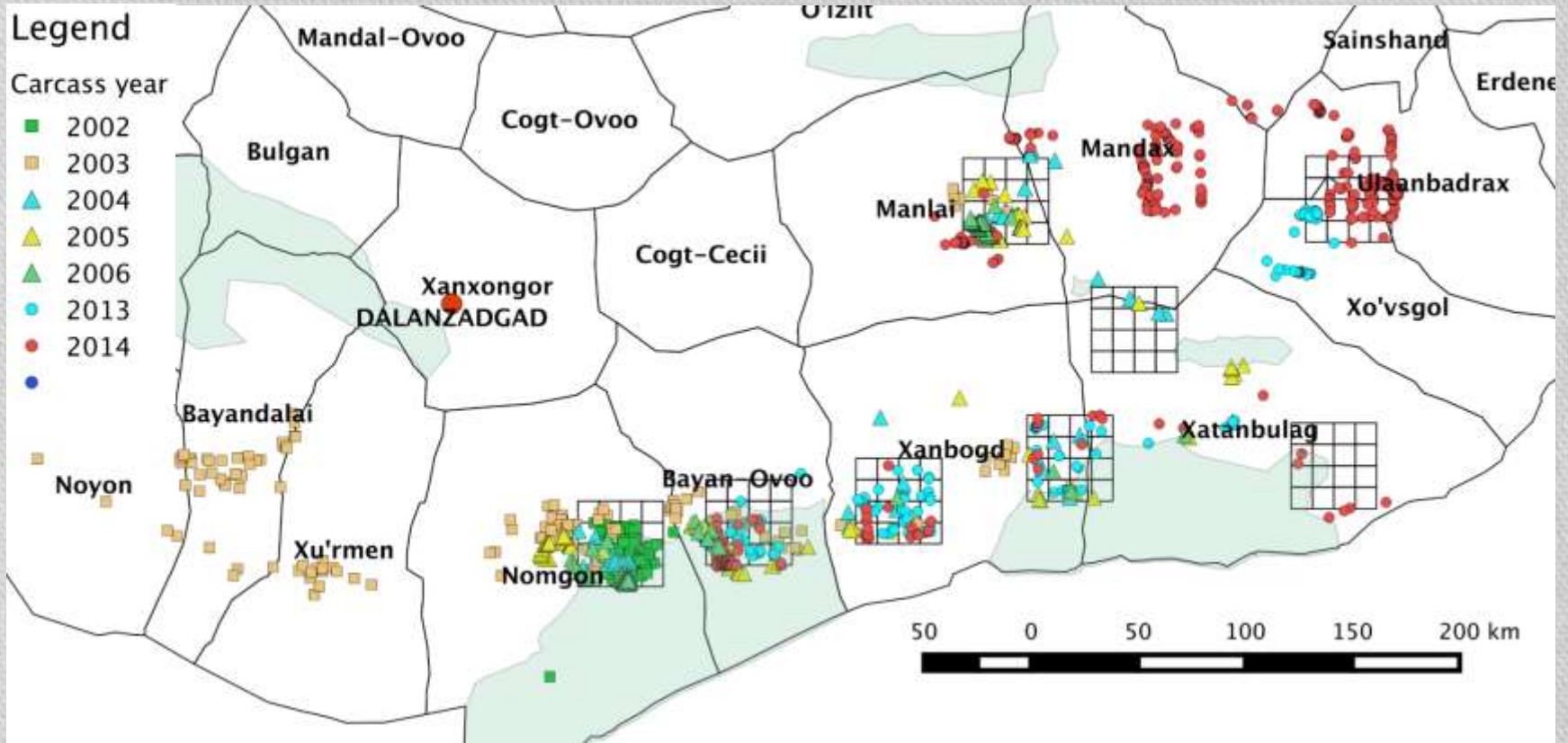


Fig. 2: The South Gobi Aimag with all localities of dead khulan between 2002 and 2006 and the Strictly Protected Areas Little Gobi A and B of this region.

Mortality



Mortality

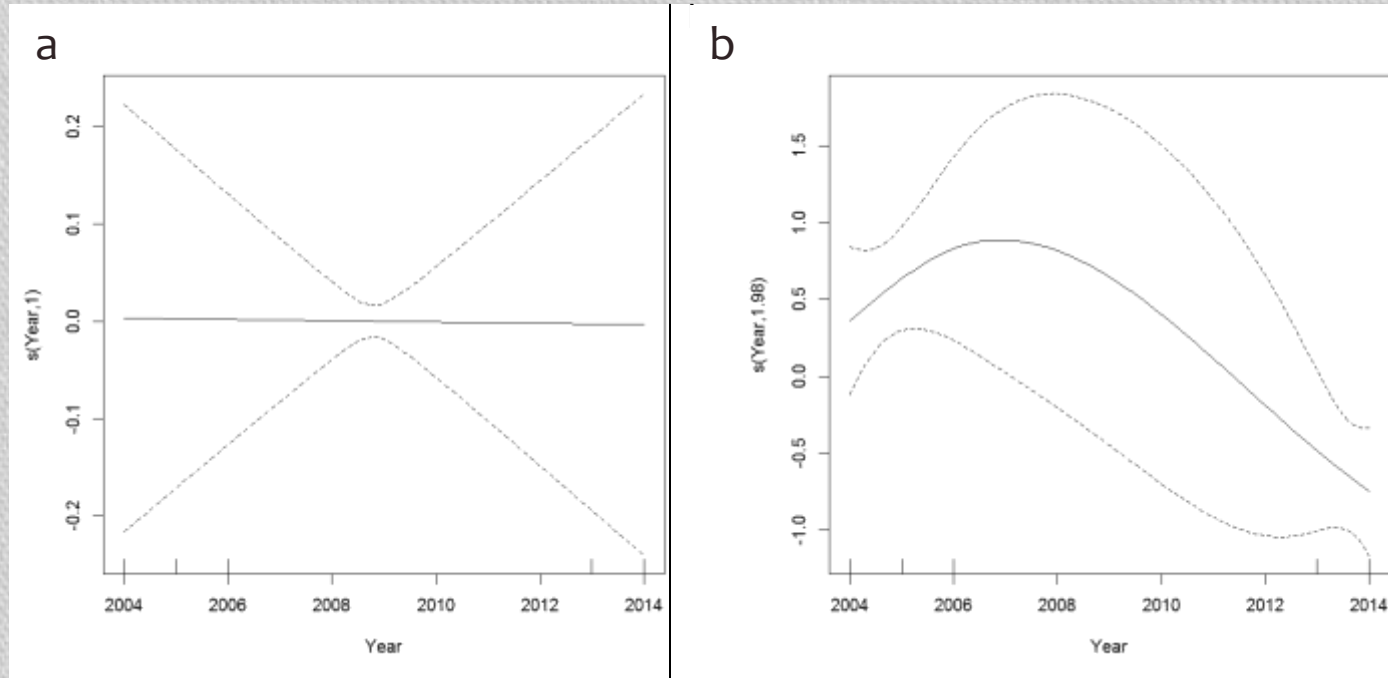
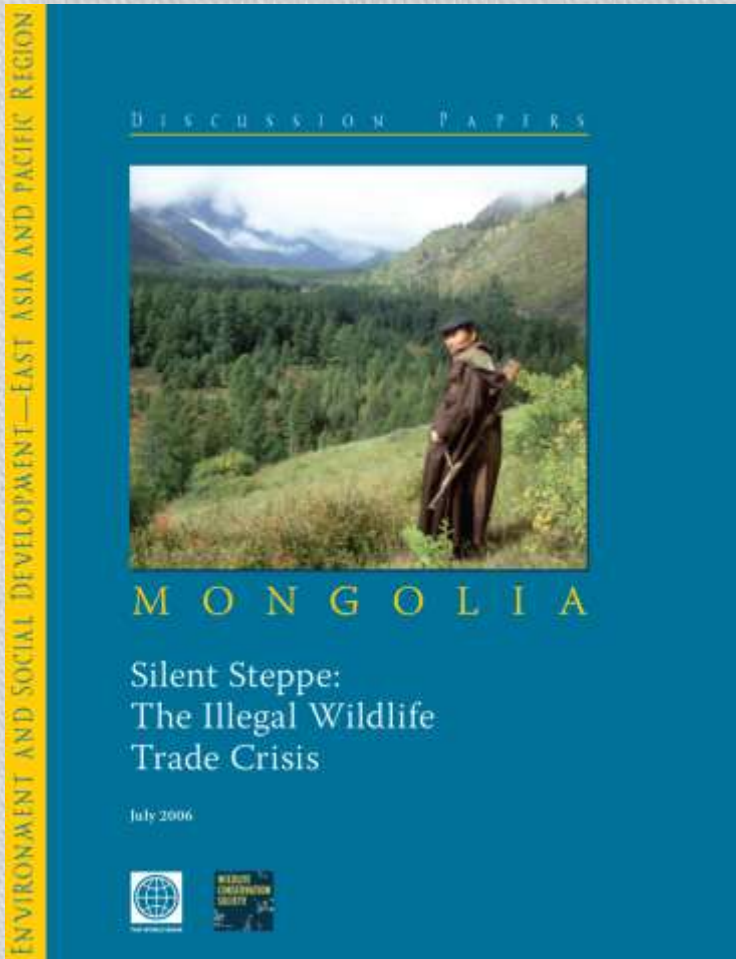


Figure 1. Khulan poaching rates over time for the southern Gobi. Shown is the estimated conditional dependence of daily counts on time. There was no significant change in poaching rates for all carcasses (a), whereas for recent carcasses there was a significant change in poaching rates over time with an initial increase in 2004-2006 and then a decrease in poaching in the later years (b).

Mortality



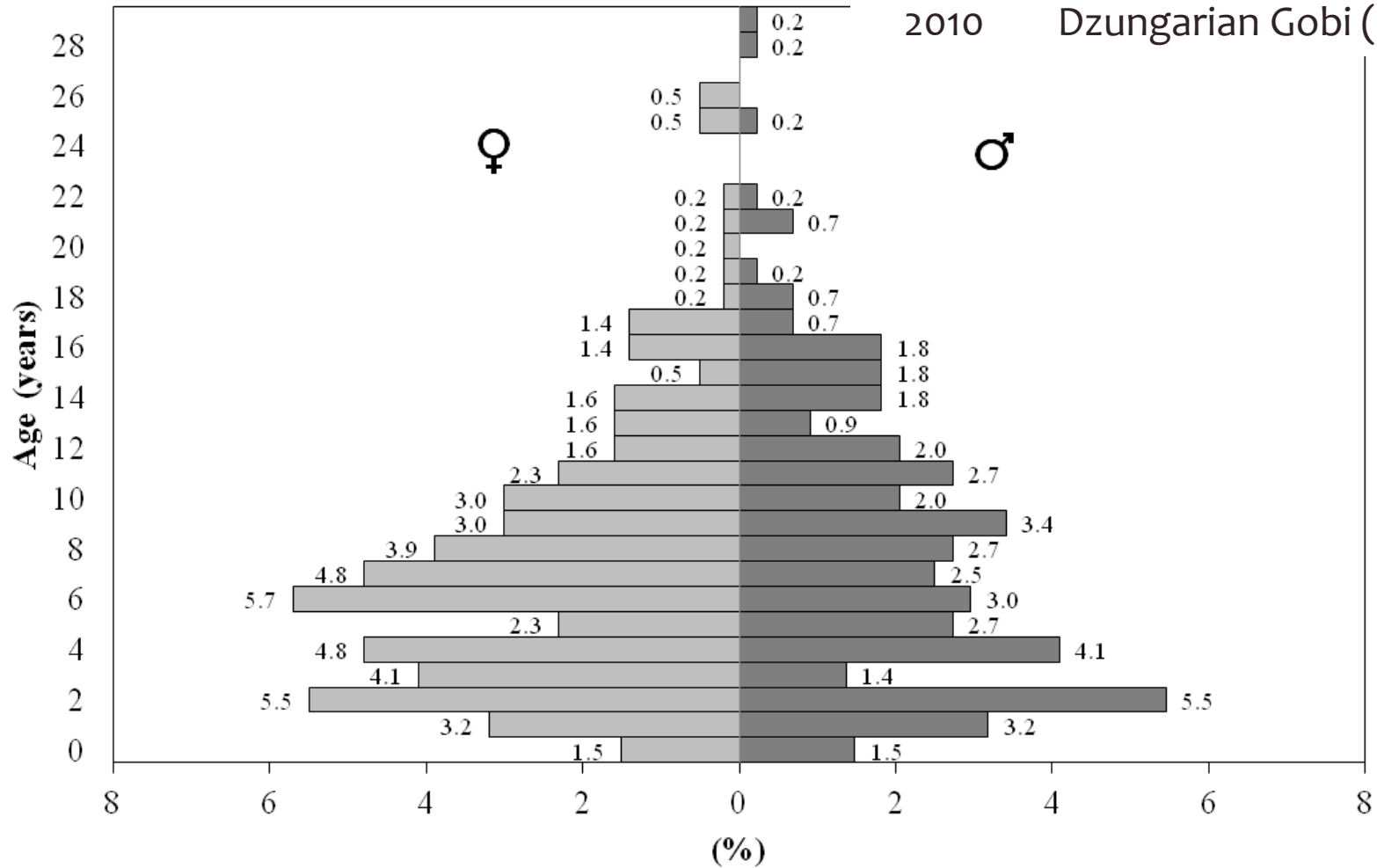
30% of Mongolian males (949 of 3,119) claim to hunt wildlife -> 245,000

In Soviet times 25,000

Wingard and Zahler. 2006. Silent Steppe: The Illegal Wildlife Trade Crisis. Mongolia Discussion Papers, East Asia and Pacific Environment and Social Development Department. Washington D.C.: World Bank.

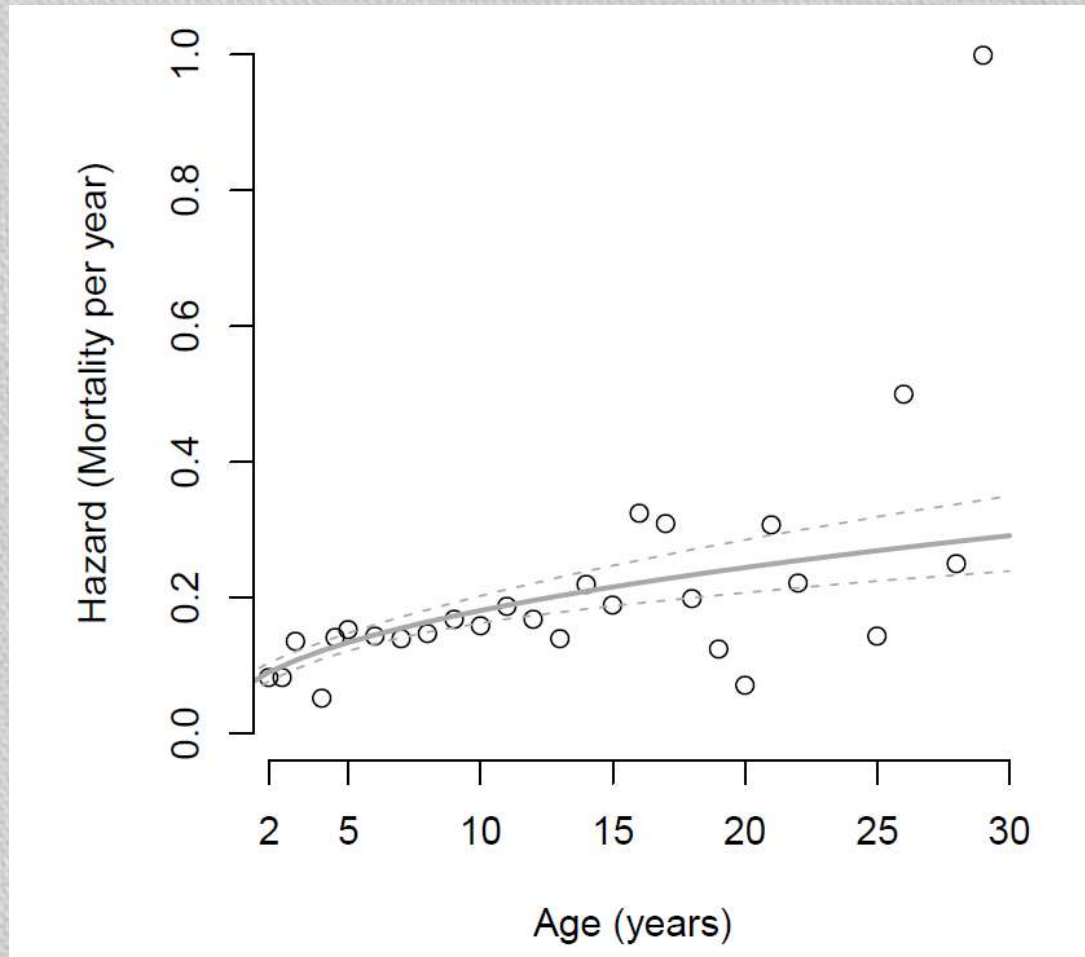
Skull age

2001-2004 Southern Gobi (N=355)
 2010 Dzungarian Gobi (N=50)



Lkhagvasuren et al. *Submitted*. Population structure of the Asiatic wild ass in Mongolia – extracting age and mortality estimates from skull samples.

Age specific mortality rates



Challenges

- Non-standardized data -> innovative, robust statistical approaches
- Rarely collected with “impact question” in mind
- Obtaining data (languages, database formats, contacts)
- Noise (environmental stochasticity, individual variation)
- Cumulative effects
- Interactions
- Other influences (e.g. climate change)

A way forward

- A large monitoring fund financed by construction projects & government
 - Develop sound monitoring techniques for key species
 - Obtain baseline data independent of specific projects
 - Increase our system understanding

Thank you for your attention!

