

## Early Warning System for Pastoral Herders to Reduce Disaster Risk by Using a Mobile SMS Service

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### ABSTRACT

Herders in Mongolia are directly affected by climate change impact more than urban residents. This research project is developing an early warning system to prevent disaster risk by using mobile SMS services based on the partnership between a scientific research group, local policy makers, industrial technology developers and support of pastoral communities. The mobile message based forecasting system has included common weather information, forage information and other local requested information and been delivered in current time since August 2013 in a case study in Biger *soum* of Gobi-Altai province, Mongolia. After the system had been implemented 98% of participants agreed they had improved knowledge about adaptation to *dzuds*, understood the importance of information access, found it was manageable for their daily job and believed it would help reduce impacts of climate disasters.

Keywords: Information delivery, SMS, *dzud* risk management, adaptation

### INTRODUCTION

Global climate change is a great challenge to Mongolians and requires adaptive solutions for nomadic herding systems to cope with natural disasters of drought and winter extreme *dzud*. The traditional nomadic herding system (*hot ail, otor*) has changed a lot due to privatization of livestock, affecting the mind of herders, education of young herders, support of community groups, information sharing mobility for herders, pasture management policy from government and the livestock market system in local areas, all of which play important roles in the herding system management.

Herders in Mongolia are directly affected by climate change more than urban residents. The herders' livelihood is dependent on seasonal climate difference, weather conditions and landscape resources of vegetation, water, natural zones, and soil productivity. In the winters of 1999-2002 and 2009-2010 Mongolia experienced the most severe serious *dzuds* (very heavy winter with heavy snow cover, cold temperature and no forage). A

resilience building project to enable better adaptation to climate change by herders has been initiated in a case study area to enable various practices to be tested (Suvdantsetseg et al., 2014).

Biger *soum* located in the Gobi Altai province of Mongolia, experienced large losses of livestock during the *dzud* events in 1999-2002 and 2009-2012. In 2002, the area experienced heavy snows from early to middle February with snow depths from 0.8-1.3 meter, and severe cold temperature that were below  $-35^{\circ}\text{C}$ . During this event, most of the big animals (horse and yaks) froze to death in the mountain pasture and small livestock either froze or died of starvation due to snow cover preventing any grazing. There was limited weather forecasting. During this *dzud* local government had no systems in place to help the herders. Biger *soum* has no fodder fund, nor storage of hay, fodder and forage to deliver to herders as the first phase in a national response. Herders relying on traditional knowledge did not think the winter would be so hard and they did not get any early warnings of the *dzud*. Consequently the herders did not sell any extra animals, in part because of poor access to markets, nor prepare in other ways for a *dzud*.

Herders have not been provided with information on how to adapt to severe conditions by managing pasture carrying capacity, nor optimizing livestock numbers and quality. This *dzud* identified the need for information access as a critical part of climate change adaptation to these tough seasons. A national herding information access system can be built on the new technologies now available (more people have mobile phones). In addition training programs can be linked to this system to provide information to herders on adapting to adverse seasons.

Several organizations are now producing information related to forages and pasture carrying capacity (Livestock Early Warning System [LEWS] project 2013), and training herders (Leveraging Tradition and Science in Disaster Risk Reduction in Mongolia [LTS] project 2013 by Mercy Corps and Radio and TV weather forecasting National Agency Meteorology and the Environmental Monitoring (NAMEM)). However the information now delivered does not get to the herders in words they clearly understand.

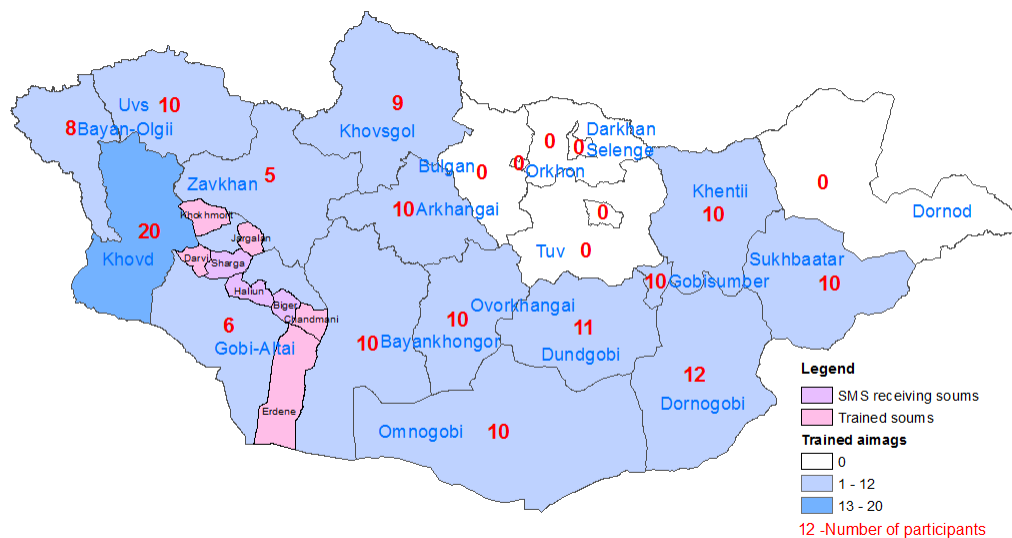
The main objective of this research was to develop an early warning system for adverse climatic events by using mobile SMS services to provide herders with information to improve awareness of weather conditions and to help herders minimize impacts of drought and winter disasters.

## METHODS

This research project (started in 2012) used a mixture of quantitative and qualitative methods to develop and test a national herd information access system that included: preliminary survey by interviews with herders and local governors, demonstration workshops, focus group discussions, questionnaires, photo observations, online feedback system (SMS receiving system) and online teaching to design a national herd information access system and then tested that system for information delivery in a case study *soum*. The below steps were followed:

1. Preliminary survey conducted with herders and local governors to identify their system requirements of *dzud* adaptation options and needs of scientific data for decision support. This survey included 7 *soums* of Umnugobi province, 8 *soums* of Gobi-Altai province and 3 *soums* of Tuv province in 2012. While we identified that an early warning system development were required to develop in Mongolian pastoralists' disaster management. The interviews in 2012 identified that 92% of respondents wanted an early warning system, 99% could not access information on daily basis, and 78% wanted capacity building to train herders in traditional and new knowledge (Oba et al., 2014).
2. Then we started to develop the technical system design that resolved to structure the delivery of information into three parts: Weather data - daily maximum and minimum temperatures, precipitation, wind speed; Forage information – herbage mass kg dry

- matter/ha; and local social information based on the herders' interest. Other aspects of system design identified the need for a database, device applications and interface design and then presentation to end users considered the targeted customers, and timing and frequency of information.
- An investigation of information availability was conducted and the most credible data sources were found to be the Norway meteorological institute open source data for weather forecasting information (<http://www.yr.no/place/Mongolia>) and the Texas A&M University open source data for forage forecasting information (<http://glews.tamu.edu/Mongolia>).
  - Partnership for the delivery of the system was formed between the operating company, system developer and local government. A contract was established between MobiCom corporate, the National University of Mongolia and Keio University to delivery mobile SMS messages at a cost of 15 tugrug per message to all MobiCom users in Mongolia. We extended partnerships in 2014 to G-Mobile corporate and the National Development Institute of Mongolia.
  - The system test was implemented in Biger *soum* after users had received training in August 2013. In a survey after the system implementation were conducted the online feedback system that is how system useful to improve awareness of *dzuds*, how to use the data delivered, and how useful for decision makers and business mans. We received the customer's comments by SMS reply system which could see in online MobiCom account to evaluate the case study of the system.
  - In order to expand the early warning system in the other cities not only in Gobi-Altai but also other Mongolia cities we organized demonstration workshops and onlite training. Demonstration workshops were held in the 7 *soums* of Gobi-Altai province in August 2014 where users were suggested to use different mobile operators based on their local capability: G-Mobile in Khukh Morit, Darvi and Jargalan *soums*; MobiCom in Sharga, Ysunbulag and Biger *soums*; and Skytel in Chandmani and Erdene. Online training on "The importance and usage of information system to prevent disaster risk via SMS service" was organized in cooperation with Mercy Corps International at 5 regional centers of Mongolia 4-5 September 2014.



**Figure 1.** Implementation map of the Early Warning System for disaster risk reduction.

**Case study *soum***

Biger city is located in the Gobi-Altai province of south western Mongolia, an area remote from large economic and population centres. There are 5 villages (*bagh* in Mongolian) governed by this city. Biger region covers an area of 3730 square kilometres,

with 2249 inhabitants (male 1143, female 1106), 635 stakeholders and 130000 numbers of livestock. The local climate is continental harsh, semi-arid, and salty (Namkhajantsan, 2006). Summer annual average air temperature is about 25°C, sand soil surface temperature is 45-60°C, annual precipitation is 73mm, and sunshine is 3103 hours/year.

Biger town is an important communication network centre at the meeting point for access roads from other southern towns to the centre of Gobi-Altai city. Mobile phone operators have infrastructure in the town and service 1150 MobiCom and 350 UNITEL users. 24% percent of the population live and work in the town centre, the rest are involved in the pastoral herding industry in neighboring and remote areas. Livestock provide the main local employment and livelihoods for the local economy. This *soum* was very adversely affected by the serious *dzud* in 1999-2002. They lost 34224 (24%) livestock (camel 1276, Horse 2076, Cattle 2678, Goat 13952 and sheep 14246) with medium to long-term effects on the livelihoods of herders and the local economy.

## RESULTS

The system development was successfully developed by the Keio University based on integrated database from existing creditable database and management of collaboration between scientific, communication and governmental organizations.

The system test was implemented in Biger *soum* after all users had received training. In a survey after the demonstration workshop, 98% of participants agreed they had improved knowledge about adaptation to *dzuds*, understood the importance of information access, found it was manageable for their daily job and believed it would help reduce impacts of climate disasters.

After the system had been implemented 154 feedback response from users of Biger *soum* were received: 98% of respondents were satisfied with the information received and where using it daily, 43% understanding that early preparedness is important for disaster prevention and managing pasture capacity, 11 % want to get forage information for other *soums* and 17 % wanted improved content of the SMS on agriculture businesses, infectious diseases, raw product market price and other social information.

One hundred and sixty-eight people participated in the online training (Altai region 36, eastern region 33, Gobi region 31, Khangai region 30 and western region 38) from diverse organizations of Agriculture partnerships (APs), Local Emergency Management Agency (LEMA), local Agency Meteorology and Environmental Monitoring (LAMEM), Zoonosis disease research institute, *soum*, *bagh* and provincial officials, herders, local farmers, and agro farmers. Surveys done found that 99% of participants understood the impact of climate change on their livelihoods and how adaptation can limit its impact; 92% percent of participants wanted capacity building training workshop including more young and experienced herders, partnership organization and governors to solve the sustainable use of system in their regions.

## DISCUSSION

Even though data accuracy and some operational matters remain problems, the information delivery system itself is providing efficient access to relevant information for herders as acknowledged by their responses.

The operating Company MobiCom has to improve the life time (from 2 minutes to 2 days) of their telemarketing SMS service to improve delivery to users.

The Mongolian weather forecasting agency National Agency Meteorology and Environmental monitoring agency (NAMEM) should cooperate with scientific development agencies on their forecasting technology to align with herder needs.

The local government, development fund should consider including a disaster prevention budget to support the sustainable use of system at the local level to reduce the countries social and ecological vulnerability.

Local adaptation plans should consider the use of forage forecasting information for pasture protection, irrigation needs, improvement of soil productivity, breeding of livestock and hay preparation zone planning.

The national government should expand herder training in traditional and new technology development of adaptation and pasture management, livestock husbandry system, improvement of livestock productivity, marketing system and agribusiness development. The system reported here requires herders to have a higher level of knowledge to interpret the data provided.

The operating organization of this system needs to continue to organize public awareness activities broadly through media, credibility of information, and coordination of customers.

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