# DAMAGE FROM COLD AND SNOW DISASTER (*DZUD*) AND COUNTERMEASURE

## Seishi Yamasaki

Japan International Research Center for Agricultural Sciences 1-1 Ohwashi, Tsukuba, Ibaraki 305-8686, Japan

*Seishi Yamasaki* received a Ph.D. in agriculture from Kyoto University (in Japan). His expertise is in the area of animal nutrition and management, especially dryland. He has worked at Kyoto University. He joined the Japan International Research Center for Agricultural Sciences (JIRCAS) in 2000 and is currently a project leader there.

## ABSTRACT

A *dzud*, in Mongolian, is an abnormal winter weather condition in northeast Asia characterized by snowy and cold winters so harsh that livestock are unable to graze through the snow cover, causing starvation and eventually death. Apparently, damage to Mongolia due to *dzud* has gotten worse in recent years. It has also inflicted serious damage and has affected farm management in the region.

Extreme weather is the main reason for livestock mortality in Mongolia. On the other hand, the country's livestock population was basically constant up until the early 1990s, but the introduction of market economy led to high demand for animal products such as cashmere wool and meat. As a result, livestock population grew rapidly to cope with demand. On average, *dzuds* strike every 10 years, but it was noted to have occurred more frequently during the past 10 years, disrupting its normal cycle. This further increased grazing pressure resulting to pasture degradation and it has been a contributing factor of the *dzud*.

It is, therefore, important that a diversified risk management and a grassland conservation system are established. The objective of the JIRCAS research project in the region is to develop livestock farming systems which contribute to the mitigation of risks to herder-households and grasslands caused by extreme weather events. The collaborative research will focus on the following countermeasures:

First, procedures for producing and disseminating rapidly-updated carrying capacity maps at a regional scale will be developed. These maps will give estimates of reasonable grazing density during autumn to spring to reduce damage to pasture. To produce the maps, maximum pasture biomass in a year will be determined during summer seasons using satellite remote sensing technology, and animal intake will be determined by seasons and pasture types.

Second, information on promising fodder crops and the elucidation of a sustainable cropping system to minimize soil degradation will be provided. Techniques for the preparation and conservation of supplemental feeds by ensiling local feed resources will be developed to reduce feed deficiency during cold seasons. Early fattening techniques for young animals by supplemental feeding will be promoted, and value-added dairy products will be produced to contribute to risk reduction and to stabilize herders' household economies.

Third, herder- and farm-management techniques that are resilient to risks will be elucidated, and a riskresilient pastoral management system will be recommended.

The Mongolian government is now identifying effective ways to reduce the risk of *dzud* and bring improvements to the animal husbandry sector. The parliament approved in 2010 the "Mongolian National Livestock Program", which settled relevant issues and contained a comprehensive plan for the next 10 years. Three percent (3%) of the annual national budget has been allocated to carry out the program, whose targets and contents are in agreement with the JIRCAS project. We hope that our research activities could solidify the program, and that the results would influence policy making decisions by Mongolian leaders.

### **KEYWORDS**

carrying capasity, market economy, risk management, pastoralism, pasture degradation

### REFERENCES

National Statistical Office of Mongolia, 2012: Statistical Yearbook - 2011.

Thomas Barfield, 2009: Nomadic Pastoralism in Mongolia and Beyond. In *Mapping Mongolia* (ed. by Paula L. W. Sabloff). University of Pennsylvania Press.









## **Mongolian Livestock National Program**

#### Importance of livestock husbandry:

Livestock husbandry is a distinctive livelihood practice in Mongolia... Livestock is ... one of the country's main economic pillars and the basis for Mongolia's development.

#### **Purposes:**

#### -To develop <u>a livestock sector</u> that is adaptable to changing climatic and social condition and create an environment where the sector is economically viable and competitive in the market economy - To provide <u>a safe and healthy food supply</u> to the population, to deliver guality raw materials to processing industries, and to increase export.

**Duration:** 1<sup>st</sup> phase; 2010-2015 / 2<sup>nd</sup> phase; 2016-2021

Budget: 3% of state public expenditure, annual. Donors etc.

## Mongolian Livestock National Program

#### **Priorities:**

- Improving <u>livestock breeding</u> to meet with demand and to increase export
   Strengthen <u>veterinary and breeding services</u> at local level and bringing
- services to international standard **3. Developing** *livestock production* that is adaptable to climatic and
- ecological changes with strengthen risk management capacity
  4. Establishing proper processing and marketing structures and increasing economic turnover.

Structure and contents of the Mongolian National Livestock Program

- Chapter 1 Current state of the livestock sector 2 Rationable and need for the national program
  - 3 Program goal and priorities
  - Program objective and activities
  - 5 Inplementation time frame and expected outcome of the program
  - 6 Indicators of program implementation
  - 7 Management and structure of the program8 Financing
  - 9 Reporting, monitoring and review of program implementation

## Development of resilient agro-pastoral systems against the risks of extreme weather events in arid grasslands in Northeast Asia (FY2011-16) 1. Development of geospatial information tools for pasture utilization which can contribute to the control of grazing pressure 2. Development of techniques which can contribute to risk reduction and to stabilization of herders' household economy

3. Elucidation of and <u>recommendation for</u> a risk-resilient pastoral management system



8













7

12



## Feed and feed materials in Mongolia

Туре	Year				
	2006	2007	2008	2009	2010
Hay	983.3	933.1	1,030.9	912.3	1,137.3
Wheat straw	4.0	8.5	11.1	8.5	8.3
Wheat residue	6.3	3.1	2.4	8.9	11.1
Hand-made	34.0	35.4	34.4	25.8	32.7
Minerals	48.5	50.5	53.8	47.0	48.0
Fodder crops	10.2	14.1	19.9	10.4	34.8
Wheat bran	34.5	29.6	56.6	104.8	95.9
Mixed feed	25.0	22.3	26.3	39.3	65.8
Brewers' grain	2.1	5.1	5.5	9.0	12.5
Distillers' grain	54.4	77.2	91.5	47.8	48.7

Pasture plants and vegetable by-products/residues It's important how to use the feed resourses more effectively.

14











17

18







51

**Chairman Dr. Tomoyuki Kawashima:** Shall we start the Session 1. The livestock sector, especially pastoral, is very vulnerable to extreme weather or natural disasters. In the Horn of Africa, for example, the severe famine was occurred due to the drought last two years. As mentioned by our President at the opening remarks, considering such a big shock to the people who live in there, we set this session to the top of the program. In this session, we will discuss about resilience in the livestock sector. I would like to introduce the first speaker, Dr. Seishi Yamasaki, JIRCAS. He took his Ph.D. from Kyoto University and his background is animal nutrition management in dryland. He has a long research experience in Mongolia. The title of his presentation is "Damage from *Dzud* and Countermeasure in Mongolia." Dr. Yamasaki, please.

**Dr. Seishi Yamasaki:** Thank you chairman for your introduction. Ladies and gentlemen, good afternoon. Today, at first, I will introduce the damage of cold and snow disaster, *dzud* in Mongolian, and its background. Then the two countermeasures for *dzud*, Mongolian National Livestock Program and JIRCAS project in Mongolia, will be presented.

The adult livestock population and mortality calculated by Mongolian livestock unit, from 1989 to 2011, are shown in the figure. The population had been stable during the socialist era, or until the end of the 1980s. But, soon after the introduction of market economy, the number started to increase from middle of the '90s. From 1999 until now, *Dzud* occurred for two times, the one during 1999-2002 and the other in 2009/2010. The economic losses caused induced livestock deaths got worse in the recent one; it accounted for almost 10 million animal deaths.

The affected areas by the last two *dzud* are shown in this slide, shown the magnitudes of the affection with the different color, the magnitudes are different by the areas and the times. But it's the same the *Dzud* affected to very wide areas.

Here, in the next slide, the background of *dzud* is mentioned. Socio-economic reform included the introduction of a market economy, the enhancement of Private Ownership Act, which went into effect in the late 1980s, was accelerated in the early 1990s, and exerted a large influence on the pastoral livestock system. The number of herdsmen continued to increase in the 1990s: the number increased by a factor of 3.1 between 1989 and 1998 because of a high rate of unemployment throughout the country and the livestock production sector played an important role as a safety net of the society at that time. The livestock population continued to increase; it reached historical highs of 28.6 million in 1995 and 32.9 million in 1998. And many people emigrated from the remote areas to the population centers such as the capital city, Ulaanbaatar. The fodder production in the fertile forest steppe area decreased sharply, then the price of fodder rose dramatically, and herdsmen were constrained more strictly to natural pastures around their quarters during the cold. These situations may demonstrate the transfer of the burden of risk from agricultural cooperative during the socialist era to individual households. Excessive grazing and pasture degradation occurred, especially in and around centers. Sustainability of the production system decreased, and the risk of *dzud* increased at that time.

Until the end of the 1990s, most of the constraints had been pointed and required to be solved. But from the '99, the *dzud* occurred two times until '10 and many constraints seem not to have been solved even though many activities were carried out by the Mongolian government, including the both of central and local governments, and foreign donor organizations. Therefore, risk management along with pasture conservation has been requiring.

In 2009, the Mongolian parliament assigned the Mongolian Livestock National Program. At first, the program mentioned the importance of livestock husbandry, that livestock husbandry is a distinguished livelihood in Mongolia, and the livestock is one of the country's main economic pillars and the basis of Mongolia's development. The main purposes were set: to develop a livestock sector that is adaptable to changing climatic and social conditions and create an environment where the sector is economically viable and competitive in the market economy; and to provide a safe and healthy food supply to the population, to deliver quality raw materials to

processing industries, and to increase export.

The program started two years ago, and it is now the third year of the first phase. The first phase will continue until 2015. The second phase will follow, until 2021. It is a 10-year program. 3% of annual state public expenditure is used for the program, in addition to the support by donor organizations.

The four priorities are written in the program: first, improving livestock breeding to meet with demand and to increase export; second, to strengthen veterinary and breeding services at local level and bringing services to international standard; third, which is very close to the target of our project, developing livestock production that is adaptable to climatic and ecological changes with strengthened risk management capacity; and fourth, establishing proper processing and marketing structures and increasing economic turnover. The program itself is a big volume, and the main contents are shown in the bottom of this slide.

Next, regarding our JIRCAS project in Mongolia, it is named "Development of resilient agro-pastoral systems against the risks of extreme weather events in arid grasslands in Northeast Asia." It is a five-year project and it is now the second year. Here, the project constitution, that is, why, how and what, is simply written down. There are three main themes in our project. First, geospatial information tools for pasture utilization which can contribute to the control of grazing pressure is developed. Second, techniques which can contribute to risk reduction and to stabilization of herders' household economy are developed. Third, a risk-resilient pastoral management system is elucidated and recommended. Tools, techniques and so on are expected to be the outcome, and pasture conservation and stabilization of herders' household economy are expected to be the outcome.

Now I will explain in more detail and introduce some parts of the first years' results of the project. In the first theme, the most important outcome is to process an up-to-date carrying capacity map. It will be prepared by the central government or the research institute, and then transferred to the local government, herders' group and/or the herders themselves. During the last *dzud*, it is said that the carrying capacity map that was prepared at that time was not useful because very old carrying capacity maps were used, and the important information was not transferred to local herders. Therefore it was decided to prepare this map, and effective dissemination of the map contents itself should be one of our research topics.

How to prepare an up-to-date carrying capacity map? It starts from combination of satellite imaging data and ground truth data. Vegetation sampling was done to determine the aboveground biomass of the pasture. On the other hand, a spectral radiometer is used to get the spectral data to apply to the regulation analysis with the biomass data. And the resulting data is calibrated with remote sensing data. Alongside that, land/pasture use information are collected and overlaid using GIS techniques. Hence, we can make many types of maps, including biomass distribution and land/pasture use maps, and the maps are overlaid using the GIS technique to prepare a biomass distribution map "for grazing lands". We also determined the animal intake by ourselves and calculated the grazing capacity. Then, grazing capacity map is made by the integration of the biomass distribution map "for grazing lands" and the animal intake. Examples of a land-using map and a biomass distribution map are shown in this slide.

In the next theme, there are four research topics. The first one is about fodder crops, the second and third ones are about animal feeds and the fourth one is about milk products. First, information on promising annual fodder crops is provided, and the conditions suitable for a sustainable cropping system are elucidated. Then it gives important information for the next topics, the development of feeding management, that is, preparation and conservation of supplemental feeds, evaluation of their nutritional values, and development of early fattening techniques for young animals by supplemental feeding using underutilized feed resources. The early fattening techniques mentioned now means reducing the reduction of the live weight as much as possible during cold seasons, then they will grow up earlier for sale and slaughter. Fourth, development of techniques to process value-added milk products. By the all of these four studies, we aim to give options to improve the productivities and reduce or

maintain the number of animals to contribute to increase the sustainability of herders' household economy which can be competitive in the market economy.

Regarding feed and feed materials in Mongolia, related to the topic on animal feed, for example, the brewer's grain is not used during summer season, although it is a very important feed resource as nitrogen source for animals in other countries. So it is very important determining how to use feed resources more effectively.

But, the types of available feeds are different by areas. For example, in Tuv Prefecture locates close to Ulaanbaatar City, and it's possible to use brewers' grain which is made in factories. On the other hand, in Urvangai Prefecture, locates around 400km far from the Ulaanbaatar City, it is very difficult to use brewers' grain so it is necessary to use local wild plants and so on.

Here are shown some of our activities and results; in the Ulaanbaatar City, brewers' grain silages are preparing and some experiments are conducted by using them, and in Urvangai Prefecture, pasture plant silage are prepared.

The third research theme is that of agricultural economic study. It was to estimate effects on the risk, considering regional differences, individual households and the systems of pasture utilization from the study in both of Mongolia and Inner Mongolia. Because there are many differences in the agricultural systems in Mongolia and Inner Mongolia, the comparison of the two regions is very effective, we think. The outputs are elucidation of response and coping mechanisms, and recommendations for a risk-resilient pastoral management system.

It's one of the results of the agricultural economic study, comparing conditions before and after dzud. After dzud, economic activities seem to decrease in comparison with before the dzud, although there were some differences in the effect between areas. But, in general, it is said that the dzud affected and decreased the economic activities at the herders' households.

In this slide, all of the themes and topics have been written down, and we hope to get an output of technical manuals, et cetera, to be used by national and local government, then to improve the stabilization of the herders' household economy, as well as pasture conservation.

The project itself was conducted by JIRCAS and the C/P Institute, but including these two institutes, a steering committee is organized through the joining of central and local governments. The committee will make suggestions for the projects, and we will enhance the activities. When we get an outcome, the committee contributes for extension of the results. These activities are agreeable with the Mongolian Livestock National Program.

Thank you for your attention.

**Chairman:** Thank you, Dr. Yamasaki, for your clear presentation about our JIRCAS activities in Mongolia. We will have question time after the three presentations are finished, so Thank you, Dr. Yamasaki.