Socio-economic and ecologic factors for mobility of herder households in Mongolian Steppe
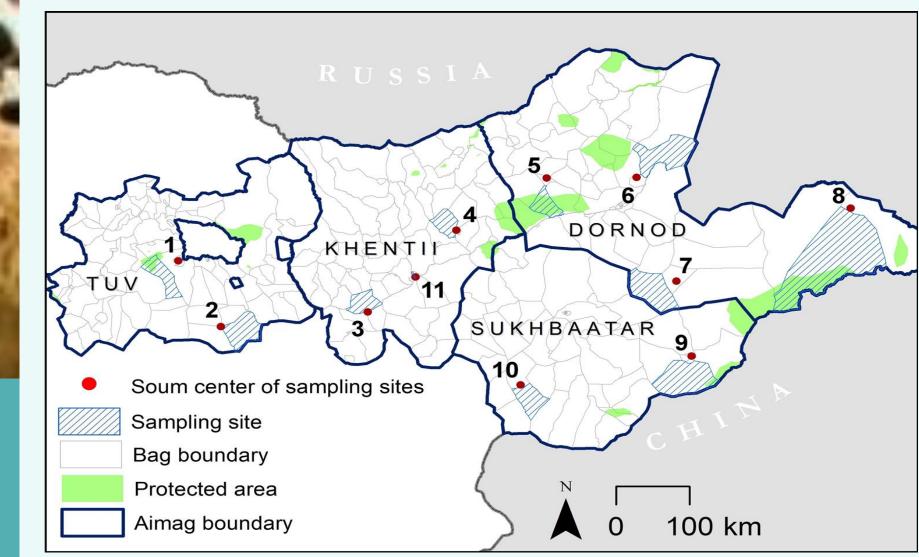
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Introduction

- Mobile grazing is considered environmentally superior compared to sedentary grazing, with sedentary grazing practices leading to rangeland degradation in some regions *(Na et al., 2018; Kerven, 2003).*

- Mongolia has experienced a significant increase in livestock numbers between 1990 and 2021, resulting in overgrazing and environmental degradation *(Tuvshintogtokh & Ariungerel, 2013).*

- Approximately 70% of Mongolia's grasslands have been reported to be degraded in recent decades *(Awaadorj & Badrakh, 2007; Densambuu et al., 2015).*

- Mobility also brings various benefits to herders, including increased livestock weight and reduced forage costs *(Kerven, 2003; Gonchigsumlaa & Damdindorj, 2021).*

- Mongolia has seen a reduction in mobility since the 1990s due to economic and social factors *(Wang et al., 2013; M. Fernandez-Gimenez, 2006).*

- The reasons for herders' mobility, including factors affecting the distance and frequency of mobility, require further exploration.

- The research aims to identify social and economic factors influencing herder mobility decisions in Mongolia and explore policy implications for increasing mobility.

(Source: MORE STEP project archive, credit to the map to Nandintsetseg Dejid)

Table 1. Sample size

Strata				Total number of Herder Households (HHs)		Number of herder households participated in the survey		
CS	Province	Soum	Bagh	HHs	Share (%)*	2019	2020	2022
A	B	C	D	EJ	$F=\frac{EJ}{\sum EJ} \times 100\%$	H	I	G
1	Tuv	Altanbulag	Altan-Ovoo	204	14.08%	45	38	33
2		Bayantsagaan	Gurvan-Turuu	99	6.83%	22	20	20
11	Khentii	Kherlen	Bayanmunkh	196	13.53%	43	39	31
4		Batnorov	Ekhenburd	140	9.66%	31	28	23
3		Bayanmunkh	Kherlen	97	6.69%	22	22	20
5	Dornod	Tsagaan-Ovoo	Guntsengeleg	81	5.59%	18	15	11
6		Choibalsan	Enger shand	91	6.28%	20	17	15
7		Matad	Bayankhangai	65	4.49%	14	12	11
8		Khalkhgol	Tashgai	93	6.42%	21	20	19
9	Sukhbaatar	Erdenetsagaan	Badrakh	137	9.45%	30	26	23
10		Bayandeiger	Duhum	246	16.98%	54	52	47
		Total		1,449	100%	320	289	253

Source: All names of herder households were obtained from bagh leaders

Note: *The proportion to each core-site (CS) is multiplied by the total sample size of 320 to calculate the sample size for each CS

Method

- The study was conducted at 11 baghs (coresites-CS) in Mongolia.

- These baghs were situated in 11 different soums.

- The soums were located across four provinces: Tuv (central), Khentii, Dornod, and Sukhbaatar (Eastern).

- The study employed stratified random sampling,

- And used regression factor analysis using 3-year balanced panel with 224 of the 253 households after outlier treatment.

- Took annual total distance of mobility as a dependent variable (ln*DIS*)

Source:
https://www.toursmongolia.com/about-mongolia/mongolian-people-and-nomads

Results

- **Multicollinearity:** VIF test showed average VIF of 1.33 (below 5, not serious)

- **Autocorrelation:** Wooldridge's serial correlation test didn't reject null hypothesis (Prob > F = 0.0736) meaning no autocorrelation

- **Heteroskedasticity:** Modified Wald test found groupwise heteroskedasticity (Prob>chi2 = 0.0000)

- **Hausman Test:** Favored FE over RE estimator (Prob>chi2 = 0.0019)

- **Sargan Hansen overidentification test:** It favored FE (P-value = 0.0003), addresses heteroskedasticity

		FE robust (xtreg)	RE (xtreg)	Pooled OLS	Pooled OLS robust
Social	FM	-0.0681*	-0.045	-0.0520*	-0.0520*
	EDU	0.022	-0.0797**	-0.121***	-0.121***
	GEN	0.538*	0.567***	0.586***	0.586***
	lnAGE	0.695*	-0.414*	-0.549**	-0.549***
	HH	0.0382**	0.0313	0.0185	0.0185
	lnEXP	-0.294***	-0.118	-0.0798	-0.0798
	ORG	0.0487	0.0957	0.13	0.13
	lnDSC	0.707***	0.492***	0.426***	0.426***
Economic	lnINC	-0.0853	-0.0978	-0.119*	-0.119
	lnFUEL	-0.968	-1.104	-1.581*	-1.581*
	lnSHU	0.0596	0.266***	0.340***	0.340***
	SMALLPER	0.00609	-0.00153	-0.00759	-0.00759
	TRUCK	-0.208*	-0.206*	-0.223	-0.223*
	lnHAY	0.0302	0.0267	0.0194	0.0194
	LPA	0.133	0.0237	-0.0119	-0.0119
Ecological	AVEG2	-0.204***	-0.292***	-0.371***	-0.371***
	WAT	0.0802	0.127	0.156	0.156
	DZUD	0.0311	0.0286	0.0147	0.0147
	DRO	0.274***	0.308***	0.371***	0.371***
Regulatory	PLA	0.238	0.381***	0.546***	0.546***
_cons		6.532	11.39*	15.89**	15.89**
N		672	672	672	672
R-sq: within		0.1414	0.1079	-	-
R-sq: between		0.0863	0.2624	-	-
R-sq: overall		0.0961	0.2066	-	-
R-sq		-	-	0.218	0.218
adj. R-sq		-	-	0.194	0.194
* p<0.10, ** p<0.05, *** p<0.01					

Highlights

- Distance from the soum center or subdistrict (*DSC*), and experiencing drought (*DRO*) positively affected annual mobility distance. In other words, herders close to soum centers are subject to restricted mobility.

- Conversely, perceiving a reduction in vegetation cover after using seasonal pastureland (*AVEG*) had a positive effect on mobility.

- Specifically *AVEG*, *DSC*, and *DRO* were associated with an increase in annual mobility distance.

- These findings were consistent across all four estimators and were statistically significant at a 95% confidence level.

Variable	Obs	Mean	Std.Dev.	Min	Max
FM	672	4.17	1.61	1.00	9.00
EDU	672	3.13	1.09	-	10.00
GEN	672	0.07	0.26	-	1.00
AGE	672	45.36	12.70	21.00	87.00
HH	672	3.80	2.51	-	40.00
EXP	672	23.30	13.05	1.00	73.00
ORG	672	0.32	0.47	-	1.00
lnDSC	672	4.66	0.68	1.39	6.19
INC	672	24,000,000	25,500,000	950,768	381,000,000
FUEL	672	2,316.54	123.55	2,094.08	2,524.17
SHU	672	563.59	361.82	37.65	1,818.93
SMALLPER	672	2.83	8.66	-	120.00
TRUCK	672	0.91	0.29	-	1.00
HAY	672	7.61	8.52	-	109.20
LPA	672	0.05	0.21	-	1.00
AVEG	672	(0.43)	0.55	(3.00)	2.00
WAT	672	0.89	0.25	-	1.00
DZUD	672	0.14	0.35	-	1.00
DRO	672	0.20	0.40	-	1.00
PLA	672	0.08	0.27	-	1.00

Results

Social factors

- Education level of the herder household head (*EDU*) negatively annual mobility distance.

- Gender of the household head *(GEN)* was statistically significant across Random-Effect (RE) and Pooled models with women-headed households moving farther/more.

- The age of the household head (*lnAGE*) was significant for the Pooled model, signifying old age is a restricting factor for mobility.

- The higher number of households grazing in the same area *(HH)*, was identified to be a significant factor for herders to move farther.

- The experience of herding in years also negatively affected mobility for the Fixed-Effect estimator.

- **Herders close to soum centers (sub-district) are subject to restricted mobility this was consistent across all 4 estimators.**

Economic factors

- The number of livestock households (*SHU*) owned positively affected mobility for RE and pooled models.

Ecological factors

- Herders' perception of reduction in vegetation cover after using seasonal pastureland (*AVEG*) had a positive effect on mobility.

- Occurrence of drought (*DRO*) motivated herders to move more. This finding was consistent across all 4 estimators

Regulatory factor

- Adhering to local government plans (*PLA*) led to an increase in annual mobility distance in the random effect (RE) and pooled models.

Acknowledgement

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