

LETTER

Social Outcomes of Community-based Rangeland Management in Mongolian Steppe Ecosystems

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Keywords

Community-based natural resource management; community-based conservation; pastoralism; integrated conservation and development; common pool resources; common property; environmental governance.

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Abstract

Community-based rangeland management (CBRM) has been promoted as a promising option for achieving both rangeland conservation and community well-being. However, research on its effectiveness is limited, and the reported outcomes are mixed, especially with regard to socioeconomic outcomes. We measured social outcomes of CBRM in Mongolia by comparing 77 formally organized pastoral groups with 65 traditional herder neighborhoods across four ecological zones. We used household surveys, focus groups, and interviews to measure livelihoods, social capital, and management behavior. Members of CBRM groups were significantly more proactive in addressing resource management issues and used more traditional and innovative rangeland management practices than non-CBRM herders. However, the group types did not differ in social capital or on most livelihood measures. Our results demonstrate that formal CBRM is strongly associated with herder behavior, but calls for consideration of how to reach livelihood outcomes, a key incentive for community-based conservation.

Introduction

Temperate grasslands are among the world's most imperiled ecosystems and Mongolia has one of the largest intact expanses of temperate grasslands on Earth. Occupying ~80% of Mongolia's territory, Mongolian rangelands are vulnerable to climate change (Batima 2006), extreme weather (Dagvadorj *et al.* 2009), degradation (Khishigbayer *et al.* 2015), and increasing rural poverty gaps (Janes 2010). Following the transition from Socialism to a market economy, Mongolia's livestock population boomed and use of traditional pastoral practices such as mobility and grazing reserves declined (Fernandez-Gimenez 2002; Fernandez-Gimenez & Batbuyan 2004). When droughts and harsh winters ensued in 1999–2003 and 2009–

2010, many herders suffered devastating losses (Sternberg 2010; Fernandez-Gimenez *et al.* 2012). In response, over 2,000 donor- and NGO-supported community-based rangeland management (CBRM) groups have organized in Mongolia since 1999, with the goals of improving rangeland conditions and herder well-being and livelihoods. This national-scale social experiment creates an unprecedented opportunity to assess the effectiveness of CBRM in meeting social development, livelihood and rangeland conservation goals.

Community-based conservation has been advanced as a win-win solution to biodiversity loss and poverty in communities that reside in and depend upon high-biodiversity ecosystems (Western & Wright 1994; Fabricius & Koch 2004). However, evidence about its

effectiveness for rangeland conservation is scant. Most existing studies are limited by small sample sizes and few compare CBRM outcomes to alternative management regimes. Globally, studies of the social and economic effects of community-based natural resource management generally, and CBRM specifically, have shown mixed results (Dressler *et al.* 2010; Saito-Jensen *et al.* 2010; Suich 2010; Bowler *et al.* 2014). Even when measurable conservation benefits accrue, economic and social development benefits do not always occur or do not reach the wider community (Collomb *et al.* 2010; Nkhata & Breen 2010; Silva & Mosimane 2013; Bowler *et al.* 2014). Lack of or weak social and livelihood benefits of CBRM are concerning, because without direct benefits to households and communities, there is little incentive for local people to engage in or support conservation.

As elsewhere, research on Mongolian CBRM has been dominated by case studies (Upton 2008; Batkhishig *et al.* 2011; Dorligsuren *et al.* 2011; Baival & Fernandez-Gimenez 2012), most within a single ecological zone and lacking comparison sites without CBRM. Some studies have shown social benefits (Batkhishig *et al.* 2011; Baival & Fernandez-Gimenez 2012; Upton 2012; Fernandez-Gimenez *et al.* 2015) or livelihood improvements (Dorligsuren *et al.* 2011; Leisher *et al.* 2012), but others show no benefits (Addison *et al.* 2013) or negative CBRM effects (Upton 2008; Murphy 2011). Taking advantage of the social experiment underway in Mongolia, we report on the first large-*N*, case-control study of CBRM social outcomes that accounts for variability across different ecological contexts. Rigorous, broad-scale studies are essential to crafting conservation policies and providing donors with information to guide future investments (Bowler *et al.* 2014). As the first large-scale study of CBRM globally, it informs rangeland conservation strategy worldwide.

Our approach to assessing CBRM outcomes is informed by common pool resource (CPR) governance theory (Ostrom 1990; Agrawal 2002), and its application to CBNRM. CPR theory predicts that, given certain institutional attributes and external conditions, groups of resource users who share the same resources are capable of self-regulating resource use. We hypothesized that in the post-Socialist Mongolian context of ineffective national rangeland governance institutions and weakened customary use norms (Fernandez-Gimenez & Batbuyan 2004), formal CBRM groups aid herders to organize and self-govern pasture use, resulting in superior social and livelihood outcomes compared to traditional herder neighborhoods that lack strong or formal organization (Figure 1). Specifically, we expected that CBRM herders would have stronger and wider social networks, use more traditional and innovative management practices,

earn higher incomes, and hold more assets than herders from non-CBRM communities. Based on CPR theory, we also hypothesized that outcomes would differ by ecological zone. We expected that collective action would be more readily achieved, and social outcomes greater, where forage supplies are more abundant and predictable, CPRs are smaller, easier to delineate and monitor, and herders are less mobile (Ostrom 1990).

Methods

Sampling

Across four ecological zones—mountain and forest steppe, steppe, eastern steppe and desert steppe—we selected pairs of adjacent soums (districts) with ($n = 18$) and without ($n = 18$) formally organized CBRM (Figure 2). Within each soum, we randomly selected an average of five community groups sharing common grazing areas and water sources, and interviewed five households representing each group. We surveyed 706 herder households belonging to 142 groups; 65 traditional herder neighborhoods (hereon non-CBRM) and 77 formally organized CBRM groups. CBRM groups averaged 5 years since formation (range <1 to 14).

Because sampling before and after CBRM was established was impossible, we used community-level poverty and leadership indicators and group-level demographic indicators to assess whether CBRM communities had other characteristics that predisposed them to higher social outcomes, and found none (Supplementary Table 1). Selecting matched sites within ecological zones and provinces further reduced potential for pre-existing environmental and governance differences. Although we controlled for potential confounding differences between CBRM and non-CBRM sites in this manner, our single-point-in-time observational measurements preclude causal inferences about CBRM effects.

Data collection

We collected data using household surveys, focus groups and interviews. Individual households were surveyed using quantitative questionnaires measuring household demographics, income and expenditures, management practices and behaviors, and social norms and networks. Questionnaires were designed to investigate whether formal organization influenced household-level practices and socioeconomic conditions. At the group level, we interviewed group leaders and held focus groups with members. Qualitative data from interviews and focus groups were synthesized into an organizational database for each group. Instrument design was

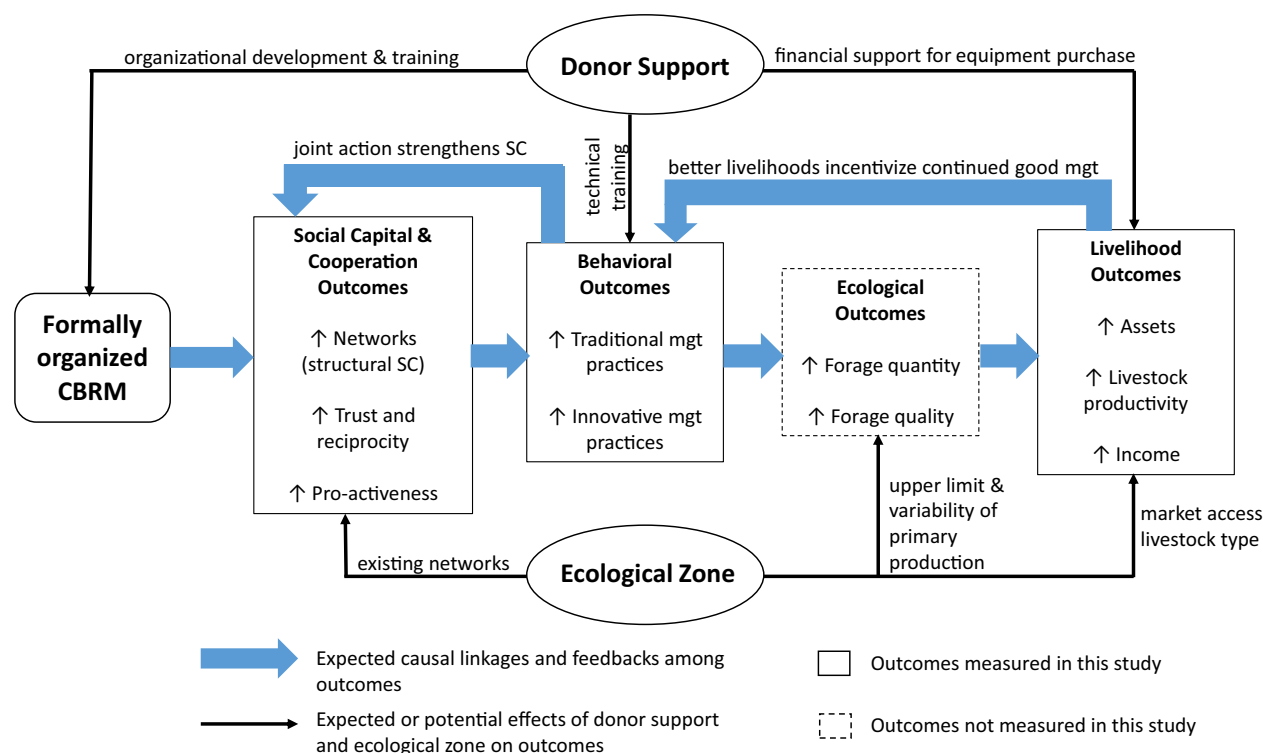


Figure 1 Theorized relationships between donor support, formal community-based rangeland management (CBRM), ecological zone, and social and ecological outcomes of CBRM.

based on prior studies in Mongolia (Fernandez-Gimenez 2002; Fernandez-Gimenez & Batbuyan 2004; Fernandez-Gimenez *et al.* 2015) and guided by the International Forestry Resources and Institutions protocols for data collection at the community level (IFRI 2013).

Variables

Organization status (CBRM vs. non-CBRM) and ecological zone were the independent variables. Dependent social outcomes included livelihoods, social capital, and rangeland practices and behaviors. Livelihoods were measured using three variables: household assets, annual per capita net cash income, and livestock number per household member in sheep forage units (SFU), a standardized livestock unit used in Mongolia. We measured two types of social capital (SC). Cognitive SC measured levels of trust and norms of reciprocity among group members. Structural SC indicated the number of bonding and linking social ties (Grootaert & Van Bastelaer 2002). Bonding ties are those with individuals of similar social position such as family, friends and neighbors, and linking SC refers to vertical ties with government, banks and NGOs, etc. (Woolcock 2001). Herder practices

and behavior were measured with three variables: (1) traditional rangeland and herd management practices in place during collectivization or earlier, (2) recently introduced innovative management practices, and (3) proactive actions and engagement in local rangeland-related initiatives. Except for per capita income and livestock number, all variables are indices calculated from multiple survey items. All outcome variables were calculated from the household survey and aggregated to the organization level by taking the mean value for the sampled households within each group. Group-level structural and demographic characteristics from the organizational database were used to assess whether systematic differences existed between CBRM and non-CBRM groups that could contribute to any observed differences in social outcomes (Supplementary Table 1).

Analyses

All data were inspected, and two variables (SFU per capita and net income per capita) log transformed and winsorized following Vaske (2008) to meet normality assumptions. We used *t* tests, chi-square tests and two-factorial ANOVA to compare groups by organization type

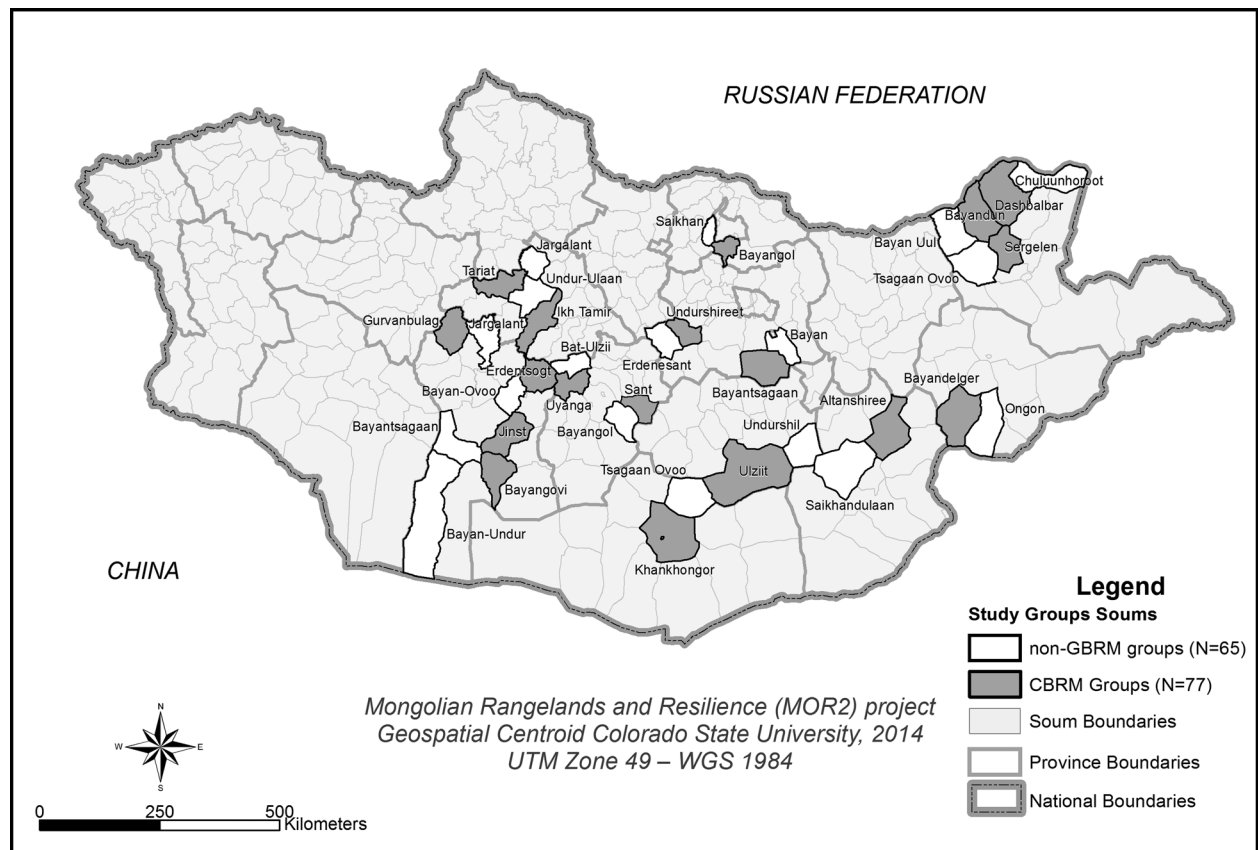


Figure 2 The location of the paired study soums (districts) with community-based rangeland management (CBRM) groups ($n = 18$) and without (non-CBRM) ($n = 18$).

(CBRM vs. non-CBRM) and ecological zone. All analyses were conducted using SPSS 22.0 (IBM Corp. 2013). We used the Bonferroni post hoc test for multiple comparisons. Statistical effect sizes were assessed using eta-squared for ANOVA and phi for chi-square and cross-tab tests (Vaske 2008). When outcomes differed significantly ($P < 0.05$) or nearly so ($0.05 < P < 0.10$) between group types or zones, we examined the constituent items in the index to identify the specific attributes or behaviors responsible for the observed differences.

Results

Social outcomes by group type

Members of formal CBRM groups demonstrated greater proactive behavior, used more innovative and traditional rangeland management practices, and possessed more household assets compared to non-CBRM herders (Figure 3). Effect sizes for proactiveness, traditional and innovative practices were moderate to substantial. For-

mal CBRM and non-CBRM groups did not differ in cognitive ($P = 0.06$) or structural ($P = 0.07$) social capital, cash income or livestock number. There were no interactions between ecological zone and organization for any of the outcome variables, indicating that CBRM is consistently associated with similar social outcomes across differing ecological contexts.

CBRM members were more proactive than traditional group herders on three measures—talking with experts about rangeland issues, joining local initiatives to improve resource use, and acting to address local problems (Table 1). Among traditional practices, more CBRM herders reported reserving winter and spring pastures, culling unproductive animals before winter, making hay and hand fodder, and digging new wells. More CBRM members used 11 out of 19 types of innovative practices. Among these, fencing critical grazing areas and hay fields, growing fodder plants, vegetable gardening, and monitoring rangeland resources had higher effect sizes.

Although the group types did not differ significantly on either SC index, they varied on some individual items.

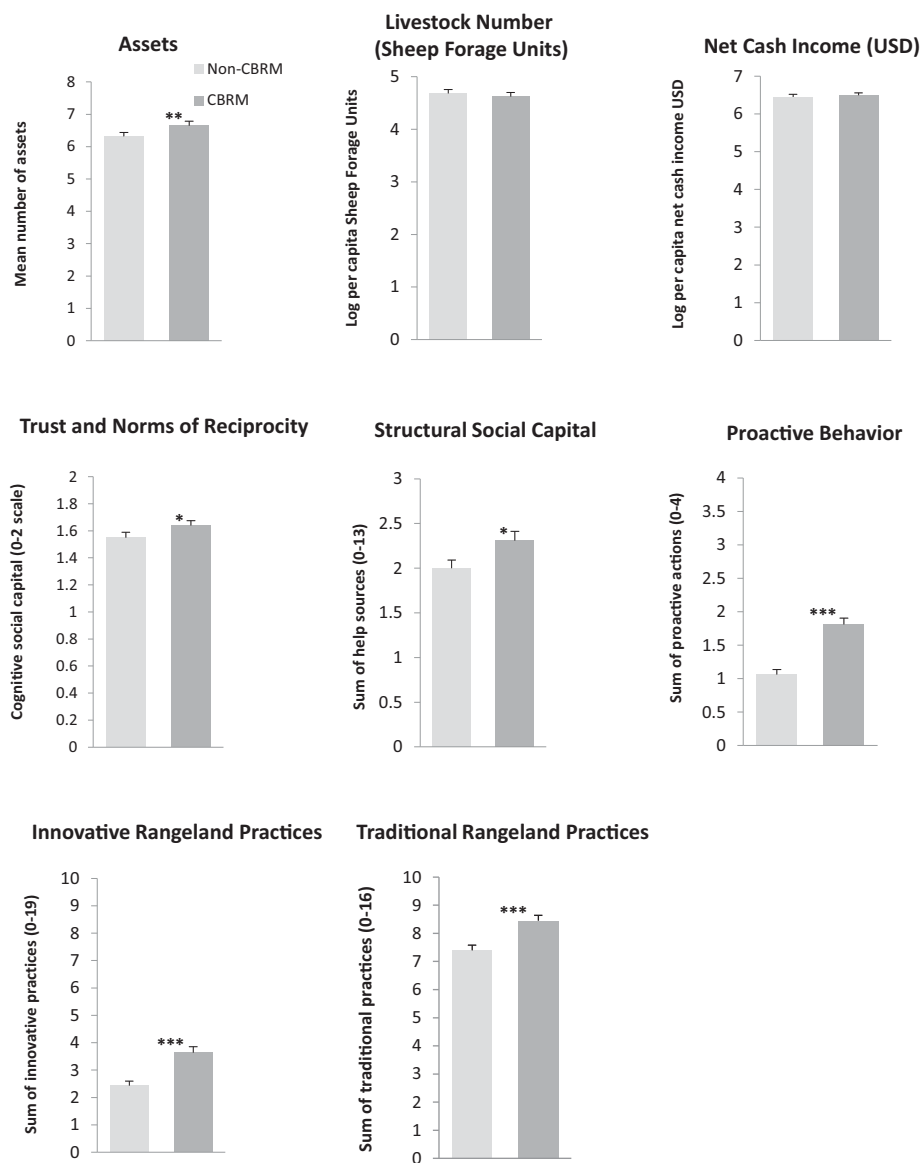


Figure 3 Comparisons of social outcomes between two types of pastoral organizations: traditional informal (non-CBRM) groups ($n = 65$) and formal CBRM groups ($n = 77$). Error bars show one standard error. *, **, and *** indicate the statistical significance at $P < 0.10$, 0.05 , and 0.01 , respectively.

More CBRM members receive help from CBRM organizations and their connections with religious leaders were modestly higher than herders from traditional neighborhoods (Table 2). More CBRM herders believed that people in their area always try to help each other and disagreed that people in their area are generally selfish (Table 3).

Social outcomes by ecological zone

Ecological zone significantly affected five of eight social outcome variables including assets, cash income, social

capital, and traditional management practices (Table 4). In all instances where there were differences, groups from the mountain and forest steppe had lower outcomes, and there were no differences among the other zones. Households from the eastern steppe had more assets than those from the mountain and forest steppe. Herders from the steppe had significantly higher cash income than mountain and forest steppe herders. Pastoralists from the steppe and the desert steppe had greater levels of trust and reciprocity than mountain and forest steppe herders. Desert steppe herders also had more bonding and linking networks. Herders from the mountain and forest steppe were

Table 1 Comparison of proactive behavior and management practice items for non-CBRM and CBRM member households

Items	% non-CBRM (n = 314)	% CBRM (n = 392)	χ^2	P	ϕ
Proactive behavior					
Talked to experts about rangeland issues	19	33	16.11	<0.01	0.15
Talked to local authority about problems	47	53	2.31	2.31	0.06
Joined in rangeland improvement initiatives	19	52	81.52	<0.01	0.34
Joined community to address other problems	21	42	33.14	<0.01	0.22
Traditional rangeland management practices					
Reserve winter pasture	47	57	7.43	0.02	0.10
Reserve spring pasture	38	49	10.96	<0.01	0.13
Reserve dzud pasture	24	32	5.72	0.06	0.09
Do fall (or summer) otor	37	39	2.47	0.29	0.06
Do winter otor	17	22	4.29	0.12	0.08
Cull (sell/slaughter) unproductive animals	55	68	14.76	<0.01	0.15
Cut hay	63	79	24.02	<0.01	0.18
Prepare hand fodder	34	48	13.75	<0.01	0.14
Purchase and store grain	76	77	0.50	0.78	0.03
Purchase and store concentrate	35	40	2.41	0.30	0.06
Purchase other feed	19	24	3.06	0.22	0.07
Vaccinate livestock	88	90	3.19	0.20	0.07
Deworm livestock	87	89	0.33	0.85	0.02
Treat livestock for external parasites	57	61	0.83	0.66	0.03
Dig a new well	13	21	7.60	<0.01	0.10
Repair existing well	48	51	2.84	0.24	0.06
Innovative rangeland management practices					
Improve camel breed	2	2	0.10	0.76	-0.01
Improve horse breed	15	15	0	0.95	-0.00
Improve cattle breed	11	13	0.87	0.35	0.04
Improve sheep breed	34	45	4.74	0.03	0.08
Improve goat breed	36	41	1.80	0.18	0.05
Intentionally change species proportion	25	27	2.23	0.33	0.06
Sell animals to reduce herd size	21	28	5.88	0.02	0.09
Intentionally not breed animals due to dzud	19	18	0.30	0.58	-0.02
Fence critical pasture area	6	22	40.87	<0.01	0.23
Fence hay area	3	16	36.55	<0.01	0.22
Fence or improve natural water sources	15	22	5.29	0.07	0.09
Plant fodder or grass	4	13	17.98	<0.01	0.16
Use fertilizer	7	17	17.67	<0.01	0.13
Use irrigation	5	12	12.12	<0.01	0.13
Plant garden for food	16	30	19.82	<0.01	0.17
Take other action to protect key resources	10	19	10.95	<0.01	0.13
Take action to reduce soil erosion	4	8	6.06	0.05	0.09
Take action to restore damaged lands	5	4	0.22	0.64	-0.02
Take part in monitoring of resources	5	13	17.21	<0.01	0.16

Note: Dzud refers to a winter weather disaster. Otor are long-distance movements to fatten animals or avoid bad weather or drought. The term ϕ (phi) indicates effect size with 0.10 interpreted as minimal, 0.30 as typical, and 0.50 or greater as substantial (Vaske 2008).

less likely to use seven traditional practices compared to those in other ecological zones. We found no difference in per capita livestock holdings, use of innovative rangeland practices, or proactiveness by ecological zone. More eastern steppe pastoralists had animal carts, butter churns, books and cell phones. Fewer mountain and forest steppe

households reported doing fall *otor* (long-distance moves to fatten livestock), reserving grain and other feed, and digging and repairing wells than the herders in other ecological zones. Herders in the desert steppe had more bonding and linking network ties than those in any other zone (Supplementary Tables 2–4).

Table 2 Comparison of structural social capital and household asset items among members of non-CBRM and CBRM pastoral groups

Items	% non-CBRM (<i>n</i> = 314)	% CBRM (<i>n</i> = 392)	χ^2	<i>P</i>	ϕ
Structural social capital					
<i>Bonding social capital</i>					
Help from neighbors	67	64	0.32	0.57	-0.03
Help from family in district (soum)	60	63	0.47	0.49	0.03
Help from family in province (aimag) center or capital city	39	42	0.73	0.39	0.04
Help from distant relatives	16	21	2.55	0.11	0.07
Help from friends	52	56	0.56	0.45	0.03
<i>Linking social capital</i>					
Help from local/national government	63	64	0.01	0.92	0.01
Help from politicians	38	31	2.45	0.12	-0.07
Help from religious leaders	4	8	3.80	0.05	0.09
Help from CBRM organization	5	44	95.43	<0.01	0.43
Help from development or aid organization	33	36	0.49	0.48	0.03
Help from nongovernmental organization	10	15	3.61	0.06	0.08
Help from banks	19	22	0.62	0.43	0.04
Help from insurance companies	5	8	1.28	0.26	0.05
Household assets					
Mobile phone	92	94	1.81	0.28	0.04
Radio	59	62	0.72	0.04	0.03
Television	84	89	2.93	0.09	0.06
Motorcycle	82	77	2.41	0.12	-0.06
Car	20	28	6.48	0.01	0.10
Truck or tractor	27	28	0.22	0.64	0.02
Cart: cattle, horse, or camel	32	31	0.05	0.82	-0.01
Refrigerator	12	20	9.25	<0.01	0.12
Butter churn	5	10	5.63	0.02	0.09
Electricity generator (portable)	17	23	3.6	0.06	0.07
Windmill	5	9	4.46	0.04	0.08
Solar panel	91	87	2.61	0.11	-0.06
Electric lights	69	67	0.25	0.62	-0.02
Books	26	38	11.53	<0.01	0.13
Computer	5	9	2.51	0.11	0.06

Note: The term ϕ (phi) indicates effect size with 0.10 interpreted as minimal, 0.30 as typical, and 0.50 or greater as substantial (Vaske 2008).

Discussion

Mongolian herders belonging to formally-organized CBRM groups demonstrate significantly greater social outcomes than herders in traditional neighborhoods on all behavioral measures, and one livelihood measure. CBRM herders had slightly higher outcomes on some social capital metrics, but not on overall social capital indices. This pattern holds across four ecological zones. CBRM was most strongly associated with proactive behavior and both traditional and recently adopted resource management practices. Although most practices measured are associated with adaptive capacity or livelihood diversification, and therefore can be considered social benefits of CBRM, the conservation effects of some practices, such as irrigation, fertilization and fencing,

are debatable or potentially negative. These results confirm earlier studies in Mongolia that documented positive social outcomes of CBRM (Batkhisig *et al.* 2011; Dorligsuren *et al.* 2011; Baival & Fernandez-Gimenez 2012; Upton 2012; Fernandez-Gimenez *et al.* 2015), and provide evidence that community-based approaches to rangeland conservation may effectively influence resource users' behavior. Lack of difference in social capital between group types may be due to strong traditions of reciprocity across all types of herder communities in Mongolia (Batkhisig *et al.* 2011). Our focus groups and interviews also suggest that while generalized trust and reciprocity are relatively high, as our survey data show, specific trust related to economic cooperation and financial risk is not well developed. We expect that if CBRM is successful, levels of specific trust and economic

Table 3 Comparison of trust and norms of reciprocity items among members of non-CBRM versus CBRM pastoral groups using ANOVA

Items	Non-CBRM (n = 314)	CBRM (n = 392)	F	P	η^2
People always try to help each other	1.65	1.78	7.60	<0.01	0.01
People help each other in times of need	1.64	1.74	5.19	0.02	0.01
People mainly look out for themselves*	1.21	1.42	11.17	0.01	0.02
Most people are trustworthy	1.73	1.78	1.61	0.21	0
People will take advantage of others*	1.57	1.63	1.31	0.25	0
Our community is getting less friendly*	1.44	1.49	0.77	0.38	0

Note: All items are on a 0–2 scale; *indicates items were reverse coded: 0 = agree, 1 = neutral, and 2 = disagree. The term η^2 is interpreted as the percentage of variation in the dependent variable explained by the independent variable (CBRM).

Table 4 Results of two-way ANOVA showing effects of ecological zone on social outcome variables

Ecological zone Variable name	Desert steppe (n = 47)	Steppe (n = 31)	Eastern steppe (n = 11)	Mountain and forest steppe (n = 53)	F	P value	η^2
<i>Livelihood</i>							
Assets (sum of 15 items)	6.62	6.58	7.24*	6.20*	3.43	0.02	0.07
Log net cash income per capita in USD	6.40*	6.79* [†]	6.62	6.33 [†]	5.50	<0.01	0.11
Log livestock per capita	4.50	4.72	4.78	4.71	1.36	0.26	0.03
<i>Social capital</i>							
Cognitive (0–2 scale)	1.66*	1.68 [†]	1.59	1.49* [†]	4.57	<0.01	0.09
Structural (sum of 13 items)	2.45*	2.19	1.90	1.95*	4.35	<0.01	0.09
<i>Behavior</i>							
Traditional practices (sum of 16 items)	8.24*	8.52 [†]	9.14 [‡]	7.1** [‡]	9.92	<0.01	0.16
Innovative practices (sum of 19 items)	3.12	2.71	3.71	3.15	1.15	0.33	0.02
Proactiveness (sum of four items)	1.65	1.34	1.41	1.39	1.80	0.15	0.03

Note: Pairs of means in the same row that share superscripts (*, [†], and [‡]) differ at $P < 0.05$ using the Bonferroni multiple comparison test. The term η^2 is interpreted as the percentage of variation in the dependent variable explained by the independent variable (CBRM).

cooperation will increase over time. The limited progress of Mongolian CBRM groups toward improving herder livelihoods contradicts prior studies (Dorligsuren *et al.* 2011; Leisher *et al.* 2012) and deserves further consideration.

CBRM member households possessed more assets than non-CBRM households, but did not differ in per capita income or livestock holdings. Donor contributions toward buying and maintaining capital assets such as wells and tractors, which freed herders to use income to buy assets like automobiles and refrigerators, may explain greater assets in CBRM households. CBRM training also may have influenced herders' investments in technology to improve production and marketing. Lack of differences between group types in income or livestock holdings have three possible explanations. First, the primary mechanism through which CBRM is expected to influence income and livestock holdings is via improved grassland quality and production, which result from more sustainable grazing practices such as increased mobility and grazing reserves (Figure 1). Increased forage quality

and quantity, in turn, should lead to greater livestock productivity in terms of number of animals (reproductive success) and individual animal productivity and quality. Because many CBRM groups are relatively young, and changes in management recent, the ecological and livestock productivity responses may lag behind behavioral changes. Alternatively, the influence of CBRM on ecologically beneficial management practices may not be sufficiently strong to result in forage quality and quantity increases that affect livestock production, regardless of time since establishment. A companion study of ecological outcomes (Chantsalkham 2015) shows slight ecological benefits of CBRM, consistent with these explanations. Finally, if CBRM and non-CBRM herders have similar herd sizes, but CBRM livestock produce more or higher quality meat, milk or fiber, we would expect CBRM incomes to be higher despite similar herd sizes. However, livestock markets in Mongolia are poorly developed and as yet do not differentiate on product quality. Herders do not receive more money for high quality products than for the same quantity of low-quality product. This is a

serious obstacle to the long-term effectiveness of CBRM in Mongolia. A differential economic return is likely an essential incentive to sustain herder commitment to CBRM.

Social outcomes of CBRM in Mongolia varied considerably by ecological zone, suggesting that resource system characteristics and geography influence group outcomes. Contrary to theoretical predictions, mountain and forest steppe communities had lower outcomes than other regions on many indicators. Mountain and forest steppes have more productive and predictable forage supplies, and are associated with smaller and more easily bounded CPRs, which we theorized would enhance collective action due to lower transaction costs and easier monitoring. However, some of these areas are also the most socially isolated and remote from markets, which may limit social networks and constrain their ability to implement some practices. Alternatively, the more productive and predictable forage supply may lead to greater competition for and conflict over pastures, as some of our focus groups suggest. Steppe herders, located closest to major markets in the capital, had the highest incomes. Steppe and desert steppe herders had higher levels of trust and reciprocity, and desert steppe herders had more bonding and linking network ties. The higher levels of social capital in less predictable and highly variable semiarid and arid zones align with findings from other pastoral regions, including Australia, where herders in variable environments form more extensive social networks with strong reciprocal arrangements to access pasture during periodic droughts (McAllister *et al.* 2011). Earlier case studies in Mongolia found a similar pattern in social capital, with the highest levels in the desert steppe (Fernandez-Gimenez *et al.* 2012; Fernandez-Gimenez *et al.* 2015).

Our findings have several important implications for conservation policy, practice and research in Mongolia and beyond. First, our results show that CBRM is strongly associated with herders' management practices and proactive behavior, which are critical steps toward improving ecological and social conditions on Mongolian rangelands. As such they demonstrate the potential social return on donors' initial conservation investment in CBRM. These findings have implications beyond Mongolia, since CBRM has been widely advocated in other dryland regions (Turner 2011), and has recently increased rapidly in southern and eastern Africa (Fabricius & Koch 2004; Bennett 2013).

Second, the lack of clear social capital and livelihood benefits from CBRM in Mongolia indicates that CBRM outcomes may take time to achieve, especially when they depend on a series of linked feedbacks, each of which is also affected by exogenous factors such as climate, weather, and markets (Oldekop *et al.* 2010).

Additionally, current levels of management may be insufficient to strongly affect pasture and livestock conditions. This suggests that ongoing technical support for CBRMs is needed, with a focus on promoting practices that have clear conservation as well as livelihood benefits.

Third, the possibility that lack of strong livelihood outcomes is due to insufficient market price differentiation for quality livestock products deserves further investigation. Livestock markets have long been recognized as a critical constraint to sustainable management of Mongolia's rangelands. If CBRM is to succeed in Mongolia over the long term, herders must be able to earn more with fewer animals through a premium price for higher quality or sustainably produced livestock products, value-added processing, or alternative rural livelihoods.

Fourth, Mongolia's CBRM movement was largely catalyzed by external actors—donors. Although the movement is widespread, it has reached only a fraction of Mongolia's herders. Whether this externally initiated movement will lead to scaling-out of endogenous CBRM—self-organized groups following the lead of earlier externally initiated groups—remains unknown, although self-organized groups have been observed (Undargaa 2006). The intensive donor-provided support to the initial CBRM groups is likely cost-prohibitive to scale out to the entire country. Therefore, both government policy-makers and conservation-minded donors and NGOs should consider how to cooperate to support grassroots CBRM initiatives through lower cost peer-to-peer training and education programs coupled with appropriate policy incentives and legislative reforms. Finally, if new CBRM groups are established with external facilitation, a randomized trial approach incorporating control sites and pre-implementation measurement of baseline ecological and social conditions will permit more rigorous assessment of CBRM effectiveness than was possible in our post-hoc study.

Further research is needed to (1) establish clear causal relationships between CBRM and social outcomes, (2) examine the process through which CBRMs achieve these outcomes and the factors that predict success, (3) determine whether CBRM performance varies with institutional design, (4) assess CBRM ecological outcomes, and (5) monitor performance of CBRM institutions over time.

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