Participatory Rural Appraisal in the Southern Gobi

November 12 to 23, 2006

FINAL REPORT

Prepared by:

Roberta Hawkins
Paul Marmer
Korice Moir

York University

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Introduction

Southern Mongolia, dominated by the Gobi Desert, is a region facing increasingly limited water resources. Decreasing precipitation, drying up of surface waters, and increasing frequency of droughts in this region may represent natural environmental changes or may be driven by anthropogenic activity. The effects of these changes are clear: local inhabitants (human and non-human) and the ecosystems they inhabit are increasingly water stressed. Specifically how different communities are affected by this water stress depends largely on their livelihoods.

People have inhabited the Gobi for millennia, surviving as nomadic herders and taking advantage of native flora (e.g., saxaul) and fauna (e.g., Bactrian camel) adapted to the region's harsh climate where precipitation is naturally low and highly variable, droughts occur frequently, and temperatures range from +40C in summer to -40C in winter. Changes in water availability, along with Mongolia's recent transition from socialism and a command economy towards democracy and a market economy, present new challenges requiring innovative solutions.

The present research implemented Participatory Rural Appraisals (PRAs) to investigate water related concerns and vegetation dynamics of herder and vegetable farmer communities in the southern Omnogovi aimag ('province') of Mongolia. PRAs have been successfully implemented to promote conservation and livelihood improvement in this region by the New Zealand Nature Institute since 1994 (C. Schmedt, pers. comm.) and more recently by the Steppe Forward Programme (SFP) (Jargal J., pers. comm.). The current research is part of the efforts of the latter organization which has worked with communities throughout the Little Gobi Strictly Protected Areas (Sections A and B), Gobi Gurvan Saikhan National Park, and Nomgon soum ('district') since 2004.

Among the notable results of SFP's involvement in the region is the training of 'eco-herders' who now systematically monitor wildlife in Little Gobi Strictly Protected Area Section A and Gobi Gurvan Saikhan National Park. The livelihood development project through the Steppe Forward Programme also works to build cooperation, skills and income generating opportunities within communities. Trainings through this program have included felt craft training, milk product processing and building fuel efficient stoves to reduce reliance on scarce and sometimes threatened (e.g., saxaul) fuel sources.

Three PRAs were conducted between November 15th and 18th, 2006, including two meetings with the herder communities, Ikh Gobi and Gobi Khishig, in the Little Gobi Strictly Protected Area Section A, and a third with two vegetable farmer groups in Nomgon soum. The PRAs involved a number of tools common in participatory research (e.g., resource mapping, priority ranking exercises, influence diagrams and problem trees). These activities provided an overview of issues and enabled community members to visually express their concerns in systemic models (stressing relationships and interactions between components) that are easily

accessible to all stakeholders. The exercises also generated discussion about livelihood and resource problems and potential solutions, as well as key factors necessary to solve problems.

The objectives of this PRA research were:

1) *To understand the water resources in the area - availability, quality and use by herders and vegetable farmers;*
2) *To identify community problems regarding water resources & vegetable farming; and*
3) *To generate possible solutions to these problems with the community members.*

The Little Gobi Strictly Protected Area Section A is located in the area of Bogt and Dersen bags of Nomgon Soum. It is at the southern tip of Mongolia, close to the Chinese border. The soum area consists of Nomgon, Khurkh, Bulgan and Khachig mountains of the Altai mountain chain. At the time the PRAs were conducted, the temperature was just above zero degrees Celsius and most days were sunny with no precipitation.

During the PRA activities, both herder communities and especially the vegetable farmer communities (the latter being newly involved with SFP) identified cooperation and coordination among community members as an essential factor to achieve increased water security and resulting livelihood improvement and all communities committed to work towards furthering this common goal. The PRA activities were supplemented with surveys about water and gender (to be analyzed at a later date), interviews with other stakeholders (government and non-governmental organizations) in the region, and attendance at and involvement in the 10th Anniversary Celebration of Omnigovi's Park Administration.

The main observations of the PRA to be discussed in this document include:

1) *The importance of water for sustaining local livelihoods*
2) *Issues of water scarcity and water quality*
3) *The importance of cooperation*
4) *The need for training and equipment*
5) *Trends of water collection, use and prioritization*
6) *Trends of vegetation*

Methodology & Techniques

Research Methodology

Participatory Rural Appraisal (PRA) defines a group of approaches and methods that enable local people to share information on and analyze their knowledge of life and living conditions in order to plan and act for the future. The benefits to using PRA techniques include the fact that community members are able to fully participate in research regarding their own lives and region (as opposed to simply responding to brief survey or interview questions) and they are able to share their valuable local knowledge with researchers.

PRA can be seen as a mutual learning experience between researchers and community members, with the community members acting as leaders, analysts and educators (Chambers, 1994a). Along with sharing local knowledge, PRA methods attempt to encourage discussion between community members on community-wide problems (which are often identified

during the PRA activities and group discussions) and to work together on proposing possible solutions to these problems.

PRA techniques are beneficial to communities as they give all members a chance to participate in community planning, including those who may not otherwise be asked for their opinions on such issues (such as women or poor people who are often not represented at community meetings). Research, education and action are combined within a PRA in order to fully acknowledge the capabilities of a community (in terms of directing their own development) and work towards collective empowerment. It involves people speaking for themselves, identifying their needs, analyzing and researching their situation, and taking appropriate action (Hall, 1992).

In most circumstances, a facilitator is required to initiate constructive dialogue (Kaner et al., 2000). It is crucial that facilitators remain relaxed, open to learning from community members, and flexible. One of the main benefits of PRA techniques is that activities and discussions can be changed, extended or dismissed, based on the needs of the community. During this current PRA research, various methods were adopted on the spot, the order of activities was often changed, and discussion lengths on issues varied depending on the community and their feedback. Maintaining flexibility and a relaxed attitude allows PRA facilitators to encourage exploration of issues that are important to the community and to generate possible solutions to those problems identified (Chambers, 1994b).

The PRAs in the current research were facilitated by master's students from the National University of Mongolia and York University (Canada) spanning a variety of academic disciplines (environmental studies, social science, biology, environmental economics, geography, etc.) to ensure the research benefited from an interdisciplinary approach. Essential to all facilitated action research, the facilitators promoted learning through dialogue and remained neutral regarding the content of the ensuing dialogue, while promoting fair and open processes that provided a space for all (regardless of age, gender, etc.) to participate.

Research Techniques

The PRA exercises conducted with the communities involved mapping water well information; charting and prioritizing water use; defining community problems, causes, impacts and possible solutions; drawing influence (rich picture) diagrams; as well as charting vegetable input and output data. Brief details of the activities are described in turn below.

A. *Community Mapping Exercise*

The community mapping exercise was designed to gather spatial information on water availability and water quality in the region. In two separate groups of mixed gender, community members drew maps noting the following information: ger camp locations; well location and water quality; number and functionality of wells in the area; water collection methods and routes; livestock and vegetation levels around the wells; distances between wells and gers; and details of the surrounding landscape. The two Gobi eco-herder groups were assigned different tasks: Ikh Gobi mapped winter and summer camp locations, whereas Gobi Khishig outlined east and west regional maps that included both summer and winter camp

details. Discussions on water quality and water collection ensued from this activity. This exercise was not carried out with the vegetable farmers.

B. *Water Use & Priorities Tables*

This activity was selected to encourage information sharing on water uses, amounts and priorities. Communities were divided by gender into two groups and asked to first brainstorm all of their activities that require water throughout the year. They were then asked to estimate how much water each activity required over one week/day or, where relevant, per time. The water use activities were prioritized, considering times of poor water availability. The ranking of priorities and amounts were compared, including facilitation of discussion on gender roles and water needs. For the vegetable farmers, one man and one woman were selected to complete the water priority table, due to the fact that only one man attended the meeting.

C. *Vegetable Information Chart*

This activity required the group of vegetable farmer to list all of the vegetables grown within their plots, include both familiar and unfamiliar species. This allowed the group to describe any potentially invasive or alien species, as well as plants that were imported or native to the region. Participants then estimated, using a scale of zero to three [0 (none), 1 (little), 2 (medium) or 3 (great)], the following information: outputs/benefits/importance in terms of sustenance and marketability (potential & profitability of sale); knowledge of the vegetable/plant; amount of required inputs including water and fertilizer; and the yield or "success of growth" of the vegetable. Notes on the ability to preserve and/or store the vegetables over the winter were also included. The objectives of this activity were to learn about the various types of vegetables grown by the farmers and how the choice of vegetables relates to water availability and fertilizer inputs, market potential, and knowledge. It also allowed vegetable farmers to identify problems related to particular vegetables as well as lack of necessary inputs, knowledge or equipment.

D. *Influence/Rich Picture Diagram*

Influence and rich picture diagrams are participatory research techniques that use visual representations (simple drawings, symbols & arrows) to identify interrelationships and "influences" between important elements of a particular issue. The Gobi Khishig herders and vegetable farmer groups were asked to draw symbols or pictures to represent particular elements in their community that were intricately connected to water resource management (e.g. wells, government, livestock) and vegetable farming (planting seeds, weather, soil) respectively. They were then asked to connect these elements via arrows that indicated cause/effect relationships and interdependencies, both positive and negative (noted by '+'/'-' signs above the arrows). Participants were asked to discuss these relationships as a group and identify any resulting feedback loops between the elements.

E. *Problem Tree*

To identify and discuss problems related to water management and vegetable farming within each community, participants were asked to brainstorm water issues within their region using the shape of a "problem tree" as a guide. For the Ikh Gobi herder community, water related problems were listed on the trunk of the tree, with causes noted within the roots and impacts/effects within the branches. Community members were then asked to note and discuss possible relationships between problem causes and effects as well as potential solutions and ways to mitigate causes through community cooperation. This technique was used with Ikh Gobi herder community but not with the Gobi Khishig. In the case of the vegetable farmers, the problem tree exercise reflected problems and solutions related to farming vegetables, which included reference to water issues and concerns.

The results from these activities are discussed in the *Data & Findings* section below.

Recommendations for Improvement

The following are suggested recommendations to improve PRA activity techniques in the future:

1. It is crucial that facilitators are relaxed and comfortable in the PRA setting (Chambers, 1994a). The first time facilitating a PRA is a slightly nerve-wracking experience and to combat this we suggest staying in the community longer before conducting a PRA (especially the first PRA). For example, it would be helpful to stay with one family for a few days and ask the family questions about the community in an informal way, or visit many families to allow facilitators to gain first hand knowledge about the community in order to be more informed once the PRA is underway.

2. Since foreign researchers were involved in the PRA activities, translation was a key part of the project. It was discussed in advance that translation should not interfere with the flow of the group discussion. However, it was beneficial to have some simultaneous translation in order to allow foreign researchers to participate and facilitate where possible. Communication between researchers and the translator should be continued in the future.

3. In several instances, the older women in the group did not participate in the activities, despite having many ideas and suggestions when asked for input from their group members. It is possible that this is due to the fact that the activities are conducted on the ger floor and these women could not kneel down to help draw or write. They instead sat behind the group on a stool. It is recommended that a board or small table be brought to future PRAs in order to encourage participation from the elderly.

4. Experienced PRA facilitators in the group from the Steppe Forward Program did an excellent job of encouraging participation from all community members. This should be continued in the future.

5. After each of the PRA sessions with the herder groups a screen and projector were set up in the ger and a slide show of pictures and video from past community activities were shown to the communities. This was a great idea and the herders really enjoyed it. It is recommended that this practice continue in the future. If facilitators come from other regions or countries, perhaps they could also bring a small slide show of pictures from their home to show the community.

Data & Findings

The following section describes the results of each technique used within the PRA activities and the discussions that ensued. Additional information, including original data, tables, etc. can be found within the appendices. Where applicable, interviews with community members and officials were inserted to verify and/or confirm information. See *Appendix A* for a list of participants and interviewees.

A. Water Resource Mapping

Ikh Gobi and Gobi Khishig herder groups were asked to draw a map of their community indicating water resources within the area. The quality of the water resources, distance to water sources from summer and winter stays, and methods of water collection were also discussed by the group. Both groups demonstrated an impressive knowledge of their surroundings and natural environment.

The Ikh Gobi community group worked on two community maps, one illustrating summer stay areas and one with winter stay areas, noting their relation to water sources. Water collection activities were discussed in detail as well as issues of water quality, vegetation and water use by animals. The maps were useful for understanding relationship between families, animals and water resources on a small scale.

The Gobi Khishig community group worked on two community maps that illustrated all of the water resources in their region. One map represented the west side of their area and the other the east. Both maps included all water sources and all winter and summer stay locations. The maps also included some information on open water sources, vegetation and topography. These maps were useful for looking at water resources on a large scale.

General conclusions, discussion points and observations generated from this activity follow:

Water Quality

Ikh Gobi:

- All wells in Ikh Gobi community are hand dug and hand operated
- Wells where water quality was deemed "good" or "medium" by community members were used by families for drinking and household uses
- Wells where water quality was classified as "poor" by community members were for animal use only
- Wells were classified as "poor" water quality by the community when if they had a high concentration of salt
- Water quality as well as vegetation trends around water sources have not changed in the recent memory of the community members

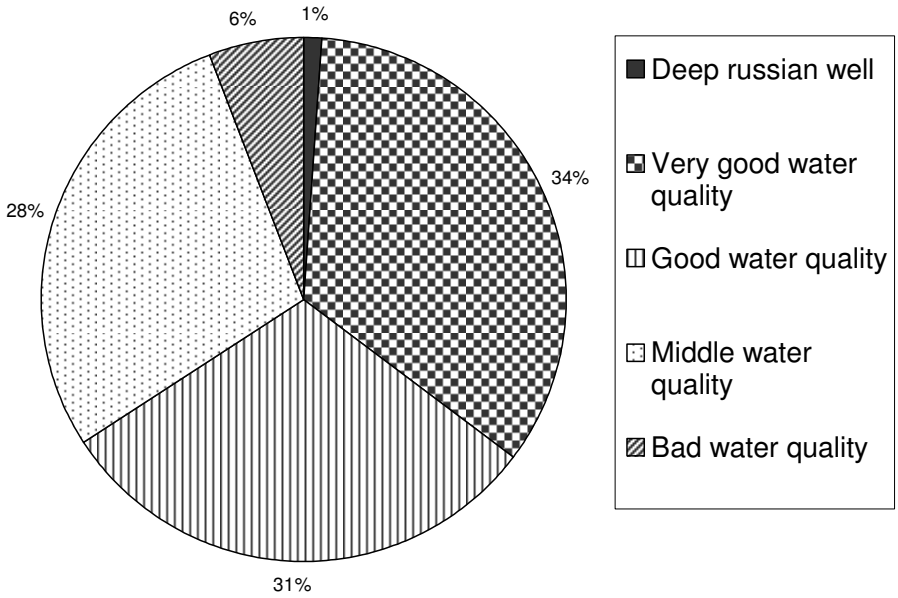
Gobi Khishig:

- Because all wells in the area were drawn by the community, the following quantitative information was gathered:

Table 1: Gobi Khishig Herder Group - Number of Wells and Water Quality

Well Description	**Western Map**	**Eastern Map**	**Totals**
Deep Russian well	0	1	1
Very good water quality	18	11	29
Good water quality	19	7	26
Medium water quality	3	21	24
Poor water quality	1	4	5
Broken wells	Not Recorded	8	N/A
Total working wells	41	44	**85**

Fig 1: Well Quality in Gobi Khishig Herder Group Area



Additional comments on water quality from the Gobi Khishig community:

- The wells indicated as medium and bad quality are not used for drinking but sometimes used for animals.
- Water quality is considered poor when salt concentration is high.
- Wells that are shallower are also poorer quality because they may freeze in the winter and tend to be saltier.
- The community members remarked that salt concentration in many wells has not varied over time and must therefore be due to geological influences.
- In the summer months all families move to the flat area close to the one Russian well and use it as their main water source.
- The community remarked that water levels are lower than they were 30 years ago
- Well quality is protected by covering the wells. However, occasionally the cover can come off and water quality deteriorates for various reasons (such as an animal falling into the well). If this occurs the well is cleaned and then used again.

Open Water Sources – Protected Area

The Gobi Khishig community also recorded open water resources on their maps with a total of 29 open water resources existing in the area. In the southern part of their region there are many open water resources and the community indicated that many wild animals live in this area. The area is part of the border zone between Mongolia and China. The community recorded the boundary separating the protected area from the buffer zone on their map but mentioned that their activities do not change regardless of whether they are living inside or outside the protected area.

Water Collection

This water resource mapping activity led to a discussion on water collection that was very informative, exploring the various methods and responsibilities associated with water collection.

General Trends

- The Gobi Khishig community indicated that families do not live more than 500 m away from a well, so water is most often collected by hand. The farthest distance a family lives from a well is 900m and in this case water is collected by motorbike.
- The Ikh Gobi community, on the other hand, indicated during this activity that wells are often 1 to 2 km away from their dwellings and that it is common to collect water from these wells by motorbike and/or camel. One family during the summer months had settled near a poor quality well that was used for animals (20 m from their ger) while the well they used for drinking was 1 km away.
- A discussion about water collection with the vegetable farmers is discussed in the *Water Priorities* section below and reflects the general trends discussed here.

Observed Trends in the Social Aspects of Water Collection

1. Water collection is not usually the responsibility of one particular member of the family, as is often the case in other countries where only women or girls are responsible for water collection. The community members stressed that whoever is free in the family usually collects water. Children often collect water as they have the most free-time.

2. The decision to collect more water is usually made by the female head of household who has more responsibilities related to water use (*see Priorities Chart Discussion*) and therefore is more knowledgeable as to when the water within the house will run out.

3. Water is collected by different methods depending on the distance from the water source to the ger and on the terrain around the water source.
    a. By hand – all members of the household collect water by hand, especially women and children. This usually occurs when the water source is less than 900 m away. Usually, between 20 and 50 L are collected by hand.

b. By camel – camels were used by one household to collect water in the Ikh Gobi Herder group from a well 2 km away because the terrain was too rough for a motorbike. The camel collects 80 L of water during each trip. All members of the family used camels to collect water.
c. By motorbike – Motorbikes were used for water collection from sources more than 900 m from the ger. Water collection by motorbike is mostly done by men and older boys.

Transect Walk on Water Collection

Prior to the start of the PRA activities, a young boy from the Gobi Khishig community group brought researchers to the family well to explain and demonstrate how he retrieves water. The well was slightly raised from the ground's surface and a bucket was used to bring water up from the well and transfer it to 20 L and 30 L containers. This well, lined with cement, was used for both animals and drinking water. A nearby well, approximately 50m away, was only lined with large rocks and was too salty, therefore not used.

Vegetation Trends

Neither herder community identified any notable changes in vegetation (e.g., in cover, abundance, species diversity) over the past several decades in the region. Herders of both communities practice a form of rotational grazing that has remained relatively unchanged in this region for millennia. Herders move between summer and winter camps, settling in lower and flatter areas in summer months and moving to the protection of mountains and hills for the winter. Herders identified their repeated use of winter and summer camps between two or sometimes several years depending on pasture recovery, which they perceived to depend primarily on climate. Several herders of Ikh Gobi noted that the decision on where to settle for the winter depends primarily on where good quality pasture is found. The same herders also noted that, despite some differences in the abundance of vegetation between areas, grasses and bushes are generally evenly distributed throughout the region. This apparent discrepancy may represent an observational differentiation in terms of temporal scale by herders: while they recognize short-term variations in pasture availability and quality, they also recognize that pasture does not vary significantly over the long-term. This is suggested by an observation by Gobi Khishig herders who stressed that vegetation always recovers and that this is a prerequisite of sustainable pasture use.

Herder's perceptions apparently differed from that of staff at the provincial park administration. During an informal interview, the park administration's Director of Research (Ravjir R.) noted, according to his personal observations, a decline in vegetation abundance and changes in plant community composition toward an increased proportion of more drought resistant species in recent years. He blamed these

trends exclusively on climate change, particularly reduced precipitation and an increased frequency of droughts within the past decade. Whether the difference in perception between herders and park staff represents a fundamental difference or simply one of temporal scale (i.e., the herders long-term observations versus interpretations from relatively short-term observations of park staff) is difficult to determine. Apart from two surveys to identify plant species diversity, the provincial park administration, responsible for the management of the Little Gobi Strictly Protected Area Section A, has no information on the area's vegetation. The park administration's Director of Research highlighted his department's lack of ecological data (as well as the lack of capacity to conduct this research) as a serious concern that inhibits the development of meaningful environmental management plans in the Little Gobi Strictly Protected Areas (Sections A and B).

The shared perception of both park staff and herders that climate is the primary driver determining vegetation dynamics coincides with research identifying the Gobi region as exhibiting non-equilibrium ecosystem dynamics (Fernandez-Gimenez and Allen-Diaz 1999; Fernandez-Gimenez and Allen-Diaz 2001; Stumpp et al. 2005). These studies found insignificant impacts of livestock grazing on vegetation dynamics along grazing gradients in desert and semi-desert steppes in Mongolia. Such systems have loosely coupled vegetation-herbivore interactions and thus herbivory does not represent a dominant impact on vegetation dynamics in these systems (Ellis and Swift 1988). The strong influence of climate change on vegetation dynamics in the region is demonstrated by recent remote sensing analyses (Yu et al. 2003; Yu et al. 2004) which have found a strong positive correlation between the areal extent of the Gobi Desert and mean annual temperatures. More research is required to determine the differential impacts of climate change and anthropogenic activities in the region.

Herder Movement Based on Pasture or Water

The PRA team and the Steppe Forward Program were interested in investigating whether the herder group families based their decision on where and when to move during the year on pasture quality or water availability. This question is very complex and various contradictory observations were made:

1. Ikh Gobi winter stay map discussion – community members commented that winter stay follows where pasture is good and that they then dig wells around dry river beds.
2. Gobi Khishig western map group – noted that they relocate based on wells not on pasture – since it is such a big area in which they live they suggested that they want to stay near wells so they relocate because of them.
3. Gobi Khishig eastern map group – in the summer all families live near the one Russian deep well. They stay there until pasture is bad and then relocate based on pasture because wells are everywhere. They leave pasture to recover which it does every year.
4. Gobi Khishig group discussion – the community noted that pasture quality depends on climate and not animal use – water levels may decrease in a well but the wells will not run completely dry – at the same time as water level decreases, the pasture quality is deteriorating, so families move because pasture is bad not because the well has dried up.

Overall, these contradictory comments and discussion points lead researchers to believe that the connection between pasture quality and well water level is very complex and that the two are intricately related. Perhaps, so intricately related that it is difficult for community members to note which occurs first, pasture quality deterioration or decreasing water availability. Future research in this area is necessary to learn more about these processes and how they affect herder movement.

General Observations on Resource Mapping

The water resource mapping activity was a good introduction to the PRA meetings with both herder groups. It allowed community members to highlight their knowledge of their surroundings to researchers and made the group feel comfortable. It also allowed researchers to gain a general understanding of the area and enquire into different issues based on questions related to the map. Having one community focus on small-scale mapping and water collection, and one focus on large-scale maps of water resources was particularly informative in the short amount of time available. Had more time been available, or in future PRAs, perhaps both scales of map could be drawn by both communities. As well, in future, it would be interesting to have all community groups include broken well locations on resource maps in order to get a sense of how many broken wells are in the area. Perhaps some of the broken wells will be particularly useful if fixed by the community due to their locations.

B. Water Use and Priorities Ranking Table

This activity was done in all three PRA sessions and was chosen with the intent to learn more about the different uses for water that herders and vegetable farmers have. For full water priority lists see *Appendix B*. How much water (approximately) each of these water uses requires and which water uses the community members found most important were also included in these tables. To be able to compare water use and priorities by gender, the activities were completed in gender-segregated groups.

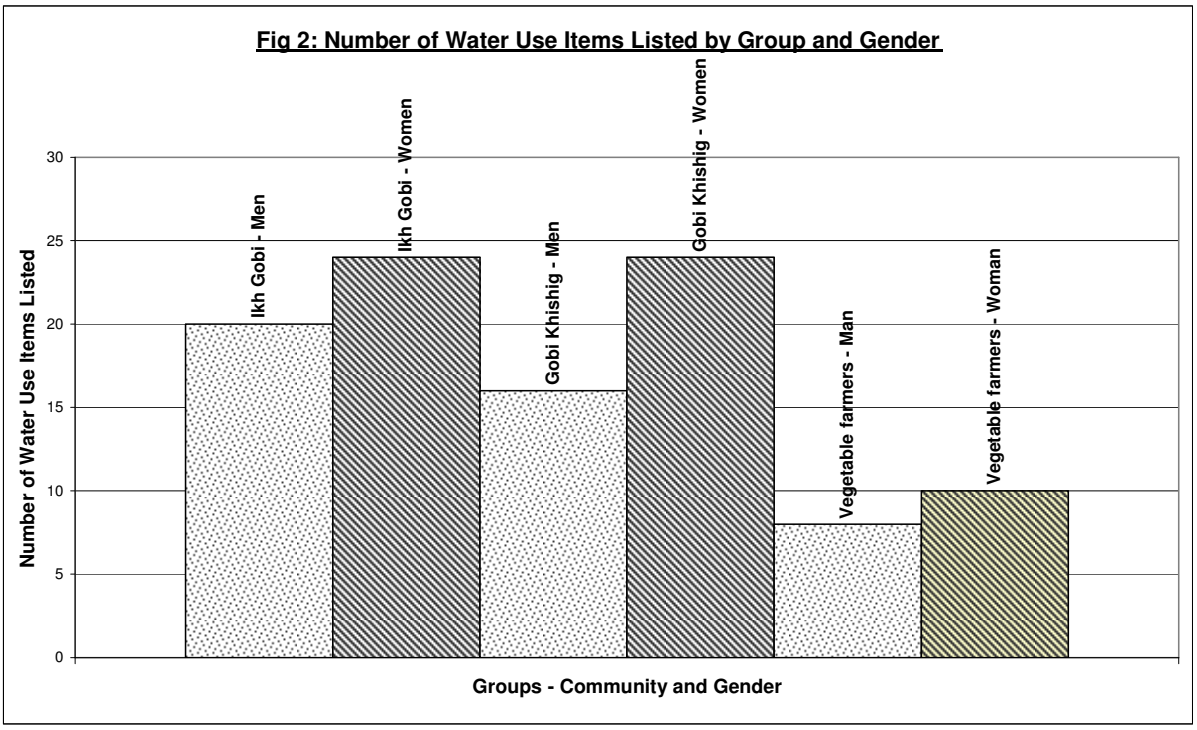
Because there was only one man present at the vegetable farmer PRA meeting, he was chosen along with one woman to participate in this activity. The pair worked individually on their water use and priorities lists and mentioned that it was difficult to determine water uses and amounts without other community members with which to discuss issues. In the future more male members of the vegetable farmer community groups should be encouraged to attend meetings by the community organizer.

Water Uses

The instructions to listing water uses were given broadly and community members were asked to list as many ways as possible that their family used water. Due to these broad directions, the results between groups varied widely and different levels of detail were included by different groups.

Overall in all three PRA sessions women produced longer water use lists than men (*see Figure 2*). These lists did not necessarily have any new activities but often divided general

water use activities into more detail. For example, in all communities women listed at least twice as many water uses related to cleaning as men. While the men's group often wrote cleaning responsibilities such as washing home or dishes, women often expanded these water uses into more detailed uses such as: washing clothes; washing wooden parts of ger; washing big cooking pot; and washing carpets. During a discussion with the Gobi Khishig group, it was mentioned that women had more activities listed because they had more responsibilities for the family that related to water.



Other small discrepancies between the lists made by women and men include: a division between the types of activities involving vehicles and water by the Ikh Gobi men's group; the mention of playing with water to cool off by the men's groups in both herder communities; and the mention of two activities involving felt-making by the women of Gobi Khishig group who make felt crafts for income generation. *Table 2* lists the number of different activities listed by type (such as relating to animals, building or cleaning) and displays the various discrepancies between gender groups as well as between community groups.

Table 2: Number of Water Use Items Listed by Type by Community Group and Gender

Water Use Type	Ikh Gobi Men	Ikh Gobi Women	Gobi Khishig Men	Gobi Khishig Women	Veg Farmer Man	Veg Farmer Woman
Animals	2	4	4	4	1	2
Food	7	7	2	3	2	2
Felt	1	1	-	2	-	-
Building	-	2	1	2	-	-
Watering Vegetable	-	1	1	1	1	1
Watering trees and flowers	-	-	1	2	-	1
Cleaning	3	6	3	6	1	3
Sanitation (Personal Hygiene)	3	2	2	3	2	1
Vehicle	3	1	1	1	1	-
Playing with water to cool off	1	-	1	-	-	-
Total	**20**	**24**	**16**	**24**	**8**	**10**

Water Quantity per Use

Community members attempted to estimate the amount of water they used for various activities involving water. These amounts are difficult to compare because some of the activities (such as washing the herd or making felt) only occur once or a few times a year, while other activities (such as washing dishes) occur daily. The water use amounts also varied seasonally depending on the work that must be done at that time of year and the climate. Because of the different methods used by groups to estimate water amounts, and the different classification of water uses, it is difficult to fully compare one water amount list to another.

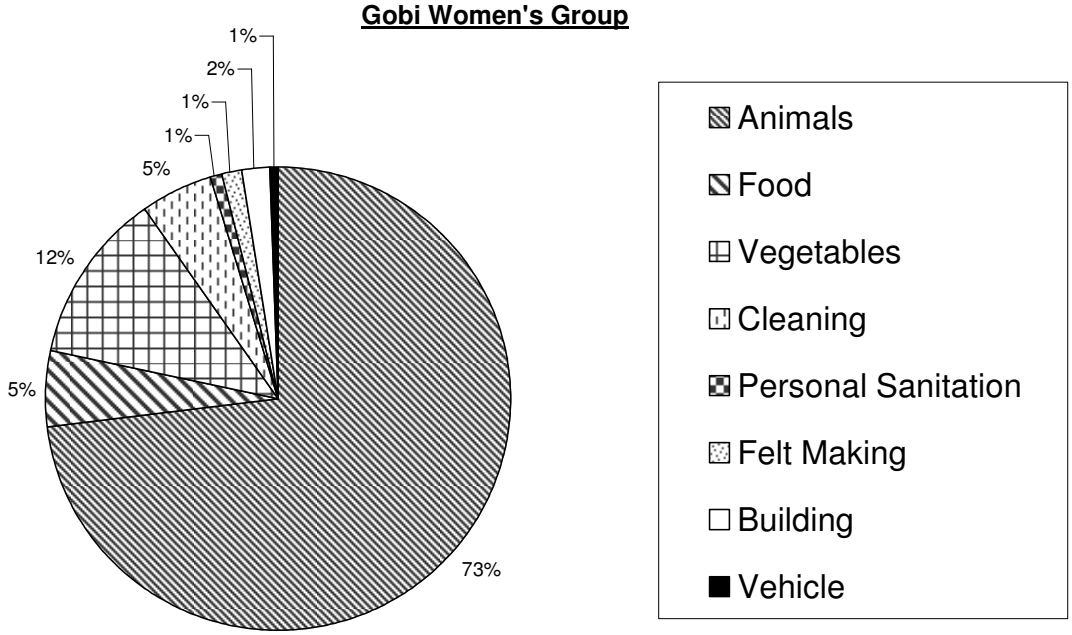
The research team was interested however to gain a general idea of how much water herder and vegetable families used over a given period of time. The fact that the families collect water and do not have it piped into their homes, as many urban dwellers do, does lead researchers to believe that the families have a reasonably accurate view of the amount of water used.

To illustrate the amounts of water used by one community, the information provided by the Ikh Gobi women's group was divided into water amount by "type" of water use (*see Figure 3*). To do this, some assumptions had to be made. The information of water use related to "building" was added even though cement and brick-making do not occur every week. Washing vehicles and making felt were also added to the graph despite the fact that these activities also do not occur on a weekly basis. Amounts recorded by the women in L/per year (because these activities - such as washing livestock only occur annually) were divided by 52 in order to get an average amount of water used for these activities per week.

Despite these assumptions, data collected from the women can be used to gain a general understanding of the percentages of water used for each activity per week by the herder families in Ikh Gobi. *Figure 3* strikingly demonstrates the importance of water for herding and therefore the herder's livelihoods. The effect that decreased water availability would have on the families can be interpreted as severe, in terms of herd morality and reduced family income.

One general trend noted by the researchers and community was that most of water uses listed were either for direct family survival (such as food and drink) or for family survival through income generation (such as herding, felt making and vegetable farming). This PRA activity illustrated the important role that water plays in the lives of herders and vegetable farmers and the severity of problems that could occur from insufficient water quantity or quality.

Fig. 3: Percentage of Water Used per Week for Activities - Estimated by Ikh Gobi Women's Group



Water Use Prioritization

In all three PRA sessions the community members listed similar water uses as top priorities in times of decreased water availability. All groups from all communities listed water for herds, food and tea in their "top five water uses". As well, women in Ikh Gobi, women and men in both Gobi Khishig, and both members in the vegetable farmer groups listed watering vegetables as a top priority. *See Table 3.*

Table 3: Top Five Water Uses Listed by each Community and Gender Group*

Ikh Gobi men*	Ikh Gobi women	Gobi Khishig men	Gobi Khishig women	Veg Farmers man	Veg Farmers woman
Watering herds	Watering herds	Cooking food	Tea and food	Making tea	Watering vegetables
Washing clothes	Washing dishes	Watering herds	Watering herds	Making food	Making tea
Cleaning the home	Making food & tea	Washing dishes	Planting vegetables	Watering vegetables	Cooking food
Washing floor	Making dough – noodles	Wash cat and dog	Washing clothes	Watering herd	Watering herd
Making tea	Washing face & hands	Watering vegetables	Having bath	Washing clothes	Watering trees

* Note: The men from the Ikh Gobi community included more than 5 "number one" priorities and also included: making food, making tea with rice, making vodka, boiling meat, cleaning animal meat, washing face and hands, having bath, washing children and coolant for radiator.

A lengthy discussion on gender and water use priorities was undertaken with the Gobi Khishig herder group in which community members commented that most of the top priorities of water use were essential for the survival of the entire family and were therefore not divided by gender.

The top water use priorities for all communities include activities with water that are usually done by women (such as cooking and cleaning) and those usually done by men (such as herding). This could illustrate that both women and men are highly aware of the other's work within the household and that the importance of all work is acknowledged by all family members. As well, the ability of both women and men to identify similar water uses as important could illustrate that the gendered division of labour is not as strict within these communities as it is in other countries around the world. Further research in this area would be necessary to draw any major conclusions.

Water Collection

The priorities list by the vegetable farmers led to a discussion (with one man and one woman) on who within the family is responsible for collecting water. Both farmers indicated that all members of the family collect water. The woman collects water from 5 m away from her ger (from the same well that is used for irrigation by the farmers) and the man collects water from a neighbour's well 300 m away. All members of his household collect water, however; if it is particularly late, he mentioned that he does it. His family collects water in two 20L buckets. These trends are comparable to water collection trends indicated by the herder communities which are discussed above in the *Resource Mapping* section.

Overall Observations on Water Priorities Chart

Overall this activity was very useful to researcher and community members as detailed lists of water use were mentioned and water collection, amounts and priorities were discussed. It was also a useful activity to be able to discuss gender issues with the community. In the future, within this type of activity, community members should be encouraged to specify how much water is used per activity each time and how many times this is done per year in order to be able to compare the charts to one another more easily. Additionally, more information from participants such as the number of herds they are estimating water for or the amount of land devoted to vegetable planting that they are watering, would help to put the water amount estimations in context. As well, if the priorities ranking section of the activity involves ranking all water uses from first to last (a very time consuming activity) then some statistical information may be able to be gathered from the results.

C. Vegetable Table Information

Farmers identified successful growth of virtually all vegetables grown (see Table 4) despite a lack of knowledge of several. Farmers noted that the seeds of crops for which they lack knowledge come from donations mainly through Agropark and the Gobi Initiative. Farmers stressed that Canadian seeds, representing a proportion of these donations, were particularly high quality seeds that are well adapted to the local environment. This may explain their high

success rate despite a lack of specific knowledge about how to grow these plants (a concern discussed during the activity).

Table 4. Vegetation table of farmers' perceptions about average outputs (benefits), knowledge, inputs, and yields of all crops grown in the buffer zone of Little Gobi Section A Strictly Protected Area. Crops are ranked between 0 (none) and 3 (much/many).

	Vegetable grown	Outputs (benefits)		Knowledge of Plants	Inputs		Yield (success of growth)
		Food (Sustenance)	For Sale (profit)		Water	Fertilizer	
1	Potatoes **	3	3	3	2	2	3
2	Onions **	3	3	3	2	2	3
3	Carrots **	3	3	3	3	3	3
4	Turnips **	2	3	3	3	3	3
5	Cabbage **	3	3	3	3	3	2
6	Watermelons	3	3	3	3	3	3
7	Melons	3	3	3	3	3	3
8	Red peppers (hot)	3	3	2	3	3	1
9	Cucumbers	3	3	3	3	2	3
10	Tomatoes	3	3	3	3	3	3
11	Brown beets *	3	3	1	2	2	3
12	Garlic	3	3	3	2	2	3
13	Gourds/squash *	2	0	1	3	2	3
14	Cumin/caraway *	2	0	2	3	3	3
15	Leafed cabbage *	1	0	1	2	2	3
16	Maize/corn *	0	0	1	3	2	3
17	Pattypan squash	0	0	0	2	-	3
18	Flower cabbage	1	0	0	2	2	3

* preserved, ** preserved and overwinters well

Farmers also noted their lack of knowledge about how to prepare and consume such crops, which is apparent by the correlation between farmers' knowledge and benefits of specific crops (Table 4).

The farmers identified having little knowledge on some crops (such as maize) and thus also identified little or no market or sustenance benefits from these crops. This activity indicated that while farmers have made use, in terms of sustenance, of some crops for which they lack knowledge, none of these crops has any market value for them.

Farmers identified all plants grown as requiring large quantities of inputs (water and fertilizer). Given the region's low availability of fresh water, the susceptibility of local soils to salinisation, and farmers lack of automated irrigation systems, among other factors, it is not surprising that the farmers were very interested in high efficiency low-cost drip irrigation systems described by the visiting student researchers.

D. Influence/Rich Picture Diagram

Influence diagrams taking the form of rich pictures were conducted with the Gobi Khishig herder group and vegetable farmers. These activities generated lively discussions about the relationships and interactions among systemic components (natural, social, economic, political) revolving around herding and vegetable farming livelihoods, respectively. The diagrams drawn by each community are included in *Appendix C*.

Both herders and vegetable farmers identified water as a key component in their livelihoods, indicated by the numerous relationships between water and other components depicted. The groups identified water as benefiting people directly in addition to livestock, vegetables, natural vegetation, soil, wildlife, and the production of felt crafts, most of which were interlinked with one another either directly or indirectly. The herder group also identified a problem with saline water for people and livestock. Only droughts were identified by both groups as having a negative impact on water availability and, by the herders, on water quality by increasing salinity.

Interesting feedbacks among components were also identified. For example, the Gobi Khishig herder group recognized the reinforcing linkage between themselves, their livestock, natural vegetation, precipitation, and government taxes: herders pay taxes, part of which are used by the government to plant trees; the trees increase precipitation through increased evapotranspiration; increased precipitation leads to more vegetation and thus more pasture to feed their livestock; more feed means more and healthier livestock, for which they pay more taxes, leading to the government planting more trees, and so on. Key findings identified in the influence diagram were reiterated in the problem tree analyses and are thus discussed in the proceeding section.

E. Problem Tree

The following section describes the main trends discussed by the Ikh Gobi and vegetable farmer groups during this exercise, including issues related to water quantity, water quality, training requirements, lack of equipment and irrigation systems, marketability of vegetables, seed purchases and collection, and cooperative efforts. Specific details recorded during the problem tree activities can be found in *Appendix D*.

Water Quantity

The Ikh Gobi community herder group identified lack of water as their first water-related problem. Within an informal discussion prior to the start of the PRA activities, community members asked the student researchers if they would be able to help them find water in their region of the Gobi. This vital resource is obviously a limiting factor in their day to day living as well as to their livelihoods dependent upon animal husbandry.

During the exercise, the Ikh Gobi group noted a reduction of rain from previous years, more extreme drought conditions, and extended hours of sunlight as the main causes of reduced water availability. There was no mention of anthropocentric (human induced) overuse of water for livelihoods or human needs. Cloud seeding, creation of an artificial basin or lake, and drilling deeper wells were options discussed as solutions during times when water is scarce. Perhaps because water use conservation is part of survival, demand management (involving strategies used to encourage the reduction of water use) as a form of increasing water supply was not mentioned by the community as an additional solution.

Water quantity issues were also discussed by the vegetable herder groups in Nomgon, noting a lack of wells and reduced water levels resulting in lower crop yields. Interviews with Nomgon's community organizer (former governor) and environmental inspector indicated water availability was both a significant problem, in terms of groundwater level reductions, as well as a nominal problem in that almost everyone in the community now had their own well, so "water availability is good". This conflicting information suggests differences between the availability of well water in the rural and urban areas and lack of scientific knowledge of actual water quantities. More investigation into apparent urban-rural discrepancies would need to be conducted to make any concrete comparisons.

In 2003, during the former governor's period in office, a special fund was created to build new hand wells (3-5m deep) in the community of Nomgon, supported by a Japanese sponsored project that supplied pumping equipment for each family. Nomgon's environmental inspector was of the opinion that groundwater levels in Nomgon have been declining in recent years due to the increased concentration of water wells, with drought and climate change considered to influence open surface water levels. Despite this observation, both community groups and the above interviewees did not mention an immediate threat or need for the government to promote water use conservation, but that these influences could result in increased scarcity concerns and possibly require additional conservation efforts in the future.

In an interview with the aimag government official responsible for environmental policy in the region, it was mentioned that conservation initiatives were underway within the aimag centre (Dalanzadgad). The aimag government uses water meters to charge for water and repairs water infrastructure with this revenue. This metered approach to water payment may also encourage people to use less water.

Conversely, the community organizer mentioned that in Nomgon soum centre residents do not pay for water because each family has their own well. This could lead to a lack of water conservation in this area and possible water availability issues in the future.

Water Quality

The salinity of the water was the main water quality issue raised by Ikh Gobi and the two vegetable farming communities during this exercise. Salinity issues were also raised within the resource mapping and influence diagram activities. The communities mentioned that the high salt content of the water has contributed to human health problems such as liver and kidney illnesses as well as poor animal health (lack of nutritious vegetation and clean drinking water result in lean animals). The Gobi region's geological structure was blamed for the high salinity levels. Purification of water for human use, with the help of special equipment, and tree planting were solutions raised to improve water quality for consumption and enhance soil conditions and vegetation.

Nomgon's environmental inspector mentioned in her interview that information on water quality issues, and observations of decreasing water levels, were reported on a regular basis by rangers within the Little Gobi Strictly Protected Area Section A and, in some cases, information was provided by volunteer environmental rangers in the soum.

The community organizer suggested a need for external researchers to measure and report to the community which wells have poor water quality and confirm whether there is increased safety in drinking from communal pumped wells instead of personal hand-dug wells. The aimag government official interviewed is quoted as saying the government supplies water purification equipment to soum centres but not to herders at this time.

Training Requirements

The vegetable farmer groups expressed an interest in training sessions to develop vegetable farming skills and knowledge including new techniques on how to plant, grow, harvest, prepare, and preserve vegetables. To improve profitability of sales, increase access to funding, and sell produce to more markets, training workshops on the basics of finance, marketing and sales would also be of great benefit.

One problem noted by the community was that agricultural professionals and students are choosing to live and work in northern Mongolian where salaries and wages are higher. The vegetable herder groups expressed the need for government policies and financial incentives that would encourage and attract specialists, including professionals and agricultural students, to work in the area and train the community members on best farming methods and practices, seed collection and storage, soil development, and food preservation techniques.

Professional language training was also suggested as another requirement in order for the farmers to read seed packages donated in foreign languages. Another option of course would be to provide Mongolian translation of this information prior to donation, as this would help the community members learn about the new plants, how the seeds should be planted and grown, and how the vegetable produce can be consumed and/or marketed.

To assist with measuring the quality of water in remote areas, training and equipment could be provided to avoid health problems and improve water quality data collected by the volunteer environmental rangers.

During an interview with Nomgon's School Director, he mentioned the need to create employment opportunities in the winter months when vegetable farmers are no longer tending to their gardens and crops. A tour of the school's bakery, recently built with the help of the children, suggested a new demand for training related to basic baking skills as an example, with other employment training possibilities in felt handicraft, wool making, or carpentry work in the off season.

Lack of Equipment & Systems

The benefit of a tractor for earlier seed planting was discussed at length by the vegetable farmer participants. By the time the tractor arrives from working in northern Mongolia, the ideal planting period has passed. The cost of a tractor requires a huge capital investment with high interest rates attached to loans from the bank. The idea of pooling resources through the creation of a farming foundation was raised as a possible way to successfully apply for funding (such as grants) and reduce interest charges. Cooperation of this nature is also discussed in a section below.

According to Nomgon's school director, the two main irrigation systems (east and west) in the area were built during the socialist period, so the soum government claims it is not responsible for managing or repairing these systems or wells. These artificial basins are replenished by springs, where water collects all year long and is used for irrigation purposes. Unfortunately, the clay lining of the east basin has been washed away from rain and they do not have sufficient money to pay for the repairs.

Irrigation is an important part of growing vegetables and trees in the Gobi. The vegetable farmers mentioned their gardens and crops require between 300 L to 10 tonnes of water per day, depending on the size and selection of vegetables. They currently dig channels in the soil to irrigate, which was identified as an inefficient use of water, so they asked about new methods of irrigation. Drip irrigation was suggested as a more efficient system, at a relatively affordable cost, that can provide plants with a controlled amount of water directly to their roots.

The school itself requires 2 -3 tonnes of water per day (during the summer), from one of two nearby wells, to water the trees in its courtyard. The Director hopes to extend the pipe connection to a larger drilled well and also implement a drip irrigation system. Advice on drip irrigation was requested.

Community members identified non-governmental organizations as possible sources of training or systems suppliers, this could be largely due to the fact that the soum and aimag governments have not aided in water provision in the past.

Marketability of Vegetables

For the vegetable farmer communities, additional markets beyond Nomgon are a considerable distance away: 100km to the nearest soum centre, 110km to Dalanzadgad, and 730km to Ulaanbaatar. They also commented that the vegetable market is small in general due to the financial conditions of families in the community. Potential new markets were suggested by the participants, including sale to soums currently without enough vegetables or without enough water to successfully grow crops. The vegetable farmers also mentioned possible markets and small business opportunities resulting from future mining operations in the area, to ensure they receive local benefits from this activity.

Contributing toward a foundation or community fund was another viable solution raised to collect money for transportation of produce and equipment purchases. Investing as a group would also hopefully improve credit worthiness for loan applications. Working together as a cooperative or farming community would also allow the farmers to pool their vegetables and sell to buyers interested in larger quantities of produce. Establishing underground storage and better preservation could potentially increase the market value of vegetables, presumably in the winter and spring when vegetables are scarce.

Seed Purchases & Collection

Without access to a tractor at the beginning of the season, seeds are collected by hand from vegetables that are not needed for subsistence or sale. Unfortunately the farmers cannot devote large portions of their crops for seed collection, as they mentioned it was more important to eat the vegetables or sell them for their livelihood. Purchasing seed has therefore become a necessity.

The vegetable farmers expressed concerns about the high cost and poor quality of seeds. Seeds were apparently purchased from China and other countries, including Canada and the United States, via northern Mongolia resulting in higher costs for transportation. The group mentioned they believed the seeds they received from Canada were of high quality, but those from China were poor.

Somewhat conflicting to the above group comments on seed purchases, the School Director mentioned that vegetable farmers mostly use their own seeds, and do note use many imported seeds. He commented that yields in the first year are often good but the second and future years do not fair as well, perhaps due to climate or collecting seeds and not planting the originals.

The vegetable farmers came up with several possible solutions regarding seed collection including creating a seed bank of their own seeds and participating in training to improve knowledge on the best ways to collect and plant vegetable seeds. Planting trees to protect vegetation seedlings from the wind and/or applying black plastic over the soil were additional ideas noted to ensure successful yields.

Cooperation

The vegetable farmers discussed establishing two community groups that would help facilitate the creation of their own community fund and foundation and encourage creative new ideas. Most of the solutions brainstormed by the community involved increasing group cooperation and working together to pool resources or knowledge in order to improve livelihoods.

The importance of cooperation was also highlighted to researchers during a presentation by C. Shmedt of the New Zealand Nature Institute. During the last ten years, cooperation has successfully resulted in the establishment of 83 conservation-oriented communities working to improve the livelihoods of local herders in the area. In some of these communities a large fund has been created, including both money and livestock, allowing herders to obtain micro-credit. This initiative has not only resulting in increased cooperation but has improved conservation and education levels, increased capacity, and improved income levels and social skills. Many communities also feel that they have better pasture management due to community discussions, experience sharing between communities, and frequent movement between their stays based on trust that community members will work together rather than take winter stays from others.

The School Director in Nomgon provided another example of direct cooperation between the school and two vegetable farmers located 30 km east of Nomgon. The school's students provide these two farmers with labour in the summer, helping with planting, picking and preserving vegetables. The School Director supplies the vegetable farmers with seeds, management skills, and market opportunities by purchasing produce for the school children

and also arranging sales in the aimag centre of Dalanzadgad. In the latter, the Director sells the produce, gives 25% of revenue as profit to the farmers, and uses the rest of the revenue to buy necessities such as textbooks, winter coats and other supplies for children. He also mentioned two other advantages of farming collectives: cooperation can keep the price of vegetables consistent, to prevent loss of profit when some choose to sell low, and it can also secure a market through the coordination of transportation of bulk produce.

In the researchers' opinion, increased cooperation for both vegetable farmer and herder groups could result in improved livelihood development and increased capacity building for communities. Herder groups should be encouraged to continue cooperation and share their experiences with other less established groups. Vegetable farmer groups should be encouraged to increase their cooperation and form official community groups.

Overall Observations on Problem Tree

This activity was particularly useful in allowing the groups to identify potential problems within the community and to discuss issues related to or causing these problems. In the vegetable farmer group, the problem tree was done early and returned to at the end of the session as a concluding activity. The farmers had thought of many solutions to problems and a discussion on how to reach these solutions followed. In the herder group however, the problem tree was done at the end of the session and not many solutions were generated from this discussion. This could be because the herder groups have been cooperating for a longer time and so have less immediate concerns as a community or it could be because water resources (which the problem tree focused on) are often technical issues with technical solutions as opposed to livelihood improvement of the vegetable farmers. One issue with the problem tree as an activity is that it involves a great deal of facilitation from researchers in order to lead community members to identify links between causes, problems and effects. An activity that enables community members to work more independently may be more beneficial in the future.

Summary of Discussion

Throughout all PRA activities and sessions, the following general trends were noted by the researchers:

The need for water for survival and livelihoods

The necessity of water availability was evident throughout the PRA activities, not only in the sense of water for survival (such as food and drink) but also as water as a means to livelihoods. Both herders and vegetable farmers used the majority of the water they consumed to sustain their livelihoods. This reliance on water highlighted the severe impact that a lack of water or poor water quality in the area could have on the communities.

Issues of water scarcity and water quality

Salty wells were identified by all community groups and salt concentration was the major determinate of water quality. As well, reduction of the water level within wells was identified as a problem. Overall, the reliance on water coupled with a general lack of water in the environment was highlighted by all groups, emphasizing that water is a limiting factor for the environment and therefore also for human wellbeing and livelihoods.

The need for and importance of cooperation

The importance of and successes of cooperation were noted by researchers with visits to herder communities. The productiveness of discussing problems as a community and identifying water resources trends is crucial to community development and addressing community issues. As well, the need for increased cooperation within the vegetable farming communities was apparent in the PRA activities. Many of the solutions to increase the productivity of vegetable growing that were proposed by community involved increased communication, collaboration and community cooperation. The benefits to this cooperation will most likely empower individuals but also the vegetable growing communities as a whole.

The need for training and equipment

The success of the training sessions thus far with the herder groups (such as felt training and fuel-efficient stove creation) was noted. Training in the future, addressing issues like well construction, and determining future well location, may be of benefit to the herders. A general lack of water and the question of where to find more water, or suggested technical solutions (such as an artificial basin creation and cloud seeding), should be discussed with the herders by a professional hydrologist or hydrogeologist.

The vegetable farmers highlighted many areas in which training and technical assistance would greatly improve their livelihoods, including: vegetable planting, seed packet translation, preserving vegetables, marketing and business and community development. As well, vegetable farmers identified a serious lack of equipment (mainly a tractor and irrigation system) that prohibits them from planting seeds early in the season and reduces harvest and seed collecting abilities.

Water collection and uses

In all communities general trends of water collection were identified and discussed. Depending on distance to wells and terrain, water was collected by hand, camel or motorcycle. The herders and vegetable farmers mentioned that water collection was performed by all members of the family, depending on who had free time. The largest amount of water used by families was for livestock or vegetables and thus was used to sustain livelihoods. As well, in terms of water priorities, women and men mainly listed similar top water use priorities that were necessary for survival and livelihood, possibly indicating an in-depth understanding of the necessity of all water uses for family well-being.

Vegetation trends

Trends in vegetation were discussed with herder communities and within some of the interviews. In this discussion, neither herder community identified any notable changes in vegetation (e.g., in cover, abundance, species diversity) over the past several decades in the region. Herders of both communities practice a form of rotational grazing that has remained relatively unchanged in this region for millennia. Park Administration staff, on the other hand, had noted a reduction of vegetation abundance and changes in the plant community in the region, which was said to be due to influences of climate change. More research and the collection of vegetation data in the area is necessary to further investigate this matter.

Recommendations

The Steppe Forward Programme should work with community members to encourage the following:

1. Experience sharing between experienced community leaders (or members) and the vegetable farmers. The benefits to working in a group should be discussed with particular attention paid to official membership and the possibility of a community fund. This fund could be used to increase equipment capabilities of the farmers or to invest in micro-credit schemes.

2. Steppe Forward Programme representatives should coordinate with herders and vegetable farmers along with NUM experts to offer training sessions on the following:

    a. *Water resources* → including where to dig wells and possible technical solutions to lack of water availability for the Herder groups. This training could also be offered to vegetable farmers to allow them to learn more about water quality and the effect that poor water quality could have on their crops, personal health and animals.

    b. *Vegetables* → types of plants and how to plant them, including growing season, soil necessities, water requirements and how to prepare vegetables to eat. This could also include translation of the seed packets at the beginning of the year before the planting season begins.

    c. *Seed collection and vegetable preservation* → this will help to reduce input costs for farmers and increase profits if vegetables are sold for higher prices in the winter and spring months.

    d. *Equipment* → advice and information on drip irrigation should be provided to the vegetable farmer community by the researchers and the Steppe Forward Program

    e. *Marketing and business* → a training session on business and marketing as well as some follow up participatory activities would allow the vegetable farmers to create and implement new ideas on how to improve their livelihoods.

f. *Other income generation* → training on small-business skills (such as bakery, construction etc.) would be useful to vegetable farmers who need to improve their livelihoods during the winter when vegetable farming is not possible.

Note: All of these training sessions should be coordinated with local government and agricultural experts from other regions in the hopes of attracting experts to the region.

3. Future research should be encouraged on:

    a. *Water resources* → more information on water resources in the area, including their location, depth and water quality would be useful to herders and vegetable farmers in planning for the future of their communities. Research of this type should include community members, training them on the technical side of water monitoring and water quality analysis.

    b. *Gender and water* → further investigation of the unique situation identified so far with regards to gender and water collection and the lack of gender differences in "top five" water priorities.

    c. *Vegetation studies* → ecological research on vegetation (species diversity, abundances, distributions, seedbanks, etc.) is required to monitor trends and identify whether changes are occurring and, if so, what the primary drivers are; this data will be beneficial to the development of meaningful management plans that reflect ecosystem dynamics in the area.

    d. *Pasture and water resources relationship* → the contradictory information received during the PRAs about whether families move based on pasture or on water indicate a need to further investigate this intricate connection between the two in order to completely understand the matter.

4. Continue PRA work in the future with all communities. In general the community members appeared to enjoy contributing to the PRA activities and socializing. Overall, this cooperation during activities works to build group dynamics which leads to stronger groups and individuals and communities that are active and empowered.

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We would like to extend our appreciation to the participants from the eco-herder communities and vegetable farming groups within the Omnigovi aimag for their willingness to share information during the PRA activities. Thank you also to the community members and officials who agreed to be interviewed to improve knowledge about water and vegetation related concerns in the area.

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J. Jargal, Director of the Steppe Forward Programme, is commended for her organization of trip and role in forming the eco-herder communities, as was Byambatseren, community organizer for the vegetable farmer groups, who coordinated efforts in Nomgon. It is hoped these community groups will successfully continue to reach their goals for community development and cooperation.

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Appendices

Appendix A: List of PRA Participants & Interviewees

PRA Participants

Ikh Gobi Community:

- Baigal A.
- Batchuluun B
- Tsendenbal Ts
- Tuyamaa
- Bayar
- Avirmed

Gobi Khishig Community:

- Byamba

- Bold
- Naraantuya
- Dorjsemne
- Tsolmon
- Ganbaatat
- Natsag
- Ontom
- Baatsom
- Namsra

Vegetable Farmer Groups:

Unfortunately there is no record of a list of participants for the vegetable farmer PRA sessions. 14 vegetable farmers participated in the PRA (13 were female and one was male). 7 vegetable farmers represented from the eastern community and 7 from the western community. Both Bayamatseren (community organizer) and Munkhtuya (environmental inspector) attended this meeting.

Interviewees

1. Byambatseren – Nomgon Community Organizer for the Steppe Forward Programme Former Governor, Secretary of the Sustainable Livelihood Project, Nov 18, 2006

2. Battogtokh – Nomgon School Director, Nov 19, 2006

3. Munkhtuya – Nomgon, Environmental Inspector, Nov 19, 2006

4. Ravjir R. – Director of Research, Protected Area Administration, Nov 21, 2006

5. Otgonbayor – Aimag Government Official, Responsible for Land, Tourism and Environmental Policy, Nov 21, 2006

Appendix B: Water Use & Priority Tables

Part A: Ikh Gobi Community

Ikh Gobi - Men - Water Priorities List

Water Use	Type	Amount /week	Priority
water for herds	animals	many tons	1

Ikh Gobi - Women - Water Priorities List

Water Use	Type	Amount/week	Priority
Watering herds	animals	4200 L/week (200 goats) (1	1

						goat = 3L/day)	
Washing clothes	cleaning	120 L	1	Washing dishes	cleaning	21 L	1
Cleaning the home	cleaning	20 L/	1	making food & tea	food	280 L	1
Washing floor	cleaning	42 L	1	making dough – noodles	food	1.5 L	1
making tea	food	70 L	1	Washing face & hands	sanitation	42 L	1
making food	food	42 L	1	Washing clothes	cleaning	140 L	2
making tea with rice	food	35 L	1	Washing vegetables for cooking	food	14 L	2
making vodka	food	70 L	1	having a bath	sanitation	10 L	2
boiling (steaming) meat	food	14 L	1	Watering vegetables	vegetation	700 L/week in season	3
Cleaning animal meat	food	10 L	1	Washing herds	animals	3000 L/year	4
Washing face & hands	sanitation	23 L	1	Cleaning the fence of the livestock	cleaning	2000 L/year	4
Bathing	sanitation	35 L	1	rinsing (foreign ready-made) noodles	food	10 L/time	4
Washing children	sanitation	21 L	1	making felt	felt	80 L/time per year	5
coolant for radiator (engine)	vehicle	10 L/time	1	Washing hides (skins)	animals	no amount provided	5
Washing livestock	animals	5 L	2	Washing camel hides	animals	40 L/time	5
making felt	felt	20 L/time	2	making clay for fence	building	60 L/time	5

making juice with powder (lemonade)	food	5 L	3
using water to cool themselves (in the summer)	other	no amount provided	3
making water vapor (purifying water for the car)	vehicle	no amount provided	3
Washing/cleaning car alternator	vehicle	10 L/time	3
Notes: everything uses water; water is a treasure			
Outside herding, use an estimated total of:		Total est: 602 L/week	

Washing floor & wooden walls	cleaning	20 L	5
Washing carpets	cleaning	35 L	5
Washing curtains & other cottons	cleaning	30 L	5
making vodka	food	30 L	5
making dough - cookies	food	3 L	5
making lemonade	food	2 L	5
making cement	building	60 L/time	5
Washing vehicles	vehicle	30 L/time	5

Part B: Gobi Khishig Community

Gobi Khishig - Men - Water Priorities

Water Use	Type	Amount/day	Priority
Food	food	20	1

Gobi Khishig - Women - Water Priorities

Water use	Type	Amount/day	Priority
Tea (1)	food	10-20 L	1

Watering herds	animals	2-4 ton (depends on livestock)	2
washing dishes	cleaning	3	3
Wash cat and dog	animals	5	4
water for vegetables	vegetable	1-2 ton (depends on size of planted area)	5
Wash clothes	cleaning	40	6
cleaning the home	cleaning	5	7
watering trees and bushes	nature	500-1000	8
making livestock feed (for winter only) like soup	animals	100	9
Having bath	sanitation	20	10
wash face & hands	sanitation	1	11
Mixing clay for fence	building	500-1000L	12
making camel vodka	food	-	13
playing with water to cool off	other	200-500L	14
washing livestock	animals	5-10 ton	15
washing car & motorbike	vehicle	500	16

Food (1)	food	5-10 L	1
Wash clothes (4)	cleaning	20-30L	1
Water herds (2)	animals	1500-3000	1
Planting vegetables (3)	vegetable	1 tonne – 2000 L	1
Having bath (5)	sanitation	10-20L	1
Washing bowls	cleaning	2-3L	2
Making felt	felt	500 L	2
Cleaning home	cleaning	5-10L	2
Feeding dog	animals	3	2
Making vodka	food	20-30	2
Washing face and hands	sanitation	3L	3
Washing herds	animals	1000-2000L	3
Washing felt	felt	20-30	3
Washing hair	sanitation	5-10L	3
Washing big pot (for cooking)	cleaning	2-5L	3
Plant trees	nature	50-100	4
Washing dishes (bigger than	cleaning	3-5L	4

bowls)			
Watering flowers	nature	5	4
Mixing clay	building	100-300L	4
Washing cat	animals	2	4
Washing car	vehicle	50-100	5
Make bricks	building	100-200	5
Washing wooden parts of ger	cleaning	10-20 L	5

Part C: Vegetable Farmers Community

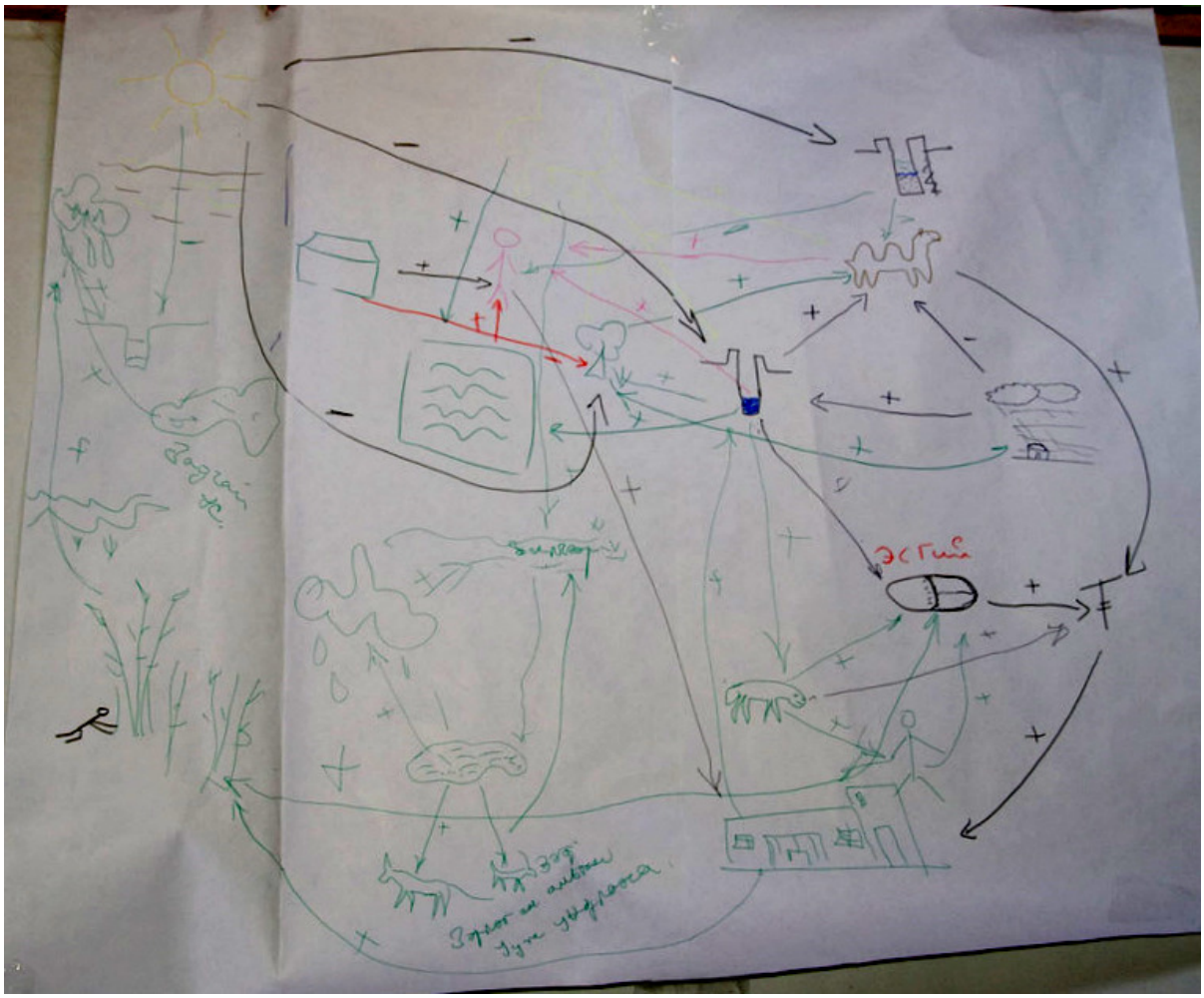
Vegetable Farmers - Man

Water Use	Type	Amount/day	Priority
Tea	food	8L	1
Food	food	6 L	1
Water vegetables	vegetable	300 L	1
Washing car	vehicle	40 L	2
Having bath	sanitation	7 L	2
Water herd	animals	700L	1
Washing children	sanitation	5 L	2
Washing clothes	cleaning	20 L	1

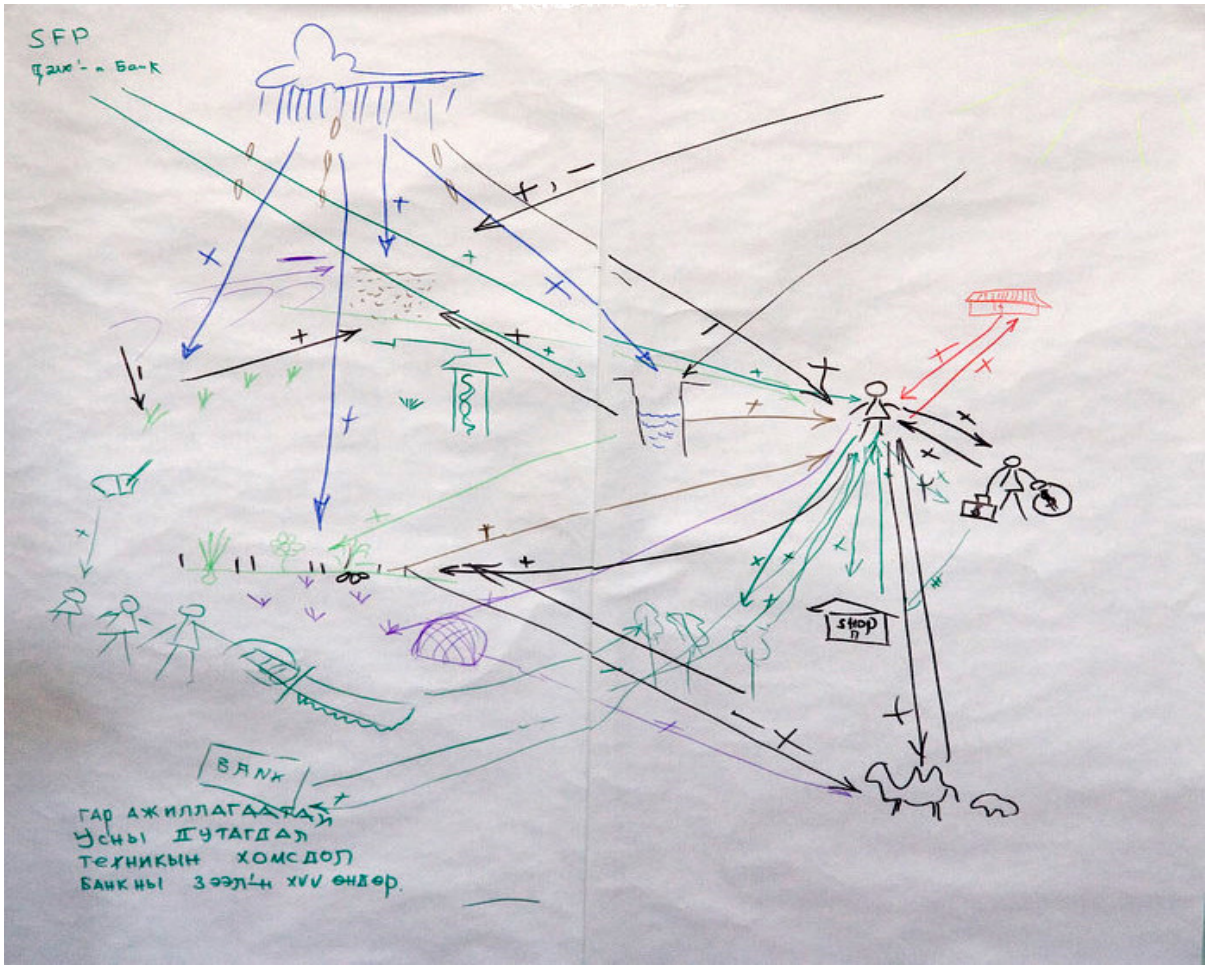
Vegetable Farmers Woman

Water use	Type	Amount/day	Priority
Water use		Amt per day	
Water vegetables	vegetable	10 Tonnes	1
Make tea	food	10 L	1
Wash dishes	cleaning	4 L	2
Wash clothes	cleaning	50 L	2
Having bath	sanitation	20 L	2
Washing ger floor	cleaning	20 L	2
Cooking food	food	5 L	1
Water dog	animals	0.5 L	2
Water herd	animals	2 tonnes	1
Camel		30 L	
Goat		4 L	
Sheep		3 L	
Cow		5 L	
Horse		5 L	
Water trees	nature	40 L	1

Appendix C: Influence/Rich Picture Diagrams



Influence diagram of Gobi Khishig herder community.



Influence diagram of vegetable farmers in Nomgon soum.

Appendix D: Problem Trees

Ikh Gobi Herder Community

Problems	Causes	Impacts	Solutions
1. lack of water 2. decreasing vegetation 3. salty water 4. drought (dry weather)	1. less rain 2. no trees & vegetation to attract rain (if vegetation cover is dense, then rain comes through feedback loop) 3. landscape (regional geological structure, salt coming from rocks) 4. lack of water (due to too much sunlight & salt in the soil)	1. liver & kidney diseases (impact of salty water) 2. livestock not getting fat (impact of salty water)	1. make large artificial basin/lake 2. shoot clouds (cloud seeding) 3. plant trees to make artificial forest 4. purify salty water for drinking 5. drill deeper wells 6. use artificial things to collect water 7. get special equipment for water purification

Vegetable Farmer Community

Problems	Causes	Impacts	Solutions
1. water resources getting lower every year (lack well equipment) 2. lack of technical equipment (tractor, etc.), cannot plant seeds early enough to get seeds 3. lack of wells (only a few wells) 4. drinking water is too salty (get sick) 5. not enough buyers b/c financial ability low 6. far from market 7. high cost of seeds & poor quality (cannot get seeds from own vegetables due to time, tractor access poor, by hand, cannot afford therefore late; buy seeds from China and elsewhere; cannot devote crop to seeds, need to eat)	1. drought & hard winter 2. bank's credit (high interest) 3. few buyers (small market) 4. people unable to buy vegetables b/c of livelihoods 5. centre market very far to Dalanzadgad (110km from Nomgon, 730km to UB, 100km to nearest soum centre) 6. bring seeds from northern part of Mongolia (Khangai) so fuel cost is high (also plant late) 7. soil fertility is low (nutrients poor) 8. climate is harsh 9. windy, etc. 10. (cost high, profit not good)	1. crops - low amount (low yield) 2. planting time is really late b/c lack equipment 3. water resource & supply poor (decreasing water, few wells) 4. effecting health 5. soil getting salty from salty water 6. cannot improve own livelihood level because people cannot buy the vegetables & market is far 7. cost increasing, revenue decreasing 8. financial & economic ability very low	1. plant trees/make forest (use trees to protect vegetation seedlings from wind, idea from china: black plastic over soil and leave hole for plant to come out) 2. establish greenhouse 3. cooperation (work together) 4. creativity (creative in new ideas) 5. need government policy – to attract specialists (convince professionals & ag. students to come to this area instead of going north) 6. establish own foundation (find projects to fund vegetable farming & improve financial capacity) 7. make seed bank (of own seeds) 8. training sessions for farmers on how to plant vegetables (also preservation) 9. attract specialists to area via gov. incentives (no one wants to go to area because cannot make money) 10. need local government support