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A study on the Recovery Condition from the “2000 *Dzud*” and Its Characteristics

—A continued survey in Bayantsagaan County in Tuv Prefecture, Mongolia—

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Summary

The objective of this paper is to clarify the characteristics and defining factors of the recovery from the “2000 *Dzud* (snow damages),” which occurred in three consecutive years from the end of 1999 to 2001.

The distinctive features of the “2000 *Dzud*” are that the devastating *Dzud* occurred in three consecutive years and that serious damage was caused, mainly to large livestock.

The state of recovery from the 2000 *Dzud* is characteristic in that, although the total number of livestock recovered to its pre-*Dzud* level in 2006, four years after the event, large livestock were slow to recover their numbers and the increase in the total number of livestock was solely dependent on the increase of the goat population. The state of recovery is defined by the degree and extent of the *Dzud* damage (Note 12), and natural and technical factors including the breeding characteristics of livestock. Among other factors pointed out are the technical factors including the relative advantage of cashmere production, and individual factors including differences in the impact of the *Dzud* damage, differences in the situation of the maintenance of the labor force and property acquisition, and differences in expenditures for family members.

Large livestock are slow to recover their numbers, presumably because of their breeding characteristics. Also, behind the change in the composition of livestock is a decrease in the demand for large livestock as a result of the shift of transportation means to automobiles and other vehicles, and the change in the demand for livestock products as typified by cashmere. Goats and sheep have been increasing relatively rapidly because of their shorter gestation period compared with larger livestock. In addition, backed by a strong demand for cashmere, goats marked a notable increase due to an effort to make up for the decline in the sales of other livestock. Considering the price slump of cashmere (Note 13) and the small demand for goat meat, the number of goats may decrease. However, as more importance is placed on the economic efficiency of livestock after the shift to a market economy, the recovery in livestock numbers after the *Dzud* seems to assume a role to facilitate the scrap-and-build system of livestock species.

1. Introduction

Since the transition to a market economy in 1991, Mongolia had steadily increased livestock numbers¹⁾, until it was struck by a *Dzud* at the end of 1999²⁾. The *Dzud* occurred in three consecutive years from 1999 to 2001 (referred to as “2000 *Dzud*”), and caused unprecedented damage that halved the number of livestock. The damage was so serious that it wasn’t until 2006 when the livestock numbers recovered to the 1999 level. In fact, however,

the state of recovery varies widely by region and individual nomadic operation. The purpose of this paper is to summarize the distinct features of the “2000 *Dzud*” and clarify the characteristics of the state of recovery while identifying the factors that affect the progress of recovery.

As a matter of course, it is an important issue to minimize damage from natural disasters and it is necessary to identify the factors that affect the damage ratio and take necessary measures.

Discussions on these issues will be addressed at another time, for this paper focuses on the study of factors affecting the state of recovery with damage ratio as a given condition.

This paper deals with sample cases of nomadic operations of 1-Bag (Village) in Bayantsagaan County, Tuv Province, Mongolia. Tuv Province is located surrounding Ulaanbaatar, the capital of Mongolia. Bayantsagaan County is situated south of Ulaanbaatar, approximately 170 km from the center of the Province. The County consists of four Bags including 1-Bag which extends from Ulaanbaatar to the central area of the County. 1-Bag is taken up not only because of convenience but also because it is not as dry as the Gobi Desert of Mongolia, the grass on its grazing land is not as vigorous as in the north-eastern part of Mongolia, it is susceptible to the effects of wind and snow due to its mostly flat land, and therefore it suffered great damage from the *Dzud*³⁾.

The farming household survey was conducted in 2004, 2006 and 2008, following the *Dzud*, mainly for nomadic operations in 1-Bag. In order to examine the state of recovery after the *Dzud*, the 2008 survey tried to target the same operations, and was conducted searching for the same nomads on the vast plains. Although the number of cases surveyed is small, the author believes that the efforts for recovery from the *Dzud* damage by nomadic operations and their distress have been clearly described.

2. Distinctive Features of the “2000 *Dzud*” and the State of Recovery

1) Changes in livestock numbers

Changes in the number of livestock in Mongolia are shown in Figure 1. The data had been taken every 5 years up to 1970. Until the beginning of the 1990, there had been little change in livestock in either species or population. The trend changed after 1990 when Mongolia shifted to a market economy and the livestock numbers increased. In the latter half of the 1990s the livestock numbers rapid-

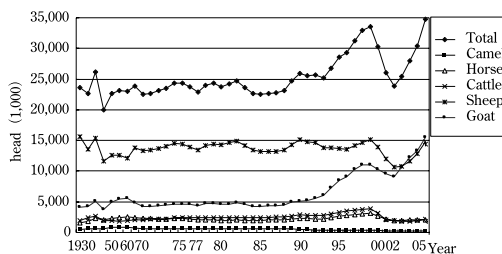


Figure 1 Transition of Livestock Numbers in Mongolia

Data:1) Livestock Numbers from 1930 to 1995 are from National Statistical Office of Mongolia [Agriculture in Mongolia 1971-1995 (A statistical profile)] Ulaanbaatar,1996.
2) Livestock Numbers from 1996 to 2006 are from National Statistical Office of Mongolia [Mongolian Statistical Yearbook].

ly increased and then came the “2000 *Dzud*” which caused unprecedented damage.

The *Dzud* discussed in this paper refers to a natural disaster that caused a sharp decrease in livestock numbers in the 3-year period since late 1999. As is evident in Figure 1, the total number of livestock decreased substantially after 2000 and did not recover to the mid 1999 level until 2006, indicating the seriousness of the impact of the 2000 *Dzud*. According to Figure 1, the total number of livestock dropped in the 1950s, the first half of the 1970s, the end of the 1970s, and the middle of the 1980s. These drops are considered to be due to the effects of *Dzuds*. However, there is no clear definition of *Dzud*. According to Komiyama who studied five such periods specified by the Government of Mongolia and universities, “the years of 1945, 1968, 1977, 2000, 2001 and 2002 are commonly regarded as the years with serious *Dzud*”⁴⁾. Here, I compare the *Dzud* in 2000 with that of 1977 (hereinafter referred to as “1977 *Dzud*”), both of which are regarded as important years for damage, to summarize the features of the “2000 *Dzud*.”

2) Distinctive features of the “2000 *Dzud*”

Table 1 shows a comparison between the “1977 *Dzud*” and the “2000 *Dzud*”. Looking at the ratio of total number of livestock to that of the previous year in the section of “1977 *Dzud*”, that for 76/75 is 97% and that for 77/76 is also 97%, each below 100% of the previous year. However, that for 78/77 exceeds 100, indicating that the “1977 *Dzud*” ended

Table 1 Comparison of Damage and Recovery Condition from *Dzud* unit: %

	Year	Total	Camel	Horse	Cattle	Sheep	Goat
1977 <i>Dzud</i>	1976/75	97	98	98	100	96	99
	change	77/76	97	100	95	99	97
	rate	78/77	105	100	99	104	107
	1975	100	100	100	100	100	100
	1976	97	98	98	100	96	99
	change	1977	94	99	93	98	96
	rate	1978	99	99	92	102	102
	1975=100	1979	100	99	92	102	103
		1980	98	96	88	99	99
		1981	100	95	88	98	100
		1982	102	95	90	99	103
	2000/99	90	91	84	81	91	93
	change	01/00	86	88	67	86	93
	rate	02/01	92	89	91	89	95
		03/02	106	101	99	101	117
2000 <i>Dzud</i>	1999	100	100	100	100	100	100
	2000	90	91	84	81	91	93
	change	2001	78	80	69	79	87
	rate	2002	71	71	63	70	83
	1999=100	2003	76	72	62	47	71
		2004	83	72	63	48	77
		2005	91	71	64	51	85
		2006	104	71	67	57	98

Data : Same as Figure 1.

Notes :1) Bold Character Means *Dzud*.

2) Figures in 1975 and 1999 are Maximum Numbers of Livestock Recent *Dzud*.

in two years. The decreased rate is within 5% for both years and the same trend is observed in the number of each species of livestock.

On the other hand, the ratio of total number of livestock to that of the previous year in the section of “2000 *Dzud*” is 90% for 2000/99, 86% for 01/00, 92% for 02/01, and 106% for 03/02. The “2000 *Dzud*” lasted for three years during which the decrease rate over the previous year amounted to 10-20%. The decreased rate by species also shows the same trend. In particular, the decreased rate of cattle over the previous year recorded 33% for 01/00 and remains around 5%, which is the level of the damage from the “2000 *Dzud*”, even for 03/02 when the number of other species recovered to the 1999 level⁵⁾.

When comparing livestock numbers immediately before and after the *Dzud*, the 77/75 ratio of the total number of livestock was 94%, while the 02/99 ratio was 71%. 1999. By species, there was no substantial difference in the damage ratio in the

“1977 *Dzud*”, while the damage ratio in the “2000 *Dzud*” was highest for cattle whose number in 2002 was 49% of that in 1999, followed by horses (63%), sheep (70%), camels (71%) and goats (83%), showing that the damage to large livestock was relatively severe. Thus, the features of the “2000 *Dzud*” are that the devastating *Dzud* occurred in three consecutive years and that serious damage was caused mainly to large livestock.

In terms of progress in recovery after *Dzud*, since the damage from the “1977 *Dzud*” was not significant, the total number of livestock in 1978 recovered to 99% of the 1975 level. Although it was in 1982 when the ratio of the total number of livestock exceeded 100% of that in 1975⁶⁾, it seems that the livestock numbers had recovered almost to the pre-*Dzud* level in the year following the *Dzud*. By species, the decrease in horses and camels that continued after the storm damage constituted a factor which slowed the increase in of livestock population.

With regard to the “2000 *Dzud*” which caused considerable damage, the ratio of the total number of livestock to the 1999 level was 76% in 2003, 84% in 2004, 91% in 2005, and 104% in 2006. It took four years to recover to the 1999 level. The progress in recovery varies significantly by species of livestock. The ratio of the number in 2006 to the 1999 level was 57% for cattle, 67% for horses, and 71% for camels. The recovery has been extremely slow for large livestock and the number of camels has been decreasing since the *Dzud*. On the contrary, the same ratio for sheep was 98%, showing a sign of recovery to the 1999 level, and that for goats was 140%, marking an even more rapid increase than the pre-*Dzud* period. This situation where the numbers of large livestock remain low while small livestock are increasing sharply is bringing about a significant change in the balance among the five species of livestock, a characteristic feature of nomadic operations in Mongolia⁷⁾.

3. Characteristics of the case study area

The damage from the “2000 *Dzud*” is also characterized by extremely large differences between

regions. Table 2 shows the damage in the study area, Bayantsagaan County in Tuv Province and 1-Bag. As already mentioned, the 02/99 ratio of the total number of livestock in Mongolia was 71%, while that in Bayantsagaan County was 40% and that in 1-Bag was 32% according to the table, showing that the damage from the *Dzud* in the study area was extremely serious. Looking at the damage ratio by species in Bayantsagaan County, cattle suffered the greatest damage with the 02/99 ratio of 12%, followed by horse (30%), camel and sheep (40%) and goat (54%). The damage to large livestock was considerable and even the least affected, goats, decreased nearly by half. The damage in 1-Bag was even more severe with the 02/99 ratio of 12% for cattle, 24% for horse, 31% for sheep and 32% for camel. Even the least affected, goats, decreased to 50% of the 1999 level⁸⁾. During the 3-year period of the “2000 *Dzud*”, the damage was particularly serious from 2000, the second year of the period, to 2001, according to the data of Bayantsagaan County.

In terms of recovery from this serious damage, the 06/99 ratio of the total number of live

Table 2 Damage and Recovery Condition from “2000 *Dzud*”

unit: head,%

	Year	Livestock Numbers	Change Rate 1999=100					
			Total	Camel	Horse	Cattle	Sheep	Goat
Mongolia (thousand)	1999	33,569						
	2000(00/99)	30,227	90	91	84	81	91	93
	2001(01/00)	26,075	86	88	82	67	86	93
	2002(02/01)	23,898	92	89	91	91	89	95
	(02/99)		71	71	63	49	70	83
	(06/99)		104	71	67	57	98	140
Bayantsagaan	1999	163,770						
	2000(00/99)	120,361	73	87	67	64	79	69
	2001(01/00)	66,067	55	70	44	21	55	70
	2002(02/01)	64,822	98	88	100	93	91	112
	(02/99)		40	54	30	12	40	54
	(06/99)		74	46	41	27	70	121
1-BAG	(07/99)		79	41	37	29	74	133
	1999	39,532						
	2001(01/00)	13,262						
	2002(02/01)	12,783	96	108	98	84	88	113
	(02/99)		32	41	24	12	31	50
	(07/99)		68	21	34	31	59	130

Data:1) Figures in Mongolia are National Statistical Office of Mongolia 『Mongolian Statistical Yearbook』.

2) Figures in Bayantsagaan from 1995 to 2000 are Statistical Office of Tuv 『*Tuv aimgiin niigem, ediin zasgiin statistikiin emhetgel*』 Zuunmod, 2001, from 2001 to 2007 are Statistical Office of Tuv 『*Tuv aimgiin ediin zasag, niigmiin baidiin tuhai taniltsuulga*』, Zuunmod.

3) Figures in 1-BAG are County Office of Bayantsagaan 『*Jiliin etssiin mal toollogiin negtgeliin “A” dans (tovchoo)*』.

Note: Figures in 1-BAG(2000) are not available.

stock in Mongolia was 104%, while in Bayantsagaan County 06/99 was 74% and the 07/99 ratio was still 79% while in 1-Bag, the 07/99 ratio was 68%, indicating that the livestock numbers have not yet recovered to the pre-Dzud level. By species, the goat is the only species whose number has recovered to the pre-Dzud level. In 1-Bag, the 07/99 ratio was 59% even for sheep, and the number of cattle has only recovered to about one-third of the pre-Dzud level. In the case study area, the damage from the “2000 Dzud” was so serious that the recovery is slow with only goats increased and large livestock slow to respond, a situation which causes a significant change in the balance among the five livestock species.

3. The State of Recovery of the Nomadic Operations of the Study Cases and its Factors

1) Damage to the nomadic operations of the study cases and the state of recovery

This paper deals with seven cases of nomadic

operations as shown in Table 3⁹⁾. According to the table, the livestock numbers dropped substantially due to the “2000 Dzud”. Looking into the degree of damage as of 2002, the livestock numbers were less than 50% of the 1999 level in all cases except for No.4. The damage ratio varied by case. In the most affected case of No.8, the ratio of the total number of livestock to the 1999 level was 20%, while in the least affected case of No.4 the ratio was 68%.

As of 2007, the total number of livestock had not yet recovered to the 1999 level in the four cases of Nos.5, 1, 8 and 4, while the 1999 level was exceeded in Nos.3, 6 and 9. The latter cases are those operations feeding smaller numbers of livestock among the cases presented in the table. By species, large livestock such as horses and cattle are slow to increase in contrast with the rapid increase in the number of goats. The study cases show the same trend as the national trend in which

Table 3 Transition of Livestock Numbers of Nomads Farming

unit: head,%

	Year	Livestock Numbers	Change Rate 1999=100				
			Total	Horse	Cattle	Sheep	Goat
No5	1999	1,665	100	100	100	100	100
	2002	608	37	35	12	35	68
	2007	1,526	92	65	33	79	262
No1	1999	1,411	100	100	100	100	100
	2002	598	42	8	13	42	70
	2007	987	70	30	35	67	114
No8	1999	582	100	100	100	100	100
	2002	119	20	28	23	9	41
	2007	178	31	24	33	8	97
No4	1999	474	100	100	100	100	100
	2002	322	68	42	8	65	111
	2007	380	80	53	49	71	130
No3	1999	461	100	100	100	100	100
	2002	231	50	113	48	28	75
	2007	587	127	123	152	69	222
No6	1999	388	100	100	100	100	100
	2002	98	25	43	5	21	44
	2007	392	101	53	26	80	336
No9	1999	93	100	100	100	100	100
	2002	42	45	13		67	50
	2007	156	168	13	57	153	260

Data:1) Figures in Livestock Numbers are County Office of Bayantsagaan [Jiliin etssiin mal toollogiin negteliin “A” dans (tovchoo)].

2) Field Survey 2004, 2006, 2008.

Notes:1) Figures in Livestock Numbers are Total Number of Livestock Owned by All Family Members.

2) We Indicate the 7 Cases that are Available Both 2004 and 2008 Survey among 14 Cases.

the increase in the number of goats pushes up the total population of livestock. The state of recovery of the study cases is summarized as follows: although the livestock numbers recovered to the 1990 level in half of the study cases thanks to the sharp increase in the number of goats, while the number of other species of livestock has not recovered to the 1999 level (except for sheep in No.9). Therefore, it is concluded that nomadic operations in general have not yet fully recovered.

In case No.3, the livestock numbers increased to exceed the 1999 level in all species except for sheep. On the contrary, in the case No.8, the 1999 level has not been achieved in all species and the total number of livestock is around 30% of that in 1999. Noting the difference in the state of recovery among cases, the following section focuses on the study of factors that affect the progress in recovery by taking up case No.1 as an average-recovery case, No.3 as an over-recovery case and No.8 as a non-recovery case.

The table does not show the number of camels because there was no case where camels were fed as of 2007. Camels had been used mainly as a mode of transportation from one grazing land to another. Also due to the reduction in the number of fed horses, the nomadic operations of the study cases have come to own automobiles and motorcycles. Table 4 shows the automobile and motorcycle ownership among the study cases. Automobiles

are owned in five out of seven cases. Among them, three cases are where automobiles were purchased in or after 2006. Motorcycles are owned in five cases other than the cases where the survey has not completed. In most cases, they purchased motorcycles in or after 2006¹⁰⁾. Thus, more operations have come to own automobiles and/or motorcycles. With regard to how they purchased such transport, No.1 paid for a jeep which was purchased in 1999 with 100 sheep and cashmere. No.3 paid for an automobile which was purchased in 2006 with the saving of 1.2 million Tg and 0.8 million Tg gained by selling a motorcycle, along with sheep and goats for the remaining portion of the price. In this way, they sell livestock in order to purchase automobiles and motorcycles. Thus, acquisition of properties involving the sale of livestock is one of the factors for the delay in recovery of livestock numbers.

Nomadic operations also expend money for marriage and education of family members, in which livestock are sold and thus decreased. The state of the labor force as of 2008 and changes in the family members after 1999 are shown in Table 5. In all cases, they seem to have expended money for marriage or education. In the cases of No.5, No.1 and No.4, in particular, there have been many such occasions as university entrance or marriage and therefore are assumed to have large expenditures.

Table 4 Property of Transportation(Car and Bike)

	Numbers	Type	Car		Motor Bike	
			Purchased Year	Price (10 thousand Tg)	Numbers	Purchased Year
No5	1	truck (used)	2007	3,500	-	-
No1	1	jeep (used)	1999	410	1	2006
No8	0				1	-
No4	1	truck (used)	1992	-	1	2007
No3	1	auto mobile	2006	300	3	-
No6	1	truck (used)	2007	3,000	-	-
No9	0				1	2008

Data: Field Survey 2004,06,08.

Note: 1) - means not available.

2) Tg is an abbreviated designation of the money unit Tugrik of State of Mongolia

2) Self-evaluation of the state of recovery in livestock numbers

Table 6 shows the self-evaluation by each operation of the study cases concerning the state of recovery. One of the points commonly mentioned by all operations is deterioration of grass vigor. It means that the snow damage that lasted for three years led to changes in the composition of grass species and reduction in grass yield. They say that because of the deterioration of grass vigor, livestock do not fatten well and reproductive performance has declined. By species, the number of horses has

Table 5 Labor Force and Changes in Family Members in Study Cases

	No. of Family Members	Labor Force (Age)			Changes in Family Members (after 1999)
		Owner	Wife	Child	
No5	3	56	50	Male (20)	Child 1 married in 2002 and moved to the central area of the county Child 2 married in 2002 and moved to the neighboring county Child 3 entered university in 2001 and graduated in 2006 Child 4 is ill and unable to work.
No1	5	49	44	Male (18)	Child 1 graduated from high school in 2001 Child 2 entered university in 2004 Child 3 entered university in 2005 Child 4 entered university in 2008
No8	4	72	70	Male (35) Male (27)	Children are unmarried
No4	7	64	59	Male (31)	Child 1 married in 2004 and moved to the central area of the county Child 2 studied in university 03-04, withdrew and married Child 3 became a driver in 2006 and moved to Ulaanbaatar Child 4 entered university in 2007
No3	3	66	63	Male (27)	Child 1 married in 2002 and moved to the capital of the province Child 2 moved to the capital of the province and engages in Christian missionary work
No6	4	30	30		Owner married in 2000 Child 1 entered elementary school in 2008
No9	3	Late 20s	Late 20s		Child 1 entered elementary school in 2008 Owner married in 2004 Father died in 2007

Data: Field Survey 04, 06, 08.

Table 6 Self-Evaluation of Increase/Decrease in Livestock Numbers

	Horse	Cattle	Sheep	Goat
No5	Brood mares were sold due to overpopulation. Management is too labor intensive.	Vulnerable to <i>Dzud</i> , therefore increasing their numbers given less priority.	Easy to manage. Making efforts to increase their population.	Increased, but the cashmere price declined and their meat does not sell well.
No1	Too few in number for adequate breeding. Purchased two in 2005. Young labor force is needed to increase horses.	Do not increase	Deterioration of grass vigor	Increased for cashmere production.
No8	Deterioration of grazing conditions	Deterioration of grass vigor	Deterioration of grass vigor	Sharp decrease in the number of herds
No4	Stopped entry in horse races because horses do not fatten due to poor grazing conditions.	Deterioration of grass vigor	Deterioration of grass vigor	Fatten and breed well when managed in the same manner as sheep.
No3	Travel by motorcycle. Horses are not used. Milking is impossible without additional labor.	Introduced a high-quality variety. Giving purchased feeds in the morning and evening. Turn on the heater when cold.	Damage was small and recovery is smooth. Maintaining an appropriate number for the available labor.	Increased for cashmere production.
No6		All died in <i>Dzud</i> .	Deterioration of grass vigor after <i>Dzud</i> .	Special care is given to delivery management. Exchanging breeding bucks with other nomads.
No9	Only two remain.	Only one remains.		

Data: Field Survey 04, 06, 08.

significantly decreased and, in order to increase the number of progeny, young workers who can provide meticulous care are needed. It is pointed out that cattle are vulnerable to *Dzud* because they cannot push snow aside to eat grass and as a result, the number of cattle is greatly diminished. As for sheep, they mention that efforts have been made to increase the number, and goats are fed to increase production of cashmere which remains profitable. Presumably, they tried to address the decline in sales by shifting emphasis upon the relatively profitable production of cashmere.

The following are the study of the above-mentioned cases of three different states of recovery.

① Average-recovery case (No.1)

No.1 is an operation feeding a large number of livestock in 1-Bag. Due to the *Dzud*, the livestock numbers dropped to less than half and large livestock such as horses and cattle suffered particularly substantial reductions. After the *Dzud*, only goats have increased to exceed the 1999 level but the total livestock population has not recovered to that level. The same trend is observed in Bayantsagaan County and A-Bag village as a whole. No.1 is an operation with a record of good performance which was once commended as a nomadic operation of excellent performance. However, the above-described situation reveals that it is extremely difficult for even such a capable operation to control the *Dzud* damage and recover livestock numbers.

No.1 pointed out deterioration of grass vigor in the grazing land as the main factor of delay in livestock recovery. This causes a decline in reproductive performance resulting in a delay in achieving higher herd yields and increased culling due to reduced reproductivity of aged ewes. Even under such circumstances, the number of goats increased because goats can graze to a greater soil depth and emphasis was placed on increasing goats in order to secure income to cover living expenses, given the steadily rising price of cashmere. In spite of their wish to increase large livestock,

deterioration of grass vigor as well as the plummet of the horse population caused declines in reproductive efficiency. Therefore, they purchased two horses for riding in 2005 for the purpose of livestock management.

② Over-recovery case (No.3)

In the case of No.3, the total number of livestock decreased by 50% due to the *Dzud*. This decrease was less serious than that in 1-Bag and other cases. In case No.3, the 1999 level was exceeded in 2007 in all species including large livestock with sheep being the only exception. No other case study has recovered livestock numbers like No.3. The background of No. 3 is also unique: It started a nomadic operation when private nomadic livestock operations emerged with the transition to a market economy in 1991. This background was advantageous at the time of the storm damage. Since No.3 was not confident about rearing livestock in winter, they sold many heads of livestock at the beginning of autumn and purchased feed with part of the proceeds from the sale. Thanks to this practice, only a small number of livestock died due to the *Dzud* and the decrease in livestock numbers was mainly caused by their sales. Another reason for selling livestock in autumn was that the initially acquired livestock were inferior in quality. The number of sheep has not recovered to the pre-*Dzud* level because of the operation's policy to increase goats for the purchase of automobiles and production of cashmere, as previously mentioned, and to maintain an appropriate number of livestock suitable for the size of the labor force. The example of No.3 suggests that, on the assumption that the degree of the *Dzud* damage can be predicted, it is effective to sell livestock while keeping good-quality animals under protected conditions¹¹⁾, and that it is important to secure sufficient feed for winter.

③ Non-recovery case (No.8)

In the case of No.8, the total number of livestock decreased to 20% of that before the *Dzud* and has

not recovered to the 1999 level as of 2008 for any livestock species. According to the survey conducted in 2008, 10 foals died in the spring of 2008 and livestock continue dying after the *Dzud*. Asked about the reason, No.8 answered that it is because the amount of grass in the grazing land, which used to be good, decreased because of use by other nomadic operations, due to the *Dzud*, and the quality of grass also deteriorated. They also said that the decrease in the number of small livestock caused by the *Dzud* to below the 70-80 level, which is the necessary number for herd increase, is one reason that livestock numbers do not increase. Although No.8 pointed out the deterioration of the grass resource as a reason for the death of livestock, poor management due to the ill health of the owner is also thought to have had adverse effects. The aged owner of No.8 (see Table 5 above) is in poor health and has been recommended to settle down by the administration. Judging from this fact, the situation of No.8 is thought to be insufficient to conduct nomadic management. This case is considered to be an example where the problem of the labor force affects the recovery in livestock numbers.

3) Characteristics of the state of recovery and its factors

Based on those cases described above, the recovery in livestock numbers after the *Dzud* is characterized by the following points. First, the factors that affect the level of recovery are: 1) the degree of damage; and 2) the extent of damage. The degree of damage is defined by the decrease in livestock numbers and the reduction in herd size. The extent of damage is the effect of deteriorating grass condition following the *Dzud*. In addition, 3) the maintenance level of the labor force can be mentioned as another factor. These factors mainly affect the reproductive performance and define the recovery in livestock numbers. Next, the factors that contribute to the wide difference in the state of recovery among species of livestock are: 4) characteristics of each species with different lengths of

gestation; 5) difference in economic efficiency among species of livestock; and 6) changes in the means of transportation. The gestation period of large livestock is around 300 days, while that of small livestock is around 150 days, about half of that of large livestock, and therefore repopulation rate differs. The rapid increase in the number of goats is attributable to high priority given to the production of cashmere whose price rose steadily. Moreover, with the expansion of the use of automobiles and motorcycles among nomadic operations as means of transportation, goats are used as an alternative to camels that are not fed anymore or horses that were once used for feed management. In Mongolia, there is a strong demand for horses for the production of kumiss (fermented mare's milk), for horse races, as well as cattle for dairy production. However, it takes time to increase their number. Therefore, in view of the circumstances where the price of cashmere was rising, priority was placed on increasing the number of goats.

4. Conclusion

The distinctive features of the “2000 *Dzud*” are that the devastating *Dzud* occurred in three consecutive years and that serious damage was caused, mainly to large livestock.

The state of recovery from the 2000 *Dzud* is characteristic in that, although the total number of livestock recovered to its pre-*Dzud* level in 2006, four years after the event, large livestock were slow to recover their numbers and the increase in the total number of livestock was solely dependent on the increase of the goat population. The state of recovery is defined by the degree and extent of the *Dzud* damage¹²⁾, and natural and technical factors including the breeding characteristics of livestock. Among other factors pointed out are the technical factors including the relative advantage of cashmere production, and individual factors including differences in the impact of the *Dzud* damage, differences in the situation of the maintenance of the labor

force and property acquisition, and differences in expenditures for family members.

Large livestock are slow to recover their numbers, presumably because of their breeding characteristics. Also, behind the change in the composition of livestock is a decrease in the demand for large livestock as a result of the shift of transportation means to automobiles and other vehicles, and the change in the demand for livestock products as typified by cashmere. Goats and sheep have been increasing relatively rapidly because of their shorter gestation period compared with larger livestock. In addition, backed by a strong demand for cashmere, goats marked a notable increase due to an effort to make up for the decline in the sales of other livestock. Considering the price slump of cashmere¹³⁾ and the small demand for goat meat, the number of goats may decrease. However, as more importance is placed on the economic efficiency of livestock after the shift to a market economy, the recovery in livestock numbers after the *Dzud* seems to assume a role to facilitate the scrap-and-build system of livestock species.

Notes

- 1) See Battur [1] for the development of Mongolian agriculture after the transition to a market economy.
- 2) As mentioned later, there is no clear definition of *Dzud* and scholars have different views. In this paper, it is widely defined as wind and snow damage in winter which is serious enough to kill livestock.
- 3) See Battur [2], Niita et al. [3], and Shiga [4] for the impact of *Dzud* in the study area, measures taken by nomadic operations, lives of nomads, etc.
- 4) See Komiyama [5] p76
- 5) See Morinaga [6] for weather conditions of the "2000 *Dzud*."
- 6) Ratios of the data for 1979 and 1981 to the 1975 level are 99.7% and 99.6% respectively, which are rounded up to 100.
- 7) Five species of livestock means camels, horses, cattle, sheep and goats, As shown in Figure 1, there was no significant change in the number of five species before the transition to a market economy. After 1990, the number of goats, horses, and cattle increased and then horses and cattle decreased due to the "2000 *Dzud*," while only goats recovered rapidly to the pre-*Dzud* level and continue increasing.
- 8) The study area used to be a major horse-raising area in Mongolia before the "2000 *Dzud*." See Ozaki [7].
- 9) In the field survey conducted three times in 2004, 2006 and 2008, a total of 14 cases were surveyed. However, it is extremely difficult to survey the same cases of nomadic operations that move across the vast plain. This study takes up seven cases that were surveyed at two points in time in 2004 (or 2006 for some cases) and 2008. Cases composed of several independent households such as branch families that conduct breeding management and move together virtually under the same operation are counted as one case.
- 10) The nomadic operations of the study cases move within the area located around 30 minutes to one and half hour's drive from the central area of the county where there is an elementary school and small shops. Automobiles and motorcycles are convenient means also for their living.
- 11) Needless to say, if many nomads sell more livestock in early autumn, price decreases will ensue.
- 12) As shown in the case of No.3, the damage ratio varies depending on the measures taken by each nomadic operation. This paper does not deal with differences in the damage ratio. This subject will be discussed at another time.
- 13) In the spring of 2008 when China suspended import of cashmere, the price of raw cashmere dropped from 43,000 Tg to 20,000 Tg and purchase support is provided. In addition, Tg is an abbreviated designation of the money unit Tugrik of State of Mongolia.

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