Mongolia Peri-Urban Rangeland Project Impact Evaluation Strategy

Daniel Rubenson
Richard Sawyer

Innovations for Poverty Action

Updated January 2013

Table of Contents

I. Introduction

This document outlines the design of the impact evaluation for the Peri-Urban Rangeland Project (PURP) activities implemented by the Millennium Challenge Account of Mongolia (MCA-M). This evaluation design was developed by Innovations for Poverty Action (IPA) in coordination with MCA-M and the Millennium Challenge Corporation (MCC).

The MCA-M PURP is addressing the problem of traditional open access grazing leading to land degradation in peri-urban areas as population densities in those areas rise. Specifically, the PURP provides herder households with long term exclusive use leases of rangeland plots; training in rangeland and herd management; and infrastructure in the form of wells, materials for the construction of winter shelters, feeding equipment, and fences. Initially, a first phase of the project was implemented in 2010 in three peri-urban areas surrounding the cities of Darkhan, Erdenet, and Ulaanbaatar.[1] The project was later expanded in 2011 to a second phase in the peri-urban areas close to the cities of Kharkhorin and Choibalsan.

The overall goal of the evaluation is to estimate the causal impact of project activities on herder household incomes. A number of other outcomes that are hypothesized to be related to income are also important. These include herd productivity and livestock and rangeland management practices, such as use of rangeland within its carrying capacity.

The basic idea behind the evaluation is to answer the question: What would these outcomes have looked like in the absence of the project? In order to do so, the most rigorous evaluation design possible, given constraints, has been developed in both phases of the project. As described in more detail below, the research designs in the two phases of the project differ considerably.

[1] This document uses the terms "Phase I" and "Phase II" in referring to the two stages of the project. In some other MCA-M documents the terms "Main areas" and "Expansion areas" are sometimes used for, respectively, Phase I and Phase II.

II. Overview of Project Components and Activities

A steady stream of poor rural Mongolians are abandoning traditional nomadic herding practices and migrating to the cities in search of better lives. The bulk of these migrants are moving to Mongolia's five biggest cities – Ulaanbaatar, Erdenet, Darkhan, Choibolsan, and Arvaikheer – where they either settle in suburban "ger" areas or peri-urban pasture land areas. In peri-urban pasture lands, Mongolia's tradition of open access pasture use, combined with the influx of migrants' herds, has led to overgrazing. The overgrazing has triggered interest in new land-use regimes that will encourage investment, improve land use, and boost agricultural and animal productivity.

Open access to the rangeland has been a tradition in Mongolia for thousands of years. Although Mongolia switched to a market based economy and the majority of the country's livestock was privatized in the 1990s, rangeland remained state property and the current Mongolian constitution enshrines the open use regime in federal law.[2] The combination of open pastureland usage and private livestock ownership led to a tragedy of the commons problem.[3] Private individuals accumulate all the benefits of adding additional livestock to their herd while most of the costs, such as degraded land, are collectivized. The number of livestock in the country has more than doubled in the last two decades that has led to a concurrent rise in rangeland degradation and desertification.[4]

[2] Fernandez-Gimenez, M.E. (1999). Sustaining the steppes: A geographical history of pastoral land use in Mongolia. Geographical Review, 89, 315–342.

[3] Garret Hardin coined the term "tragedy of the commons" (Hardin 1968). The term describes how a commonly owned or open resource is doomed to overexploitation due to an imbalanced distribution of the costs and benefits of usage. He used the idea of the "commons"– open pastureland classically available to all herdsmen in a region – as the key illustrating example. Hardin pointed out that eventually the pasture would become overgrazed because each herdsman can capture all the benefits of adding more cows, while facing only a fraction of the costs, since all users share the costs evenly.

[4] Cheng, Y., Tsubo, M., Ito, T., Nishihara, E., and Shinoda, M. (2011). Impact of rainfall variability and grazing pressure on plant diversity in Mongolian grasslands. Journal of Arid Environments 75, 471–476

Responding to this growing threat to herders' livelihood, the project introduces a system of long-term leasing of rangeland in peri-urban settings along with technical assistance to herders. The Project activities include:

- **Household leases**: By providing private groups of individual households with an exclusive long-term usage right to a specific piece of rangeland, the project will give these groups a strong incentive to invest in the land's productive capacity. Since these groups have a legal guarantee that they will reap the long-term benefits of their investments in the land, the project should induce an increase in investment, an improvement in herd management, and an increase in productivity. Since these groups will also directly bear the costs of any activity conducted on their tract of rangeland, the project should also induce the adoption of more sustainable herd management practices, and eventually a reduction in land degradation. These changes should have a positive effect on incomes.
- **Herder group leases**: By extending the lease right to collective groups of herders rather than individuals, the project will build upon traditional norms of pasture management, encouraging cooperation and collaboration both among and between herder groups.
- **Legal and regulatory reforms**: By creating a new national rangeland law and developing local enforcement mechanisms, the project will harmonize land use regimes across regions and allow for a more consistent and transparent enforcement of the new approach to rangeland management.

Table 1, below, provides a complete list and timeline of the main activities associated with the PURP.

Table 1. Project Activities and Timeline

	Main Area		Expansion Area	
Activities	**Start**	**End**	**Start**	**End**
Rangeland Tract Mapping	March 2009	August 2009	April 2011	September 2011
Public Outreach	August 2009	December 2009	April 2010	September 2010
Herder Group Application	October 2009	October 2009	August 2011	August 2011
Review and Selection Process - soum committees	October 2009	September 2009	August 2011	August 2011
ESA review and field verification	July 2010	August 2010	August 2011	September 2011
Final selection	January 2010	January 2010	September 2011	September 2011
Lease signed	September 2010	December 2010	September 2011	September 2011
Well Installation	May 2011	March 2012	March 2012	November 2012 (ongoing)
Supplying Seeds for Plantation and Fence Installation	December 2011	April 2012	June 2012	December 2012 (ongoing)
Herder Group Training	May 2011	June 2013 (ongoing)	May 2011	June 2013 (ongoing)
PURLS Survey - Baseline	September 2010	January 2011	January 2012	April 2012
Land Quality Survey – Phase I Areas Baseline	April 2011	May 2011	N/A	N/A
Land Quality Survey – Phase I and II	August 2012	September 2012	August 2012	September 2012

III. Research Questions

The main problem to be addressed by the PURP is a classic tragedy of the commons situation in which migration to peri-urban areas is leading to overgrazing of common use lands.[5]The research questions that will be addressed by this design are the following:

1. What is the causal impact of participation in the PURP on herder incomes, rangeland carrying capacity, and productivity?
2. What individual and household level characteristics predict higher incomes, rangeland carrying capacity, and productivity due to participation in the PURP?
3. What individual and household level characteristics predict changes in rangeland and herd management behavior due to participation in the PURP?

Specifically, IPA will evaluate the impact of the PURP on the following key outcomes:

- Household Level Outcomes, such as:
    - Income and consumption patterns
    - Herd composition and size
    - Herd management practices
    - Herd productivity
    - Investment activities
    - Attitudes toward investment and future investment plans
    - Access to credit and loans, borrowing behavior, terms of credit
    - Herd infrastructure
- Herder Group and Rangeland Tract Level Outcomes:
    - Land quality and productivity
    - Herder cooperation and conflicts
- Local Administrative Unit (Soum) Level Outcomes:
    - Patterns of land use and land planning
    - Land conflict and land related conflicts

[5] For other seminal work on the management of common pool resources, see Ostrom (1990).

IV. Research Design

Many factors can have an impact on incomes, animal productivity, herd management practices and rangeland health—some of the main outcomes of interest in this intervention. Some herder households may have more productive herds to begin with. Some may be better managers of their herds and rangeland. It is possible that the land used by some groups is more productive than that in other areas. Any number of other similar differences may characterize herder groups in Mongolia. The purpose of a "rigorous" evaluation is to isolate the effect of the project on the outcomes of interest: Did participation in the project raise incomes? In answering this question, we are confronted by a familiar problem. If we simply observe project participation and then estimate income differences, we may find that participation in the project is to be correlated with higher incomes. It would be unclear, however, whether or how project participation *causes* incomes to rise. The challenge in identifying a project effect is due to the fact that it is often difficult to separate participation in the project from other characteristics—such as those mentioned above—that might influence income levels, for example.

The goal here is to produce a research design that best allows us to answer the counterfactual question: What would outcomes have looked like in the absence of the project? A design that generates random variation in project participation is generally considered the first best alternative. In such a design, participation in the project would be determined entirely by some random process such as a coin flip or a lottery and would, therefore, be unrelated to other confounding factors.

As noted above, the PURP was implemented in two phases. Phase I, in the areas surrounding the cities of Darkhan, Erdenet, and Ulaanbaatar, where implementation began in 2010; and Phase II in the peri-urban areas close to the cities of Kharkhorin and Choibalsan. Implementation of the project in Phase II areas began in 2011. For a number of reasons, project beneficiary selection differed in the two phases and these differences have necessitated distinct evaluation strategies. Below we describe the differences in the selection process in the two phases and the two distinct evaluation strategies.

IV-A: Selection Process

In Phase I, 279 herder groups were ultimately selected to participate in the project while in Phase II 165 herder groups were selected. The selection of project participants differed considerably in the two phases of the PURP, leading to differences in how comparison groups were defined.

Herder Group Selection Process – Phase I Areas:

The project first identified 665 tracts of land that met the following criteria:

1. Access to well water within an average depth of 50 meters of the surface;
2. Regular use and access by local herders; and
3. Relatively high quality of pasture and forage.

Then the project initiated outreach to government officials and herder families to explain the application process, encourage families to submit applications, and provide guidance in the preparation of applications. The herder families were also encouraged to form herder groups.

Local soum governments formed selection committees that included both local officials and citizen representatives. These committees conducted the first screening of applications (for more details, see Appendix I). The applicants which passed this first screen were then reviewed by the MCA-M PURP Project Implementation Unit (PIU) and implementer, which resulted in the disqualification of several herder groups due to non-compliance with project requirements, such as land tract size or water access. Subsequent to this, environmental and social assessment (ESA) work carried out by MCA-M revealed violations of the involuntary resettlement policy.[6] As a result, only 279 herder groups passed the eligibility screens and were awarded leases. Due to the low number of successful applicants, it was not possible to conduct a lottery and randomize the intervention during Phase I; all 279 eligible herder groups were admitted into the project.

Herder Group Selection Process – Phase II Areas: The first part of the selection process for the Phase II areas was very similar to the process utilized in the Phase I areas. The key difference

[6] O.P.4.12 stipulates that households and individuals cannot be forced to relocate or involuntarily denied access to resources they previously enjoyed as a result of a development aid project. A number of herder households residing on the land tracts claimed by short-listed herder groups complained that they had not been made aware of the project and/or its goals of granting exclusive use right to the land they normally resided upon.

being that the involuntary resettlement issues experienced in Phase I were avoided by engaging in an earlier process of public outreach and ESA.

In each soum, a lottery drawing was organized. One hundred sixty-five leasing slots were distributed amongst soums, set proportional to the total number of applicants in each soum, with a random adjustment built in to account for rounding issues. All the lottery drawings were conducted on stage, in public and recorded on video. For more details on the lotteries, see Appendices II, III, and IV.

IV-B: Empirical Strategy in Phase I Areas – Matching

Due to the low number of successful herder group applicants in Phase I a randomized design was not feasible. A decision was made to employ propensity score matching (PSM) to establish a comparison group.[7]

A PSM design attempts to determine the causal effects of an intervention by simulating the logic underlying a randomized controlled trial. A randomized controlled trial creates two similar groups of households by randomly choosing which households will receive the project. The PSM strategy works in reverse. One starts with households already chosen for to receive the project and then identifies other households that are similar to those households to serve as a control group. By matching the selected households on characteristics observed in the data set, it is possible to create a comparison group for the project households that are similar along all of the dimensions observed in the survey. Those households, the project and non-project groups that are good matches, will be selected for the final "treatment" and "comparison" groups. Thus,

[7] For discussions of matching, see, for example, Abadie, A. and Imbens, G. (2009). "Matching on the estimated propensity score," (Working paper); Diamond, A. and Sekhon, J. (2006). "Genetic matching for estimating causal effects: A general multivariate matching method for achieving balance in observational studies," (Working paper); Rosenbaum, Paul R.; Rubin, Donald B. (1983). "The central role of the propensity score in observational studies for causal effects." *Biometrika* 70: 41–55; Rubin, Donald. (2006). *Matched Sampling for Causal Effects.* Cambridge University Press; Winship, Christopher and Stephen Morgan. (1999). "The estimation of causal effects from observational data." *Annual Review of Sociology* 25: 659–707.

households that appear, after the matching exercise, to be particularly poor matches, will be dropped.

The PSM methodology is designed to create two research groups that are similar along the variables used for the matching process, but the challenge is the characteristics which are not or cannot be measured in the survey. The current evaluation methodology will match households that did not apply for the project to households that applied for and received the project. However, there was some reason that one group applied and the other did not, even among households with otherwise similar characteristics. The underlying cause could be quasi-random factors such as a random power outage that prevented some households from watching television at the time the project was advertised. However, the underlying cause could also be that some households exert significantly more effort in general to be informed than households that did not apply. Since that underlying desire for new information is difficult to measure, it cannot be used in the matching process. However, if Non-Applicant households remain less likely to seek out new information than Project households even after matching on observable characteristics, then Project households might be more productive over time than Non-Applicant households even without the project because they seek out other information about new herding management techniques and other business opportunities than Non-Applicant households. As a result, any observed differences in the follow-up surveys might be due to the project or they could be due to remaining unobserved differences.

PSM is conducted in two steps. First, we create a model that identifies the relative importance of individual characteristics in the matching process. With multiple characteristics defining households, choosing households that are similar on a single dimension can cause those households to be very different along other dimensions. For example, if we matched households on milk yields, the overall differences in the sample along another dimension such as livestock sales might increase. To resolve this, one first estimates a single value called the "propensity score" for each household that is based on a model that takes all of the observed characteristics and numerically relates them to the probability that a household has been selected for the project. This estimated equation creates a single value for each household that balances all of the

underlying characteristics and that can be used to match Non-Applicant and Applicant households to the Project households.

Once the propensity score is estimated for all households, each of the Project households is then paired up with one or more comparison household with a similar propensity score. This then creates two groups of households – Project-beneficiary households and households that had similar propensity scores but were not selected for the project.

One major disadvantage of propensity score matching, as an identification strategy, is that only observed covariates enter into the matching model. That is, bias might still be present due to unobserved heterogeneity across project and non-project households. Nevertheless, under the constraints of the Phase I design, a propensity score matching approach is a viable alternative for estimating project effects.

As described above, the evaluation targets three types of potential comparison households for data collection:

1) The herder households that had applied to the project but had not passed the screening process;
2) Neighbors residing within 2 kilometers of project beneficiary camps;
3) A random sample from the general herder population residing within the project area.

Table 2, below, describes these groups in more detail, along with the rationale for including them in the data collection and PSM exercise.

Table 2. Comparison Households for the PSM Exercise – Strengths and Weaknesses

	Comparison Group	*Strength*	*Weakness*
1	All herders that applied for the project and dropped out of the selection process at any stage.	These herders should be similar in at least some aspects – i.e., motivation to apply, general eligibility to apply, access to rangeland, etc.	*1.* Small sample size. *2.* These groups are known to be different in many key variables given that they dropped out of the selection process for various reasons. *3.* There may not be enough households in this group that are similar enough to the project beneficiaries to allow for propensity score matching to be viably utilized.
2	Neighboring herder household that live next to project beneficiaries.	These herders should be similar in at least some aspects – they are located on similar plots of land, etc.	*1.* There are reasons these herders didn't apply to the project. Most likely they don't meet the requirements of the project. If they do meet the requirements, they are likely very different in their future plans or their need for land security, and their relationship to the soum government
3	A random sample of herders in project soums that never applied for the project.	These herders are affected by the same regional and soum level trends and variation. There is also a larger sample size available.	1. There are reasons these herders didn't apply to the project. Most likely they don't meet the requirements of the project. If they do meet the requirements, they are likely very different in their future plans or their need for land security, and their relationship to the soum government 2. Developing a list of such herders is costly both in terms of time and money.

IV-C: Randomized Controlled Trial in Phase II Areas

A randomized design was possible in the Phase II areas of the expanded PURP. A large proportion of the 366 herder groups that applied for the project in Dornod, Uvurkhangai, and Avarkhangai made it through the initial screening process carried out by MCA-M and soum officials.[8] In total, 329 herder groups passed the screening process. There were 165 leases to be allocated in the Phase II areas and it was decided that theses would be assigned using a lottery.

Three separate public lottery ceremonies were organized – one in Dornod province's capital, Choibalsan, another in Arkhangai province's capital, Arvaikheer, and a third in the regional city, Kharkhorin. A separate lottery drawing was held for each soum administrative unit. In some of

[8] See Appendix I for details on this selection process.

the central soum units, surrounding the regional cities or capitals, there was not enough rangeland within the central soum to provide land for all applicant herders. In these cases, residents of the soum applied for leases to land tracts located in neighboring soums. When this occurred, a separate drawing was organized for all non-resident applicants in each adjacent soum. Quotas were established for each of the lottery drawings to determine how many lease winners were selected in each drawing. Quotas were simply set proportional to the number of applicants in the drawing. For more detail on the quota setting process, see Appendix II.

Because project benefits were randomly allocated among herder groups via the lottery ceremony, the baseline characteristics of herder households in the control group are, in expectation, on average the same as those in the treatment group, in terms of both observable and unobservable characteristics. As a result, any differences in outcomes that are observed across treatment and control groups can be safely attributed to the PURP intervention.

V. Sample

V-A: PURLS Sample, Phase I Areas

The original sample frame for the Phase I project areas was intended to consist of all of the member households of the herder groups that applied for project assistance, as well as a randomly selected sub-sample of herder households that resided on adjacent rangeland plots, in order to measure potential spillovers. However, once it became clear that a lottery was not feasible, a different sampling strategy was developed in order to provide data that would better allow for estimation of project effects via a propensity score matching approach (described above). The goal of this new strategy was to sample and gather data from a wide variety of non-project herder households that were potentially similar to the households that had passed the MCA-M screening process and received project benefits.

This new sampling strategy involved the use 3 different sampling frames:

1. *The list of all 477 herder households that were members of herder groups that applied for the project and for whom sufficient documentation had been retained.*[9] The PURP PIU and its associated contractors developed this list. This sampling frame was deemed appropriate because it contained the potential project households, which would need to be interviewed anyway. Moreover, it contained the households who applied for the project but who, for a variety of reasons, were rejected during the screening and selection process. These rejected households were considered to be a good comparison for project households because they resided in the same geographic areas and had similar motivations and ambitions with respect to the project. At the time when the Peri-Urban Rangeland Leasing Survey (PURLS) baseline data collection started, in November of 2010, the MCA-M field verification process was still ongoing and the list of project beneficiaries had not yet been finalized. Researchers decided to interview all the households within this sampling frame in order to: a) ensure that all final beneficiaries would be interviewed regardless of the ultimate outcome of the MCA-M selection process; and b) maximize the number of rejected applicant households interviewed, as these households appeared to be the most appropriate comparison group.

2. *A list of all neighboring herder households residing within a 2 kilometer radius of the rangeland tract utilized by project beneficiaries.* The PURP PIU and its associated contractors also developed this list. In the original sampling plan, neighbors were included only to measure spillover effects. In the new sampling plan, neighbors of project beneficiaries were included because it was thought that, due to proximity and regular interaction with the project, they might be similar to project households and form a good comparison group. As mentioned above, at the time of baseline data collection the MCA-M field verification process was still ongoing and the list of project beneficiaries had not yet been finalized. Therefore the research team decided to interview only neighbors of "potential" project herder groups that had not already been rejected from the project. At the time, the list of potential beneficiaries consisted of just 317 herder groups that had not yet

[9] Originally, 677 herder groups applied for the project but after the initial screening process was complete, some of the soum level selection committees did not retain application materials for the rejected herder groups. Unfortunately, once lost, this information could not be recreated. Detailed documentation was retained for only 477 herd groups. It was these groups and their members that formed the final sampling frame.

been disqualified by the MCA-M field verification process. Only 287 of these 317 herder groups had a list of neighbors associated with them. The goal was to gather baseline data from one randomly selected neighbor household for each of these 287 potential beneficiary herder groups. In order to ensure this goal was fulfilled, a randomly ordered list of 3 neighboring households per herder group was generated. The 2nd and 3rd households on the list would serve as substitutes in the event the first neighboring household could not be contacted or refused to participate in the survey.

3. *A "census" list of all herder households residing in the project areas.* The PURP PIU's rangeland mapping contractor, the Centre for Policy Research (CPR), developed this list. Initial inspection revealed that this list had a number of shortcomings. First, the list only contained 10,406 households, a number substantially lower than the corresponding herder population estimates generated by official sources. Moreover, the contact information contained in the list was not detailed enough, potentially making it challenging to locate and interview households. Nevertheless, this list was deemed the best frame available—short of official census data, which could not be obtained due to legal restrictions—for the purpose of selecting a random sample of the general herder population.

   It was estimated that budget restrictions would only permit for 1700 of the households from this list to be interviewed. The list was stratified on soum and the number of randomly selected households to be targeted from each soum was weighted proportional to the number of the 317 potential beneficiary herder groups located in each soum. For example, if 32 (10.1%) of the 317 potential beneficiary herder groups were located in soum X, then 170 (10%) of the 1700 sample of randomly selected herder households would be targeted for soum X.

   For every household targeted in a particular soum, three households were drawn from the list, with the understanding that enumerators would probably be unable to locate some households and that substitutes would have to be ready to replace these households.

For the herder group leader portion of the PURLS data collection, the research team interviewed the leaders of all 317 herder groups that remained in the potential beneficiary group. A list of these leaders was provided by the PIU.

For the soum governor portion of the PURLS data collection the research team interviewed the governors of all 41 soums where the project was being implemented.

V-B: Expansion PURLS Sample, Phase II Areas

The sampling plan for the data collection in the Phase II areas mirrors the original plan intended for the project's Phase I areas. The plan was to collect baseline data from the member households of all 329 herder groups (treatment and control) that applied for project assistance and passed the initial soum selection committee screening to participate in the lottery.

In addition, data was collected from a randomly selected sub-sample of neighboring herder households that reside on rangeland plots adjacent to these 329 herder households, in order to measure potential spillovers. In contrast to the Phase I areas, in the Phase II areas the research team wanted to collect data from neighbors of both treatment and control herder groups since, in this case, the purpose of interviewing neighbors was to measure spillovers rather than to provide potential matches for project beneficiaries. The plan was to collect data from two of the neighbors associated with each herder group. Experience with the baseline data collection in the Phase I areas had revealed that neighbors were difficult to locate and that they often refused to participate in the data collection. So, rather than randomly selecting and ordering a specific number of neighbors per herder group to target for surveying, the full list of neighbors for each group was sorted and randomly ordered. Enumerators were told to approach neighbors according to the order in which they appeared on the list until they obtained data from at least two separate households or until the list was exhausted. This random ordering approach was designed to maximize the number of neighbor interviews obtained.

V-C: Rangeland Monitoring Sample[10]

I. Background and Site Selection

In 2011 USDA and its local partner, MSRM, randomly selected 96 land tracts (48 land tracts occupied by project beneficiaries and another 48 located on adjacent tracts used by households that were not included in the project) in the Phase I areas from which to collect land quality measures—including plant production and utilization. In 2012 an additional 100 tracts (50 treatment tracts and 50 control) were identified in the project's Phase II areas as follows:

- Kharkhorin Peri-Urban Area (Ovorkhangai and Arkhangai Aimags[11]): 31 Treatments & 31 Controls (plus 3 extra Treatment & Control tract pairs in case of rejections).
- Choibalsan Peri-Urban Area (Dornod Aimag): 19 Treatments & 19 Controls (plus 3 extra Treatment & Control tract pairs in case of rejections).

2011 site characterization (soils, topography) and vegetation cover, composition and spatial distribution data have been provided in an Access database and are described in the "Data collection completion report for the Land quality monitoring project funded by MCA Mongolia, 2011". No production or utilization data are available for 2011 due to destruction of the production cages by livestock: the materials used to construct the 480 cages on these 98 tracts turned out to be of substandard quality. In Phase II, five hundred production cages were installed in treatment group tracts. Cages were limited to treatment tracts due to concerns about the potentially confounding effects of paying control tract herders to protect the cages. As a result, only residual biomass will be harvested (in addition to the plant cover and composition data) in the control tracts.

Site selection 2011 (Phase I)

A one hectare site was randomly selected within each of the treatment tracts. Due to the lack of GIS layers indicating the location of project control areas, paired control sites were randomly selected on adjacent land. A matching approach was used to constrain random selection to those areas with similar key biophysical characteristics. Key characteristics are those that control potential plant community composition and production (i.e. the response variables of interest for

[10] With input from Jeff Herrick and Justin Van Zee (USDA-ARS).
[11] Aimags are Mongolian provinces.

the rangeland monitoring aspect of this project), and resilience (i.e. the ability of the plant community to respond to treatment). These characteristics include slope, slope shape, landscape position, and soil texture and color by depth. The current condition of the soil and plant community also determines its responsiveness to treatment.

Matched sites (a one hectare site in each treatment and control) were identified using the following protocol:

(1) Visually similar areas in each of the pairs were identified based on satellite imagery.

(2) A set of potential sites were randomly selected within the treatment and controls for each pair. Potential sites within each were randomly ordered. Potential sites were excluded if they were less than (<) 100-meters from:

   a. A visible road
   b. A camp site (dark colored dung marks on soil)
   c. Open water
   d. A building or other structure
   e. An agriculture field or haymaking area

(3) The first treatment site was visited and accepted if it was:

   a. Greater than (>) 100-m from a medium to high-use road (defined as such if no vegetation was growing in tire tracks.
   b. >100-m from a wall or dung pile of camp
   c. >100-m from a building or structure
   d. >100-m from a permanent body of water
   e. >100-m from an agricultural field or haymaking area
   f. On a slope of < 50%
   g. Not limited by accessibility (i.e., located in a bog or marsh)

(4) If rejected, the crew went to the next potential site until a site was found that met the criteria, and completed a site characterization.

(5) Potential sites in the paired control area were then visited.

(6) The first potential site in the list that was determined to be functionally similar in terms of (a) potential plant community composition and production, and (b) resilience.

This 'ecological site' approach to matching is the standard for rangeland inventory, assessment and monitoring in the United States. It is used in place of propensity scoring where it is cost-prohibitive to collect characterization data for the entire population of land sites.

Response variable baseline data were used to test for bias. Foliar cover, basal cover and bare ground were compared between treatment and control tracts in each of three Phase I regions. In only one of the nine comparisons was the p value less than 0.25, demonstrating the matched pair approach was successful.

Site selection 2012 (Phase II)

In 2012, GIS layers were available for both treatments and controls. IPA provided matched pairs of treatments and controls based on socioeconomic (not biophysical) criteria. Distance between Treatment and Control herder groups varied. Some pairs were approximately one kilometer and some were more than 100-km from each other, likely resulting in increased variance due to rainfall variability, in addition to the increased variance due to lack of biophysical criteria in the matching. However, this approach should increase our ability to integrate land quality with other analyses. USDA and MSRM then randomly selected and characterized a one hectare site in each treatment and control as described above for Phase I.

VI. Data Collection

VI-A: PURLS Data Collection, Main Areas

During the summer and fall of 2010, three data collection instruments were developed for the PURLS baseline survey – the household questionnaire, the herder group questionnaire, and the soum governor questionnaire. The household questionnaire contained 22 sections and required approximately 120 minutes to complete, on average. The herder group questionnaire and the soum governor questionnaire required approximately 30 and 60 minutes to complete, respectively. Details on the content of each questionnaire are provided in Table 3 below.

Table 3. PURLS Survey Questionnaires – Types and Content

Household Survey	Herder Group Leader Survey	Soum Governor Survey
• Household expenditure and income • Loans, support and assistance received, • Migration patterns, Infrastructure & pastureland quality at seasonal camps • Household livestock information • Livestock hay-making and forage production and purchases • Land disputes • Future investments • Opinion regarding the MCA Peri-Urban project	• Basic Herder Group Information • Information on Herder Group members • Plans for excess livestock • Existing assets and plans for new assets (wells, fences, equipment, etc.) • Plans for land usage • Herder Group activities • Pastureland and forest management plans	• Demography and migration in Soum • Available Services • Soum-wide livestock and land information • Land disputes • Donor programs and development projects

In the Phase I project areas, the PURLS baseline data collection was implemented by MEC and the Mongolian Center for Development Studies (MCDS). The data were collected from November of 2010 to January 2011 and are currently entered into an electronic database and being prepared for analysis. Together MEC and MCDS collected socio-economic information from 3289 herder households spread across Tuv, Darkhan-Uul, Orkhon, Selenge, and Bulgan aimags.

The final number of herder households and herder group leaders differed substantially from the number targeted. The primary reason for the discrepancy was that, due to the rough terrain, the high mobility of the nomadic herder households/ individuals targeted, and the less than ideal contact information contained in the sampling frames, it was sometimes impossible to physically locate the household in order to conduct an interview. Even when households were located, they occasionally refused to participate in the interview. This was the case with a relatively high number of the households that had applied to the project and been rejected. In the case of neighbors, a significant number of the households from the randomly selected herder group list turned out to be duplicates of households from the neighbor list. When this was the case, the household would be reclassified as a neighbor, even if it was targeted from the randomly selected list. For this reason, the neighbor category is the only category of household where the number interviewed exceeds the number targeted. Table 4 below contains more detail on the extent of this problem among different types of respondents.

Table 4. PURLS Data Collection – Response Number by Respondent Type

Respondent Type	Number Sampled and/or Targeted	Number Interviewed
"Potential" Beneficiary Households	1,172	978
Rejected Households	622	345
Neighboring Households	317	327
Randomly Selected Herder Households	1,700	1,639
Herder Group Leaders	317	296
Soum Governors	41	41

A mid-line follow up PURLS data collection will be conducted in the winter of 2012-2013. An additional end-line survey may also be carried out if preliminary analysis indicates a need.

VI-B: Expansion PURLS Data Collection, Phase II Areas

The data collection instruments used for the original baseline PURLS was updated and slightly modified for the Expansion (E-PURLS) baseline data collection in the Phase II areas. A new section on political dynamics was added, bringing the total number of sub-sections in the questionnaire to 23. Some specific questions within these sub-sections were deleted or modified to keep the length of the interview within the 120 minute average previously established. In addition, a series of behavioral economics games was fielded as part of the E-PURLS data collection. The goal of these data is to measure pro-social attitudes, generally, and behavior and beliefs having to do with fairness, altruism and trust, specifically. All the new sections and updated questions were piloted in December of 2011 and January of 2012. Data collection was undertaken by MEC and MCDS, the same firms that carried out the baseline data collection in the Phase I areas, starting in February of 2012. Data collection activities were wrapped up in April of 2012 and the data was entered and cleaned throughout May and June.

As with the baseline data collection in the Phase I areas, rough terrain and the high mobility of herder household conspired to prevent the data collection team from interviewing every single household targeted in the sample. However, drawing on lessons learned in the Phase I areas,

MCA-M was able to collect much more precise and accurate contact information from Phase II area households. This made it possible for MEC and MCDS to locate and ultimately interview a much higher proportion of the targeted households than in the Phase I areas. Table 5 contains more details on the number and types of respondents targeted and also successfully interviewed.

Table 5. E-PURLS Data Collection – Response Number by Respondent Type

Respondent Type	Number Sampled and/or Targeted	Number Interviewed
Treatment Households	669	669
Control Households	529	528
Neighboring Households	658	423
Herder Group Leaders	329	316
Soum Governors	21	21

A mid-line follow up E-PURLS data collection will most likely be conducted 2 years after the baseline, during the winter of 2013-14. An additional end-line survey may also be carried out if preliminary analysis indicates a need.

VI-C: Rangeland Monitoring Data Collection, All Areas

Since a key objective of the Peri-Urban Rangeland Leasing Project is sustainable livestock farming, and since Mongolia's peri-urban pasture lands are generally highly degraded, herder groups participating in the project are required to limit their animal numbers to the land's carrying capacity and will receive training on improving land management. It is expected that these measures will slow the degradation and lead to a gradual improvement in pastureland environmental conditions

In order to assess this expectation, MCC and MCA-Mongolia is carrying out a land quality survey as part of its evaluation. This survey examines whether and how the Project's activities affect environmental degradation and rangeland quality in peri-urban areas. The Land Quality Survey measures the Project's impacts on a variety of outcomes that reflect rangeland health such as grass yields, carrying capacity of rangeland and rangeland quality as measured by the state of soil, vegetation composition, and biomass production. To the extent feasible, many of the

indicators to be used for evaluation purposes will be designed and collected in a way that will be usable by the Government of Mongolia over the long-term. Table 6 below outlines the various types of data, the purpose for collecting them, and their applications.

Table 6. Data Types, Objectives, and Applications Summary. (Current results are in *bold italic.)*

	Site characterization	**Transects**	**Biomass clipping: caged plots (exclosures)**	**Biomass clipping: uncaged plots**
Objective	1. Support matched pair approach (Phase I). Determine whether unexplained differences may be due to inherent differences in production potential between treatment and control plots (Phase I+II).	2. Determine whether unexplained differences may be due to initial differences in plant basal cover. 3. Detect medium-long-term changes in rangeland health based on changes in basal cover and species composition. *(Both recorded simultaneously on same transect and datasheet)*	4. Determine whether original treatment design was correct (based on how much biomass is produced in a year). Data will also contribute to ongoing Parliament debate about national carrying capacity (which was one of the primary objectives of the Peri-Urban Project. 6. Determine whether the treatments are being correctly implemented (utilization - based on comparison between caged and uncaged in treatment areas).	5. Determine short-term changes in rangeland health based on changes in residual biomass (how much is left after grazing).
Primary applications	Data interpretation (Obj. 1). ***Review of Phase I data confirm minimal differences between tmt and control.***	Test for antecedent differences in baseline data (Obj. 2). ***Phase I tests confirm no differences.*** Post-compact project evaluation (Obj. 3)	Determine whether post-compact monitoring should be done based on (a) whether original treatment design was correct (Obj. 4), and (b) treatments are being correctly implemented (Obj. 6). ***Phase I 2011 data compromised by cage destruction – no conclusions.***	
Completed on	All plots	All plots	Treatments only	All plots
Repeat?	No	Post-compact	Compact+	Compact+

VI-D: Behavioral Games Data Collection, Phase II Areas

By providing exclusive use land rights in the form of long-term leases, the PURP represents a major institutional change in Mongolia. Those that have been assigned the leases and related infrastructure and capital goods will now very likely be more integrated in local markets and will

perhaps engage in less migration during the year. Moreover, herders in the project will also need to work more closely with those in the herder group to manage the rangeland and animal herds. Together, these aspects entail an increase in continual contact and interaction with a wider range of people. Following the findings of existing work[12], we believe that this in turn ought to lead to an increase in pro-social behavior as such behavior is generally more efficient in settings of repeated interaction.

The PURP is specifically designed to address the problem of rangeland degradation and its effects on herders' incomes and well-being. A central aspect of the project involves changing the ways in which herders manage the rangeland and their herds by introducing more sustainable rangeland and animal husbandry practices. For the most part, these practices involve changing the way in which herders operate now, in order to see improvements some time in the future. The success of the project, therefore, depends in no small part on herders' willingness to make changes (that might be perceived by them as sacrifices) in the short term, for gains that they will not see for several years. Therefore, we believe it is important to include in the impact evaluation of the project measures of how individuals' think about present versus future gains as well as risk, and how these views affect their behavior. Including this in the design of the impact evaluation may contribute to our understanding of the mechanisms behind project effects and to the design of future programs.

Over the past three decades, work in behavioral economics and psychology has provided significant insights into the way in which individuals behave and interact with one another. Increasingly, the tools of these disciplines—behavioral "games" and other measures of behavior—are being used to improve our understanding of—and design of—development programs. In the PURP we are particularly interested in measuring two aspects of behavior that we believe will be affected by the program, as well as provide possible mechanisms for program success (or lack thereof). First, we have included in the PURP several behavioral measures of so-called "social preferences" or "pro-social behavior"—that is, behavior by individuals that exhibits a concern for the well being of others around them and that is not merely motivated by

[12] See, in particular, the work of Henrich et al (2004) and (2010).

self-interest. Second, we plan to include in future rounds of data collection measures of individuals' risk and time preferences—that is, measures of how people's views about present versus future rewards affects their behavior.

A "game" is simply a scenario in which an individual is presented with some set of choices of how to behave vis-à-vis another individual and then asked to make a decision over one of the alternatives. In the games played by herders as part of the PURP, individuals are asked to make decisions about the allocation of money in different scenarios. The games might seem somewhat artificial; however because the money is real and because the individuals are anonymous and enumerators are blind to their decisions, the behavior displayed in these games is a powerful measure of how people actually behave, as opposed to how they say they behave.

The inclusion of the behavioral games in the PURP allows us to hone in on the following questions:

- Are social preferences sensitive to short-term shocks in an individual's and a small group's market integration?
- Do people behave differently when interacting with others whom they know to be in a different economic institutional setting?
- Are there heterogeneous effects of changes in property rights on pro-social behavior across gender, age, and socioeconomic groups?
- Do individuals' risk and time preferences affect their rangeland management practices?

In the first round of data collection in the expansion areas of the PURP, three behavioral economics games were administered to all respondents of the household survey, including all treatment, control and neighbor households. The games played were dictator, ultimatum and trust games. These are the canonical games in the literature used to measure pro-social behavior and attitudes. The protocols used for the administration of these games amongst PURP herders are included in the appendix, but the following is a summary of each:

1. **Dictator Game.** This game is a measure of how altruistic (or selfless) a person is. In the Dictator game, individuals are given an endowment of money (in this case, 5000 MNT[13]) and offered the opportunity to, anonymously, give some amount of this money to a stranger. If an individual were entirely self-interested, they should keep all the money. Allocations of some amount of money (i.e. amounts greater than zero) can therefore be seen as a measure of altruism.

2. **Trust Game.** In the Trust game, an extension of the Dictator game, there are two players. Each is given an endowment of money (2000 MNT each). The first player, the sender, decides whether to share their endowment with the second player, the responder. If the sender sends the 2000 MNT, it is tripled before it reaches the responder. The responder then decides what, if anything, to send back to the sender (0, 2000, 4000 or 6000 MNT). The Trust game is played anonymously—neither player knows the identity of their counterpart. The first part of this game measures trust and the second part measures trustworthiness, or reciprocity.

3. **Ultimatum Game.** The Ultimatum game measures fairness. This game also involves two players and is also played anonymously. The first player is given an endowment of money (4000 MNT). They can then decide to anonymously share some of this money with a stranger. The second player (in other words, the stranger) decides if the amount sent by the first player is acceptable. If the second player accepts the offer, the money is divided as proposed; if the first player rejects the offer, both players receive zero. This game is a measure of fairness by testing whether individuals negatively reciprocate when they perceive someone else to have acted unfairly (i.e. the proposer offers too little). Fairness is thus measured by observing whether individuals are willing to sacrifice their own monetary gain when they feel the other player has been unfair.

Note that in the Trust and Ultimatum games, there are two stages to the game. In the first stage an individual makes a decision about whether to send money and how much. In the second stage, there is also the behavior of another "player". For example, in the Trust responder game, we are

[13] MNT is Mongolian Tugrik.

asking individuals to tell us how they would respond if another, anonymous, individual had sent their endowment to them. Would they respond by returning zero or some other amount of the tripled endowment? Similarly, in the Ultimatum responder game, we ask individuals to indicate their minimum acceptable offer. For logistical reasons, it is not possible to administer these two-stage games by having individuals play against others in "real time." Instead, we simply ask individuals how they would behave ("If someone sent you their tripled endowment, how much would you send back?" and "What's the lowest amount you would accept in the Ultimatum game?"). We will then randomly pair players in the follow up survey in order to determine the payoffs of these two games. In other words, payoffs for any individual will be a function of the strategy of the player randomly chosen from among all other players in the study.

The specific measures produced by the games described above are listed in Table 7. These are the quantities that will be compared between treatment and control households in order to answer the research questions outlined. As can be seen in the table, there are a number of ways in which we can operationalize these measures. In analyzing the data, we will presents results using each of these in order to provide as complete a analysis as possible.

Table 7. Behavioral Game Data

Game	Concept	Measures
Dictator	Altruism	• Continuous measure: 0 – 5000 MNT • Dichotomous measure: 0; > 0 • Categorical measure: 0; less than half; more than half
Trust sender	Trust	• Dichotomous measure: send the 2000 MNT vs. send 0 (if sent, the amount is tripled)
Trust responder	Trustworthiness	• Size of return: 0; 2000; 4000; 6000 MNT
Ultimatum proposer	Altruism	• Continuous measure: 0 – 4000 MNT • Dichotomous measure: 0; > 0
Ultimatum responder	Fairness	• "Minimum acceptable offer" (MAO)
	Overall pro-social behavior	• Count of the number of "pro-social" actions taken over the three games

In each of the games above, participants were put in a scenario with another person described simply in terms of being a "stranger" or "someone living in Mongolia" or similar language to that effect. We are also, however, interested in the extent to which knowing something about the other person in the game affects behavior. That is, does behavior change when an individual

interacts with others they know to be either similar or dissimilar to themselves? One of the realities of the PURP is that by providing leases, loans and capital goods to some households and not others, the project is, in some sense, creating inequality—even though the allocation of these resources is done in a fair and transparent manner. In follow up rounds of data collection, we will vary with whom a herder is playing. That is, we can measure differences in behavior when the other player is "someone else in Mongolia" versus "another project participant" versus "a non-project participant." By comparing these differences across treatment and control groups, we gain insights to how (and whether) access to stronger property rights affects social preferences. For example, is it the case that those who have been given exclusive use land rights become more insular in general or perhaps more trusting toward others in a similar economic situation? Moreover, by including this modification, we can also provide evidence of whether control group participants feel animosity toward project recipients.

Our design also allows us to investigate differences in the effects described above across various subgroups of the population. For instance, do project effects on pro-social behavior differ between men and women, or across age groups, or between more and less well off individuals? We will examine heterogeneous effects on overall pro-social behavior as well as across the different behaviors measured by each game.

As mentioned above, in future rounds of data collection, we intend to include measures of risk and time preferences. These will be simple exercises where individuals are asked to make choices between different alternatives. For example, a risk preference measure could provide a choice between two rewards of money with different probabilities of winning and different monetary values. A time preference measure could be in the form of asking individuals to make choices between gains in the present versus future gains. These measures, in particular if done in both mid-line and end-line data collections, will allow us to assess the extent to which differences in self-control and in individuals' views of future decisions in the present to help explain project effects. In turn, these insights can provide evidence for the design of future programs.

VI-E: Animal Health Data Collection (Cancelled), All Areas

At the outset of the project the intention was to conduct an additional data collection, specifically designed to gather more detailed and objective scientific measures of the health and well being of the animals cared for by the various herder households in the study. These data would provide rigorous estimates not only of primary indicators of health and performance such as the volume and value of animal products, but also secondary indicators that contribute to changes in animal product output, such as birthing rates, mortality rates, and rates of weight gain. Tertiary indicators that contribute directly to animal output such as the rate of abortions and the prevalence of parasites and disease would also have been collected.

The plan was to begin collecting data in the autumn of 2011. Unfortunately, no qualified bidders were found to implement the survey during the first round of procurement and the activity had to be delayed. A second round of procurement began in the spring of 2012 but, once again, no bidders were found who met all the technical and legal requirements for the contract. In summer of 2012, after consideration of the length of time estimated to see project effects on these indicators, it was decided to cancel the activity due to financial constraints and procurement challenges. However, the research team, in collaboration with MCC, will revisit the animal health data collection at a later date, post compact, and may collect the data then.

VII: Statistical Power

Initial analysis suggests that the statistical power of the study—the ability to detect an effect, provided that the project actually has an effect—is quite strong. Power is a standard measurement that researchers use to evaluate the statistical strength of a study, given expectations regarding sample size and other assumptions. The initial power calculations carried out by IPA suggest that the study's ability to detect changes in simple outcomes, such a milk yield, is quite strong. This is particularly the case if MCC's expectations regarding the project's impact on these outcomes are accurate.

For example, according to MCC's ERR (Economic Rate of Return) model, the average milk yield of cows cared for by beneficiary households should increase by approximately 304%, as a

result of project activities. We have focused on milk yield here as it is one of the key variables in the ERR. As Table 8 below demonstrates, given current sample sizes, if MCC is correct and the actual increase in yields is anywhere in the neighborhood of 300% then the study will have nearly a 100% (greater than 99.99%) probability of detecting this impact. As the table shows, even if the actual project impact on milk yields is substantially lower than MCC expectation, in the neighborhood of 30% or 50% of the baseline standard deviation, the study still has an incredibly high chance, again close to 100%, of detecting project impacts. In fact, as the final row in the table highlights, the study still has a reasonably high (90%) probability of detecting impact, even if the actual increase milk yields is more in the neighborhood of 18-20% of baseline standard deviations–quite a positive indicator.

These figures should be taken with a grain of salt, however. Milk yield is one of the more precise and less noisy variables being evaluated by the study, which means that even if significant changes in yields are detected, researchers may not necessarily be able to pick up changes in other noisier but more fundamental variables such as income and consumption. In addition, IPA researchers fear that MCC expectations regarding the increases in milk yield may be rather inflated. In most social evaluations, an increase of 20% of standard deviation of an outcome variable is quite large and unusual. Actual project impacts are likely to be much smaller than those projected given real world complexities, such as members of the control/ comparison group learning from project beneficiaries, etc. Nonetheless, a preliminary examination of the figures appears quite positive.

Table 8. Power Calculations—Milk Yield

	PURLS — Phase I Areas	Expansion PURLS — Phase II Areas
Number of Treatment/Project Households	978	669
Number of Control/Comparison Households	345	528
Baseline Estimate for Milk Yield — Liters	3.39	2.19
Standard Deviation of Milk Yield — Liters	2.192	1.318
MCC Estimated % Increase in Milk Yield	303.85%	303.85%
MCC Expected Increase In Milk Yield — Liters	10.314	6.649
Lower Bound Estimated % Increase In Milk Yield — Liters (50% of SD)	32.29%	30.12%
Lower Bound Estimated % Increase In Milk Yield — Liters (50% of SD)	1.096	0.659
Significance Level	0.05	0.05
Power (If MCC Estimate is True)	99.99%	99.99%
Power (If Lower Bound Estimate is True)	99.99%	99.99%
Minimum Detectable Increase (90% Power) — Liters and % of SD	0.44497 (0.203% SD)	0.24882 (0.189% SD)

Appendix I – Herder Group Screening Process

I. Overall Herder Group Selection Method

PURP awards leases to groups of herder households rather than individual households (or individuals) because (i) the harsh, semi-arid Mongolian climate requires ongoing cooperation among herding families to manage risk, and (ii) this is in accord with the way in which herders have traditionally worked.

Task summary: Selection panels in each soum/district will evaluate applications from herder groups according to criteria established by the PURP. A short-list of applicants who meet the criteria will prepare business proposals, which will be graded by the selection panels.

Establishment and Operation of Soum selection panels

The process for selecting herder groups requires sensitivity to the fact that allocating rangeland by lease marks a major departure from Mongolia's historical approach of open access. For this reason, the project must utilize a process for awarding leases that the public understands, can participate in, and accepts as fair. The first step will be creating a properly constituted managerial body following rules designed to execute a successful process. The PURP will establish a special "selection panel" in each soum/district of all peri-urban areas included within the scope of the project to evaluate herder group applications and make decisions on lease allocation.

Each selection panel will consist of an odd number of representatives of the following regional administrations, civil societies and private sectors:

1. Soum/District Governor;
2. Soum/District Senior Land Officer or Land Specialist;
3. Soum/District Agricultural Officer;
4. Soum/District Social Specialist
5. Bag/Khoroo Governors;

6. Soum/District Environmental Inspector; and
7. Community representatives.

The soum/district governor will establish the Selection Panel by issuing an order pursuant to his/her authority. This order identifies the individuals to serve on the Selection Panel, except for the community representatives. The initial members of the Selection Panel will then select the community representatives. The community representatives are required to possess the following experience in order to serve on the Selection Panel:

- Experience working in a private or governmental organization within the fields of environmental resource management, land/pastureland possession and/or rights;
- Previous experience working with herders, herder groups/farms and have taken part in the improvement of the social conditions of herders; or
- Experience and knowledge of pastureland uses, water resource, supply and irrigation, and pastureland disputes.

Each Selection Panel will have a Head/Chairman and a Secretary. The Selection Panel members will nominate and elect the Head/Chairman and Secretary through a democratic process. Both women and men will serve on the committee.

The Selection Panel will be responsible for the following tasks:

1. Selection panels select qualified herder groups/farms to lease peri-urban pasturelands of Ulaanbaatar, Darkhan, and Erdenet. This selection will be conducted in accordance with the herder group/farm selection criteria formulated by the PIU.
2. Selection panels make sure that herder groups sign when they receive the application and business plan templates and submit them back for review.
3. Each Selection Panel member shall independently evaluate and assign a score to each application and business plan submitted to the panel for review.

4. For each application and business plan, the lowest and highest scores of panel members shall be removed and the remaining 5 scores of the panel members shall be averaged. The panel shall prepare a sheet containing the average score and overall panel comments on the application or business plan.
5. Results of the Selection Panel's work shall be posted publicly. Herder groups who are not selected to participate in the program have the right to have their application reviewed directly by MCA. This right shall be posted publicly as well.
6. Selection Panel shall submit documents of the selected herder groups/farms to the local Citizens' representative assembly for pasture land lease approval.
7. A copy of the signed contract shall be sent to MCA. Ongoing and final reports on the herder group selection shall be submitted by the Selection Panel to MCA.

Herder group applications

The project consultant will announce the project and make a publicized call for proposals including through the national television/radio stations. Interested herder groups will be able to come to any of the 57 information stations that shall be established and located in each soum to find out more information about how to apply for the project. Each application will then be evaluated by the Soum Selection Panel with assistance from the contractor, and all the applications ranked.

The following criteria will be used to evaluate the applications:

- A majority of the households in a herder group have directly engaged in livestock production as the main source of household income as of at the end of previous year;
- Presentation of a business/range-management plan that has a reasonable likelihood of (i) improving the condition of the range, (ii) generating income sufficient to make a profit while at the same time carrying out needed investments, paying the annual rent proposed and re-paying for the construction of wells and provision of fencing and winter shelter materials. The Project will provide assistance to herder groups in preparing these plans;
- The amount of annual lease payment that the group is prepared to pay;

- Herding experience and past herder success;
- Willingness to establish a permanent residence on the leased land (if this is not already the case);
- Evidence of strong group dynamics;
- The number of households in the herder group that are classified as poor;
- Completion of the first phase of the Project-providing range land management training.

A key concern for the selection process is to ensure that low income households benefit. The conditions described above seek to effectively restrict access to leases to true herders, and limit the ability of people who may have livestock interests but do not engage in herding directly, or as a relatively full-time activity, from gaining control over leases.

Appendix II – Lottery Quotas

Rule for Developing Quotas in Expansion (Phase II) Areas
Prepared by IPA
September 23rd, 2011

The Millennium Challenge Account of Mongolia's (MCA-M) Peri-Urban Rangeland Project (PURP) has funding to support 165 herder groups in Dornod and Uvurkhangai aimags In 2010, it was agreed that the herder groups that would receive this funding and support would be selected using a randomized lottery process. In the summer of 2011, more than 300 herder groups applied to participate in the project. Subsequently, the PURP's project implementation unit (PIU) requested that the lottery drawings to determine participation be held at the soum level. Holding drawings at the soum level will guarantee that all local governments and other key stakeholders continue to have local constituents represented in the PURP, which will in turn help assure the political viability of the project.

Soum level lottery quotas thus need to be developed. The fairest and most transparent way to develop such quotas is simply to divide the number of available projects slots proportionally among the soums according to the number of local herder groups that applied in each soum. There are 165 slots available and 329 herder groups have applied for the project and passed the first stage of selection. Therefore, soum level quotas should be set equal to approximately 50.1% of the number of eligible herder groups in each soum. For example, if there are 12 qualified herder groups in soum X, then the quota for soum X should be set equal to 12 multiplied by 0.501 (approximately 6.018).

The only challenge with the approach is that setting the soum level quotas equal to 50.1% of eligible applicants will not always yield an integer or round number. For example, if soum Y has 3 eligible herder groups, then according to the rule elaborated in the previous paragraph, the quota should be set at 3*0.501, which is equal to approximately 1.5. Obviously, it is not possible to select half a herder group, so some consistent rule must be developed to decide which soums will have their quota rounded up and which soums will have their quota rounded down. A simple rounding formula, such as the one found in excel, will not yield the desired result. Simply round

up or down to the closest integer can yield a total number of slots that is significantly greater or less than the desired 165 target.

IPA thus recommends the following rule for assigning quotas:

1. All soums will be assigned an initial quota equal to the number of eligible herder groups multiplied by 0.5015197568389058
2. The resulting initial quota will be rounded down to the nearest integer.
3. The total number of resulting assigned quotas slots will be subtracted from the total overall allotment of 165
4. The remaining number of slots, which should be quite small – approximately 8, will be randomly allocated among the soums in the sample

NOTE: The same process described above will be used to determine the quotas for the intensive regional level lotteries

Appendix III – Lottery Protocol

Protocol for PURP Lotteries in Expansion (Phase II) Areas
Prepared by IPA
July 19th, 2011
Updated: September 28th, 2011

IPA and the MCA-M M&E unit would like to propose the following approach to conducting lotteries for herder group selection in the expansion areas:

1. A final list of eligible herder groups whose applications were approved by the selection panel and who passed the field verification exercise will be developed and delivered, along with supporting documentation, to M&E.

2. After the selection panels have finished, the number of lease slots to allocate to each soum will be determined.
    a. In general, the quota shall be set proportionally to the number of eligible herder groups in each soum. For example, if 329 eligible herder groups end up passing the field verification and the number of leases to be allocated by the project is 165, then the Soum level quota will be set equal to 329 divided by 165 (approximately 50% depending on final numbers). However, in some soums with small numbers of herder groups and/or odd numbers of herder groups it may not be possible to set the quota precisely equal to the correct ratio. For example, if the percentage ends up being 50%, in a Soum with 9 eligible herder groups it would not be possible to set the quota equal to 4.5 herder groups because herder groups are holistic units that cannot be subdivided. The quota will need to be set equal to either 4 or 5.
    b. A randomized computer program will be used to set the quota for soums with small numbers of herder groups and/or odd numbers of herder groups. The computer program code will be shared with the PIU and other members of MCA-M. If it is approved, the program will be run and the quota officially set as part of

a small ceremony held at MCA-M headquarters with all relevant parties in attendance. The results will be certified and announced to all project stakeholders.

3. Preparations will be made for a series of public lotteries. The lottery will be a traditional physical drawing using balls and glass boxes. Venues have been reserved and public announcements made. There will be a press conference on September 26th, 2011. The first lottery will happen in Choibalsan on September 29th, 2011. The second lottery will happen in Arvaikheer on October 5th and the third lottery will occur in Kharkhorin on October 7th.
    a. Intensive herder groups will have separate lotteries from semi-intensive herder groups. Semi-Intensive herder groups will have Soum level lotteries. Intensive herder groups will have lotteries at the aimag level due to the fact that there are only 18 intensive herder groups, which makes Soum level lotteries not possible. That means that there will be one intensive lottery at Kharkhorin, one at Arvaikheer, and one at Dornod.
    b. Given the facts above, the lotteries will be broken down in the following manner:
        i. The Kharkhorin lottery event will have 6 lotteries, one for each participating Soum (Khotont, Tovshruulekh, Burd, Khujirt, Kharkhorin) and then one intensive herder group lottery with 11 intensive herder groups. 6 of the 11 intensive herder groups will be selected to receive the lease.
        ii. The lottery event at Arvaikheer will also have 6 lotteries, one for each participating Soum (Zuil, Ulziit, Taragt, Zuunbayan-Ulaan, Arvaikheer) and one intensive herder group lottery with 2 intensive herder groups. 1 of the 2 intensive herder groups will be selected to receive the lease.
            1. Arvaikheer herder groups all applied for pastureland in Taragt and therefore the Arvaikheer lottery will be grouped with the Taragt Soum lottery and will occur right after the Taragt Soum lottery.
        iii. Dornod will have a total of 8 lotteries even though there are only 5 Soums. This is because Kherlen will be broken up into 3 lotteries. All herder

groups in Kherlen selected pastureland locations in Bayantumen, Bulgan, or Choibalsan. The Kherlen herder groups will therefore be split into a Kherlen – Bulgan lottery, a Kherlen – Bayantumen lottery, and a Kherlen – Choibalsan lottery. Thus there will be a total of 8 lotteries: 7 soum lotteries (Sergelen, Bayantumen, Bulgan, Choibalsan, Kherlen – Bulgan, Kherlen – Bayantumen, and Kherlen – Choibalsan) and one intensive herder group lottery with 5 intensive herder groups. 3 of the 5 intensive herder groups will be selected to receive the lease.

4. The exact procedures for the lotteries have been developed and are as follows:
    a. Guests will enter the venue and first stop at the information desk. There they will be given a brochure explaining the procedure and their lottery number. Their lottery number will be the last 2 digits of their pre-assigned herder group ID. After receiving these two documents, guests will be seated in the venue.
    b. The PIU and M&E will open the lottery with a speech and presentation about the Lottery. After these occur, three guests will be randomly selected out of the crowd to be official observers for the lotteries. These three observers will be seated at the front of the room at their own table. They will be given lists of herder groups for each lottery for them to monitor the lottery process.
    c. Once these observers are seated the first lottery will be announced. The number of herder groups participating in the lottery as well as how many herder groups that will be selected during the lottery will be announced. Each herder group will have a ball with their ID written on it (this ID number will be given to them upon entry to the lottery as well as posted on the wall). These balls (one for every herder group participating in the lottery) will be presented to the audience and observers one at a time. As each ball is presented, the observers will circle the corresponding herder group lottery ID on their lottery sheet. After it has been presented it will be placed into the glass container. After all of the balls for each herder group involved in the lottery have been presented to the audience and the observers and placed in the box, the box will be sealed.

d. The box will then be rotated 5 times. The sliding door will be opened and one ball will roll out of the box. If the ball does not roll out automatically, the sliding door will be shut and the box will be flipped one more time. The sliding door will be opened again and the ball will roll out. If a ball fails to roll out again, the door will be closed and the box will be flipped one more time and the procedure will be repeated as many times as necessary until a ball rolls out of its own accord. This ball's number and the name of the corresponding, winning herder group will be presented to the audience and the observers. The observers will mark that herder group name on their list of all herder groups in that lottery (previously mentioned) and the PIU will mark the winner on a large poster on one side of the room (one poster for every lottery). After this, the box will be closed and rotated 5 times. After rotating it 5 times another ball will be selected and the whole procedure will be repeated. This will happen as many times as needed to select the right number of herder groups for a Soum. After the lottery has finished, the observers will all sign two sheets with the winning herder groups listed to verify the results. One sheet will be retained by the PIU while the other will be kept by M&E/IPA. After the papers have been signed, the next lottery will begin. The same process will happen all over again with the new lottery.

e. All of these events will be announced by the moderator.

f. After all the lotteries have been completed, there will be closing statements.

5. The results of the lottery will be carefully recorded and approved by the official observers that were selected by the audience. Winners will be given an invitation to the relevant lease signing ceremony that will happen on October 11th in Dornod and on the 18th, 20th, and 21st in different areas of Arvakhangai and Uvurkhangai.

Appendix IV – Lottery Results Lottery Protocol Lottery Quotas

Choibalsan Lottery Event – There were 117 total herder group applicants that passed the selection process and field verification. We selected 60 of these herder groups through 8 different lotteries. One intensive herder group lottery and seven semi-intensive herder group lotteries. There were 5 Soums participating but one Soum had herder groups that applied for leases in 3 different Soums. Therefore that Soum had three separate lotteries.

Lottery	Number of Herder Group Applicants	Number of Herder Groups Selected	Number of Herder Groups Rejected
Bayantumen Soum	43	21	22
Kherlen Soum- Bayantumen Pastureland	11	5	6
Bulgan Soum	17	10	7
Kherlen Soum – Bulgan Pastureland	11	6	5
Choibalsan	21	10	11
Kherlen Soum – Choibalsan Pastureland	3	1	2
Sergelen Soum	6	4	2
Intensive Herder Groups - Dornod	5	3	2

Arvarkiheer Lottery Event– There were 6 total lotteries during the Arvarkiheer Lottery event: Zuil Soum, Ulziit Soum, Taragt Soum, Zuunbayan – Ulaan Soum, Arvaikheer Soum, and one intensive herder group lottery. All Arvaikheer Soum herder group applicants applied for lease plots in Taragt. 44 herder groups were selected to receive leases out of 91 herder group applicants who passed through the initial selection process.

Lottery	Number of Herder Group Applicants	Number of Herder Groups Selected	Number of Herder Groups Rejected
Zuil Soum	16	8	8
Ulziit Soum	3	1	2
Taragt Soum	28	14	14
Zuunbayan – Ulaan Soum	27	13	14
Arvaikheer Soum	15	7	8
Intensive Herder Group Lottery	2	1	1

Kharkhorin Lottery Event - There were 6 total lotteries run during the Kharkhorin lottery event. The lottery was very successful and selected a total of 61 herder groups out of 121 qualified herder group applicants. The lotteries that took place during the Kharkhorin lottery event were: Khotont Soum, Tovshruulekh Soum, Burd Soum, Khujirt Soum, Kharkhorin Soum, and one intensive herder group lottery.

Lottery	Number of Herder Group Applicants	Number of Herder Groups Selected	Number of Herder Groups Rejected
Khotont Soum	24	12	12
Tovshruulekh Soum	25	13	12
Burd Soum	11	5	6
Khujirt Soum	19	9	10
Kharkhorin Soum	31	16	15
Intensive Herder Group Lottery	11	6	5

Appendix V – Behavioral Game Protocols

The following are the protocols and scripts used in the administration of three behavioral games during the Peri-Urban Rangeland Leasing Survey (ePURLS) in the Phase II expansion areas. In each case, the household member responding to the survey played the games.

General Introduction

[Enumerator reads the following script:]

Before we leave, we are going to ask you to make some decisions using real money. The decisions you make in these tasks will determine how much money you receive.

You will be completing these tasks along with other people in Mongolia. They are not here today, but your decisions and their decisions will both affect how much money you receive.

We will explain each task to you. You can ask questions at any time.

Finally, please do not reveal to anyone the decisions you make, not even the amount of money you received. If you tell other people about the decisions you make, you will jeopardize our research. This will make it difficult for us to come back and do more surveys with you.

[Enumerators: Very important that respondents understand clearly that this anonymous and that it's for real. Decisions are real, the money is real and no one will ever know how much they give or keep.]

[Enumerators should also make a note of how many other people are present when the games are being conducted.]

Dictator Game

The purpose of this task is to understand how you might share money with someone else in Mongolia. This task involves real money.

In this task, there are two people: you and a receiver. This receiver is a real person who lives somewhere else in Mongolia. You will never know who they are. They will never know who you are.

We are going to give you 5000 MNT and an envelope. If you want to give any money to the receiver, please place it in the envelope. Please put in your pocket any amount of money that you want to keep.

For example, if you wanted this other person to have 2500 MNT you would put 2500 MNT in the envelope and put 2500 in your pocket. If you wanted to give them 0, you would put all 5000 MNT in your pocket.

Do you have any questions?

When you are ready, I will turn my back and you can choose how much to give away and how much to keep. When you've made your decision, please put the envelope in this box.

Do you have any questions? If no, please make your decision [enumerator provides for anonymity by turning their back or leaving the ger].

Trust Game

Sender Game Instructions

The purpose of this task is also to know how you might share money with another person. We would like you to take the task seriously. You may win some money.

We will explain the task to you.

In this task, there is you and one other person. This person lives in Mongolia. Your identity will always be unknown to the other person.

In this task, we will give 2000 MNT to you and 2000 MNT to the other person. **[Make sure that for this game, enumerators use one 2000 MNT note, for simplicity]**

You can decide whether to send your 2000 MNT to the other person. You can do this by putting the 2000 MNT in this envelope.

If you give a player 2000 MNT, we will triple this amount and send them 6000 MNT. The other person can then choose to send back to you 0, 2000, 4000 or 6000 MNT. So, you can receive more money in the end by giving away your 2000 MNT now. But it is not **[guaranteed/for sure/for certain/(whatever phrase will best capture uncertainty.)]** The other person will make the decision whether to return the money at another time.

You can also decide to keep the 2000 MNT for yourself by putting them in your pocket or in the envelope we gave you. The other person will still get to keep their 2000 MNT.

Let us show you an example. [Name of assistant] has an envelope in front of him. I am going to give him 2000 MNT. [Assistant] now has to decide whether to put his 2000 MNT in the envelope. If he does, the other person would receive 6000 MNT plus the 2000 MNT he had at the start. Remember, if [assistant] sends the 2000 MNT, the other player will receive 6000 MNT more, and could choose to send back to [assistant] 0, 2000, 4000 or 6000 MNT. [Assistant] can also decide to put the 2000 MNT in his pocket and keep it.

I am now going to let [Assistant] make his decision.

[The enumerator now turns away and lets the assistant make her decision without watching.]

[At this point, the assistant puts the note in his pocket, and then says he is finished.]

What decision did [assistant] make?

How many MNT did he get in the end? [The correct answer is 2000.]

And how many MNT did the other player get? [The correct answer is the 2000 they started with.]

Let's show another example. [The enumerator gives the assistant another 2000 MNT and another envelope.]

[Name of assistant] will now decide whether to send his 2000 MNT note to the other player.

I am now going to let [Assistant] make his decision. **[The enumerator now turns away and lets the other assistant make her decision without watching.]**

[At this point, assistant puts the note in the envelope, and then says he is finished.] What decision did assistant make?

How many MNT does [name of assistant] have right now? How many could he have if the other player decides to send some back? [The correct answer is 2000, 4000 or 6000 MNT]

Remember that if the other player decides to send none back, [assistant] would end up with zero.

We are now ready to play the game. Do you have any questions?

[If there are no questions, then hand the subject an envelope.]

Here are 2000 MNT. **[At this point 2000 MNT is placed in front of the player.]** If you wish us to increase the value to 6000 MNT and give it to the other person, please put the 2000 MNT note in the envelope. If you do this, the other player will receive 6000 MNT and they can give you back 0, 2000, 4000 or 6000 MNT. Although the other person is under no obligation to give anything back, we will pass on to you whatever he decides to return. **[Now the subject makers her bid.]**

Have you made your decision? If so, please place the envelope in the box.

Responder Game Instructions

Now, we are going to give you a piece of paper. **[Assistant hands out the responder sheet.]**

We would now like to know how you would respond in this game if you were the person receiving the money and another person chose to send you their 2000 MNT.

You will see four numbers. **[Assistant should hold up an example sheet and point to these numbers.]** These numbers are 0, 2000, 4000, and 6000 MNT. We would like to know how many MNT you would send back to a person if they sent you 2000 MNT and we increased it to 6000 MNT. Would you send back 0 MNT, 2000 MNT, 4000 MNT or 6000 MNT?

If another person chooses to send you 6000 MNT and you choose to send back 0 [assistant points

to 0], then you will receive 8000 MNT and they will receive zero. If you choose to send back 2000 MNT, then they will receive 2000 MNT and you will receive 6000 MNT. If you choose to send back 4000 MNT, then they will receive 4000 MNT and you will receive 4000 MNT. If you choose to send back 6000 MNT, then they will receive 6000 MNT and you will receive 2000 MNT.

Remember, this decision will be used to figure out how many MNT we give you if another person sends you their 2000 MNT.

Are there any questions?

It is now up to you to decide what to give back to the other person. You can choose to give something back or not. Do what you wish.

If there are not any questions, then please circle how much money you would give back to another player if you received 6000 MNT from them.

[At this point, enumerator turns away and lets the player make their decision.]

Have you made your decision? If so, please place the sheet in the box.

Thank you. We will now move to the next type of game.

[Participants can be given a short break if needed.]

Ultimatum Game

We will now do a final task. In this task, we've also paired you with someone else in Mongolia, again you do not know him or her and they do not know you.

In this envelope, I have 4000 MNT **[show the MNT in an envelope with their name or respondent ID or similar]**. These will be yours, and we will give them to you soon. But we will also give you a chance to share them with the other person.

Here is a piece of paper. I want you to write down how much of this money you would like to share with the other player. You can choose to give them none by writing 0. You can choose to give some of the money to the other player. You can choose to give them all of the MNT by writing 4000.

A little while after you tell us how much you would like the share, we will go to the other person. We will tell them that we gave you 4000 MNT **(but we won't tell them your name)**, and that you had a chance to give them some of these MNT. We will then tell them how much you decided to share with them and how much you decided to keep for yourself. **Remember, we won't tell them your name or anything else about you.** We will ask them if this is acceptable. If they say it is, you will be given the amount you wanted to keep and they will get the amount you sent them. But if they say it is not ok, you will both receive 0.

Do you have any questions?

What would you like to do? Please write down your answer and place it in the envelope and then in this box.

[At this point, enumerator turns away and lets the player make their decision.]

Ultimatum Responder

Now, what if you were the other player and someone had decided how much to share with you. How many MNT would they have to give you to be acceptable? Please write down from 0 to 4000 MNT how many MNT they would have to give you. Remember, if the person decides to give you less than this, then both of you will receive 0. If they decide to give you more than this, then you will only receive the amount you said was acceptable.