During the transition period, the budget spent on education sector was reduced. Consequently the quality of education has substantially deteriorated at all levels, especially in remote areas. Due to low capacity of dormitories, herder children are compelled to stay with their relatives, friends or in groups in *Soum* centers. This has a negative impact on their study, and it is one of the causes of school dropout.

2.5 LIVESTOCK FARMING

2.5.1 LIVESTOCK FARMING IN THE STUDY AREA

(1) Pasture Grade and Carrying Capacity

Pastures were categorized into 201 classes according to type and 8 classes according to productivity for the whole of Mongolia based on the pasture productivity survey carried out mainly by the Livestock Research Institute. (*"Evaluation of Carrying Capacity, ecology and its value in Mongolia", Tserendash* et.al 2000) This classification can be used as a rough comparison of pasture productivity for wide areas, even if the results of the survey contain some weak points such as that the simple comparison of each measured yield makes no sense because the survey was carried out over several years. Regional pasture productivity and carrying capacity is shown in Table 2.5.1.

Table 2.5.1 Proportion of Pasture Grade and Carrying Capacity in Whole Country

	Grade	Yield (100kg/ha)	West		Central		East		Gobi	
Whole pasture area (thous,ha)	-	-	52319	(%)	33046	(%)	27781	(%)	34894	(%)
Areas in each grade(thous.ha)	I	20.0~	115	0.2	0	0.0	0	0.0	1	0.0
	II	14.0~20.0	920	1.8	163	0.5	1452	5.2	10	0.0
	III	10.5~14.0	332	0.6	659	2.0	2778	10.0	3	0.0
	IV	8.0~11.0	5334	10.2	10475	31.7	13196	47.5	571	1.6
	V	5.0~7.9	13481	25.8	16086	48.7	8903	32.0	3534	10.1
	VI	3.0~5.0	23567	45.0	4696	14.2	1451	5.2	26842	76.9
	VII	1.0~3.0	8488	16.2	1233	3.7	0	0.0	3932	11.3
	VIII	0~0.9	82	0.2	0	0.0	0	0.0	0	0.0
Area proportion of over grade VI (%)	-	-	61.4	-	17.9	-	5.2	-	88.2	-
Carrying capacity ① (sheep unit/100ha)	-	-	47.0	-	69.7	-	89.4	-	33.9	-
Carrying capacity ② (ha/sheep unit)	-	-	2.1	-	1.4	-	1.1	-	2.9	-

Regional devision of aimags are as follows, West: Bayan-urgy, Ubs, Hobd, Zabhan, Gobialtay, Bayanhongol (6 aimags), Central: Hubsgol, Alhangay, Ubrhangay, Borgan, Tuv, Serenge (6 aimags), East: Henti, Sufbatar, Domodo (3 aimags), Gobi: Dudgobi, Umnugobi, Domogobi (3 aimags)

Source: Livestock Research Institute

The share of low productivity pasture, lower than class VI, is the highest in Gobi region (88.2 %) among the four regions. Its carrying capacity is also estimated as much lower than other areas (33.9 heads (sheep unit)/100 ha). Contributing to this low pasture productivity, there is one more characteristic of Gobi region and that is wide annual variation affected by meteorological conditions.

The livestock rearing system should be based on pastoral livestock system in such low and unstable productivity areas. The seasonal migration system can avoid the deterioration of pasture productivity by livestock feeding. Most migrations are within *Soum* territory, but long distance migrations over the *Soum* and/or *Aimag* are carried out in drought years.

After transition to market economy, total livestock number increased rapidly and its peak was reached in 1999. It declined because of continuous *Dzud* disaster in the period 1999 to 2001. Even if the number of livestock is declining, the existing livestock number still has a higher impact on the weakness of pasture resources in Gobi region, because of recent continuous drought.

Moreover, some herders are making fodder in fenced small areas to supplement such poor and unstable pasture resources. Gobi region is located far from major places of fodder production such as *Hangai* region, so that due to high transport cost, the purchase price of fodder become high (2 to 3 times the basic cost). Therefore, a new movement has started to produce supplemental feed for winter by one's self.

(2) Number of Herder and Their Livestock

According to the livestock census, the smallest livestock number since 1999 was 23.9 million heads in Mongolia; this is equivalent to 71.2% of the largest number recorded in 1999 (33.6 million heads). Among the three *Aimags* of the Study Area, *Dundgobi* turned upward from downward in 2002; *Dornogobi* and *Umnugobi* respectively did in 2003.

Table 2.5.2 Number of Livestock and Change Index

Aimags	*Dornogobi*		*Dundgobi*		*Umnugobi*		Country Total	
year	thous. Head	%	thous. Head	%	thous. Head	%	thous. Head	%
1999	1,110.2	100.0	2,105.2	100.0	1,608.9	100.0	33,569.0	100.0
2000	1,036.6	93.4	1,282.8	60.9	1,489.6	92.6	30,227.4	90.0
2001	838.3	75.5	1,397.4	66.4	1,209.5	75.2	26,075.2	77.7
2002	825.8	74.4	1,475.0	70.1	909.1	56.5	23,897.6	71.2
2003	926.4	83.4	1 598.1	75.9	907.4	56.3	25 427.7	75.7
2004	1,019.0	91.8	1,781.0	84.6	1,070.0	66.5	28 027.9	83.5

Source: Department of Information, MFA

By animal type, the increase of goat was remarkable after the market economy transition. Originally, the number of goat was high in *Umnugobi*, but after 1996 it became more than two times sheep. The number of cows and horses increased rapidly after 1992 and then decreased after *Dzud* disaster in 1999. The number of camel was decreasing before the transition to the market economy. After this transition, the number in the whole country was steady until 1999 (it increased slightly in *Umnugobi*), but it decreased again in the last three years.

The highest number of herder families is in *Dundgobi* in the Study Area, and next is *Umnugobi*, then *Dornogobi*. Increase in herders began since 1990 when the symptoms of socialism collapse appeared. Especially, the highest rate was in 1991; the average for three *Aimags* was about 150%, and thereafter the growth rate declined and finally decreased in 2001. Even so, the number of herders increased 237% (average) until maximum 2000 based on 1988 as the base year.

Table 2.5.3 Change in Number of Livestock

	Dornogobi						Dundgobi						Umnogobi					
	Camel	Horse	Cattle	Sheep	Goat	Total	Camel	Horse	Cattle	Sheep	Goat	Total	Camel	Horse	Cattle	Sheep	Goat	Total
1971	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1975	0.91	1.10	1.46	1.15	1.17	1.14	1.04	1.15	1.53	1.19	1.27	1.21	0.93	0.90	0.90	1.11	1.25	1.11
1980	0.86	0.98	1.57	1.10	1.09	1.09	0.87	0.90	1.52	1.15	1.23	1.14	0.96	0.90	1.21	1.06	1.26	1.11
1985	0.86	0.88	1.71	1.17	1.08	1.11	0.82	0.79	1.36	1.12	1.23	1.10	0.93	0.76	1.38	0.97	1.06	0.99
1990	0.76	0.82	1.67	1.28	1.18	1.17	0.83	0.96	1.68	1.26	1.49	1.27	0.86	0.72	1.51	1.03	1.21	1.05
1995	0.39	0.89	1.84	0.97	1.73	1.10	0.48	1.03	1.86	1.28	2.23	1.44	0.62	0.91	1.80	1.23	1.94	1.39
1998	0.37	1.10	2.03	1.04	2.20	1.27	0.46	1.37	2.46	1.53	3.15	1.86	0.66	1.31	2.55	1.55	2.71	1.85
1999	0.38	1.23	2.25	1.13	2.40	1.38	0.44	1.36	2.27	1.52	2.82	1.77	0.66	1.38	2.43	1.61	2.67	1.85
2000	0.37	1.18	1.94	1.08	2.20	1.29	0.33	0.71	0.78	1.04	1.62	1.08	0.62	1.15	1.46	1.47	2.55	1.72
2001	0.35	0.81	0.97	0.87	2.04	1.04	0.30	0.70	0.54	1.08	2.03	1.18	0.55	0.76	0.74	1.13	2.16	1.39
2002	0.35	0.74	0.81	0.81	2.20	1.03	0.31	0.71	0.59	1.08	2.29	1.24	0.48	0.49	0.42	0.82	1.65	1.05

Note: Maximum number is indicated by boldface.
Resource: Mongolian Statistical Yearbook, Ministry of Food and Agriculture

Density of livestock (Sheep units converted) and herders in each *Soum* is shown in Fig. 2.5.2 . Growth was at a high rate in the north part of *Dundgobi* in both data sets. It seems that herders concentration was due to seeking better conditions because the north part of *Dundgobi* belongs to the steppe pasture area and pasture yield in this area is high compared with other Gobi regions.

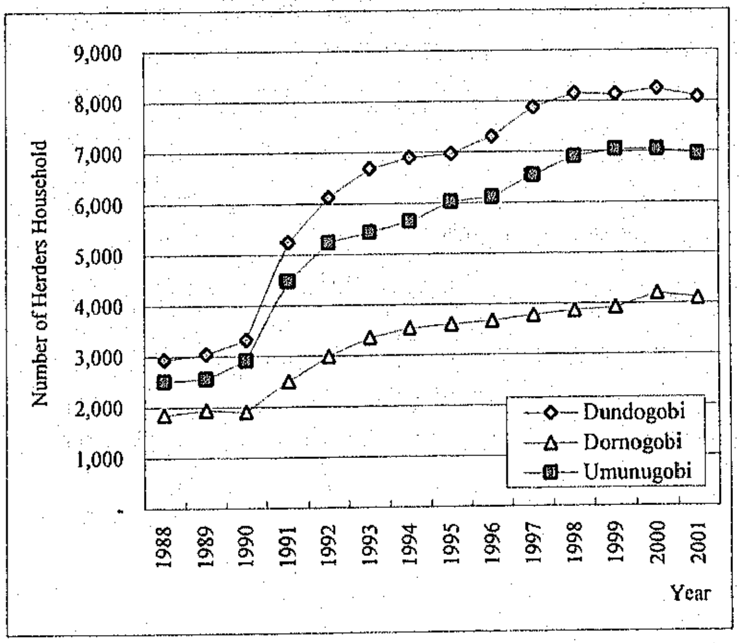
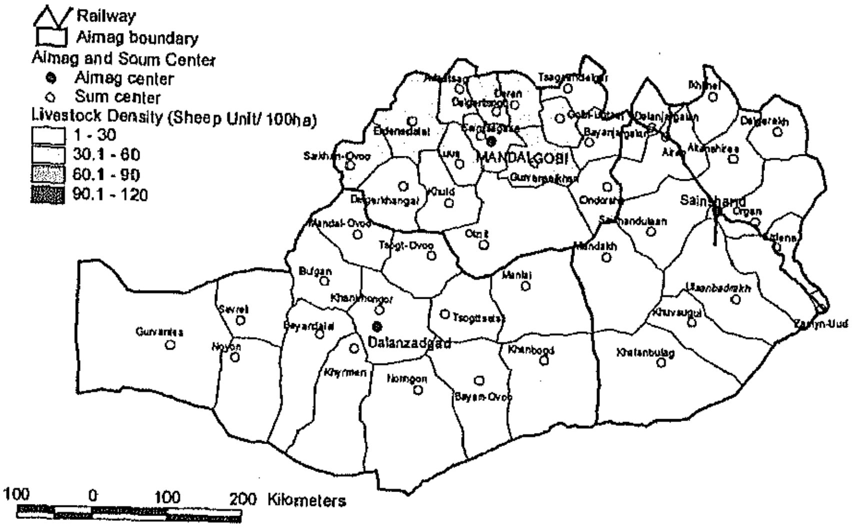
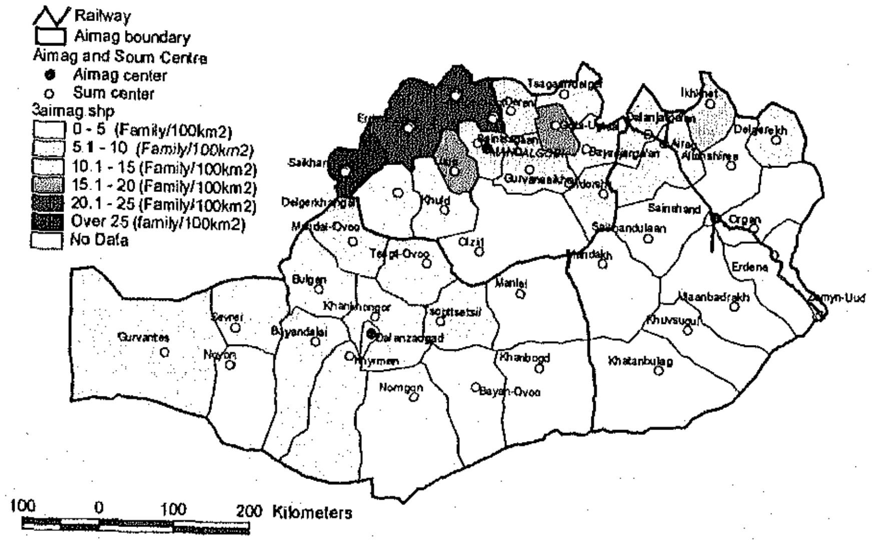


Fig.2.5.1 Transition of Herders Household Number
(Source: Mongolian Statistical Year Book, MFA)



Livestock Density (Sheep Unit Conversion / 100 ha) - 2002



Density of family who has livestock - 2002

Fig. 2.5.2 Livestock Density and Density of Family who Has Livestock

Source: JICA Study Team

2.5.2 VEGETATION AND CARRYING CAPACITY

(1) Present Condition of Pasture Use

Recently, degradation of the pasture has become a problem through regional overgrazing in Mongolia.

1) Classification of Pasture Use

The degree of pasture use depends on the crude density of herders. The pasture is classified into 5 types from the viewpoint of utilization as follows:

Table 2.5.4 Five Classes of Pasture Use

Unused	Pasture which is far from *Soum* Center or lacks water supply facilities (water sources)
Low Used	Pasture which is far from *Soum* Center or lacks water supply facilities (water sources). But large livestock such as camel and horse can use if there is snow and water is available.
Appropriately Used	Seasonal herding is appropriately conducted consist with plant yield.
Highly Used	Temporal burden on pasture is concentrated because of year-round stay in winter camp or decrease of plant yield due to drought.
Overused	Devastated pasture due to constant high use such as the pasture around wells and crowded winter camps.

There was a decrease in number of water sources due to the breakdown and collapse of Engineering Wells after the transition to market-oriented economy and because the area of unused or low used pasture expanded. On the other hand, the tendency of overused or highly used pasture adjacent to unused or low used pasture can be observed.

2) Year-round Use of Winter and Spring Camps and Degradation

Water level in winter and spring camps is relatively high because they are located at the bottom of mountains, the valleys between hills, and the edge of basins where Traditional Wells can be dug. On the other hand, summer and autumn camps are located in the plain, and thus there is a tendency not to supply stable water sources. Moreover, the installed Production Wells in socialist era became unusable as mentioned above, and most of the pasture around summer and autumn camps became low used or unused.

On the other hand, there is a problem that herders have begun inappropriate *Otor* (migration). There are social and economic reasons; however, the water supply ratio is one of the factors to prevent inappropriate *Otor* (migration) and herders falling into the vicious circle such as staying in winter and spring camps throughout the year and using the adjacent pasture. Accordingly, herders tend to use the pasture and exceed its carrying capacity. This behavior will cause devastation of the pastures and then degradation of environment.

3) Concentration of the Livestock Herds exceeding Water Supply Capacity of Traditional Wells

Water supply using Traditional Wells also results in permanent burden on the pasture around the wells. It is said that the capacity of Traditional Wells can supply water only for 1-2 households which have less than 500 heads of livestock as fundamentally found in Gobi. But actually, the method burdens the vegetation of the pastures around the wells, because for example, 5-6 households who have more than 1,500 heads of livestock, and worse, more than 10 households who have more than 2,500 heads of livestock concentrate on the pastureland around the wells. Furthermore, herders have to spend all day long for watering livestock because of the difficulty of continuous feed-water due to very limited yield of the wells. As a result of such long and inefficient feed-water, livestock herds stay a long time around the wells and this accelerates the devastation of the pasture.

4) Mechanism of Overgrazing

To summarize the issues mentioned above, the factors of "overgrazing" that are presented as problems occurring in winter/spring camps are as follows:

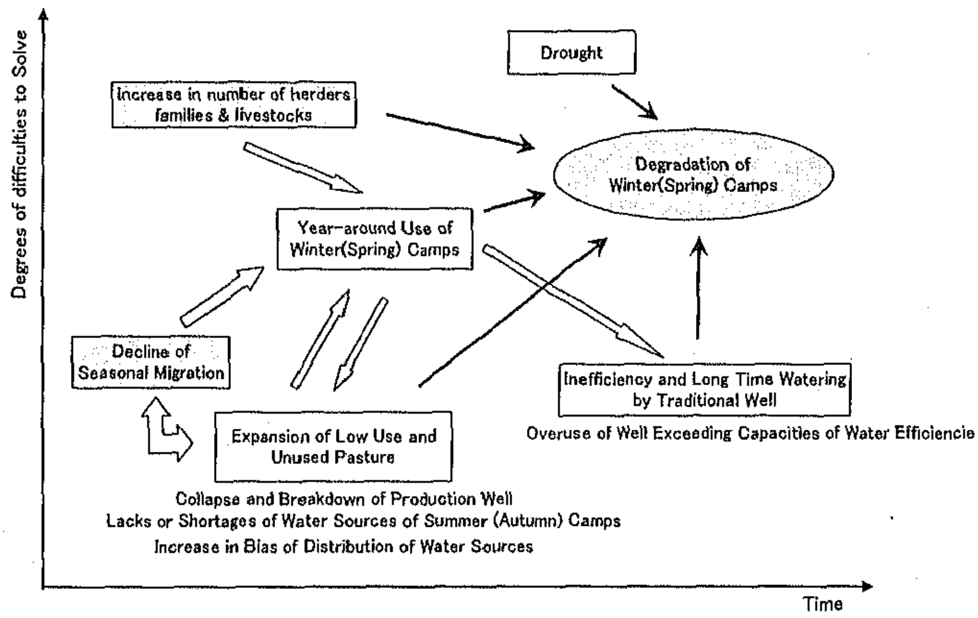


Fig. 2.5.3 Mechanism of Overgrazing

(2) Vegetation and Carrying Capacity

1) General Condition of Vegetation

Carrying capacity fluctuates every year and the regional difference is also large by year in the target areas. The planning should take account of regional environmental fluctuation such as the occurrence of the drought year every few years. In this planning, the appropriate number of livestock referring to carrying capacity is calculated as the average number of livestock mentioned above (mean) multiplied by 0.9 as safety ratio, considering for the annual fluctuation and tendency of drought, referring to data of carrying capacity (Livestock Institute, *Tserendash* et.al 2000).

Division of vegetation in each *Soum* in 3 *Aimags* was calculated. Criteria of carrying capacity are divided for 4 types as shown below aiming to understand the vegetation character in 3 Aimags.

Table 2.5.5 Division of Vegetation

Division of vegetation	Steppe	Desert-Steppe high	Desert-Steppe Low	Desert
Carrying Capacity (s.u*/ha)	0.54<	0.27~0.54	0.15~0.24	0.15>

*s.u. : Sheep Unit

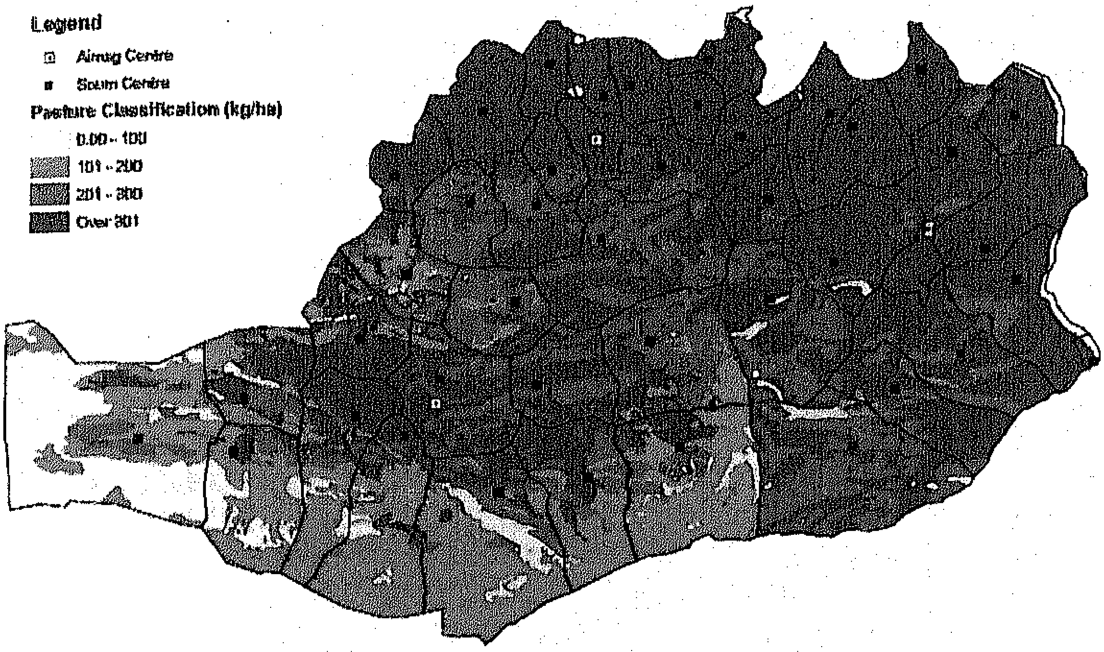


Fig. 2.5.4 Carrying Capacity

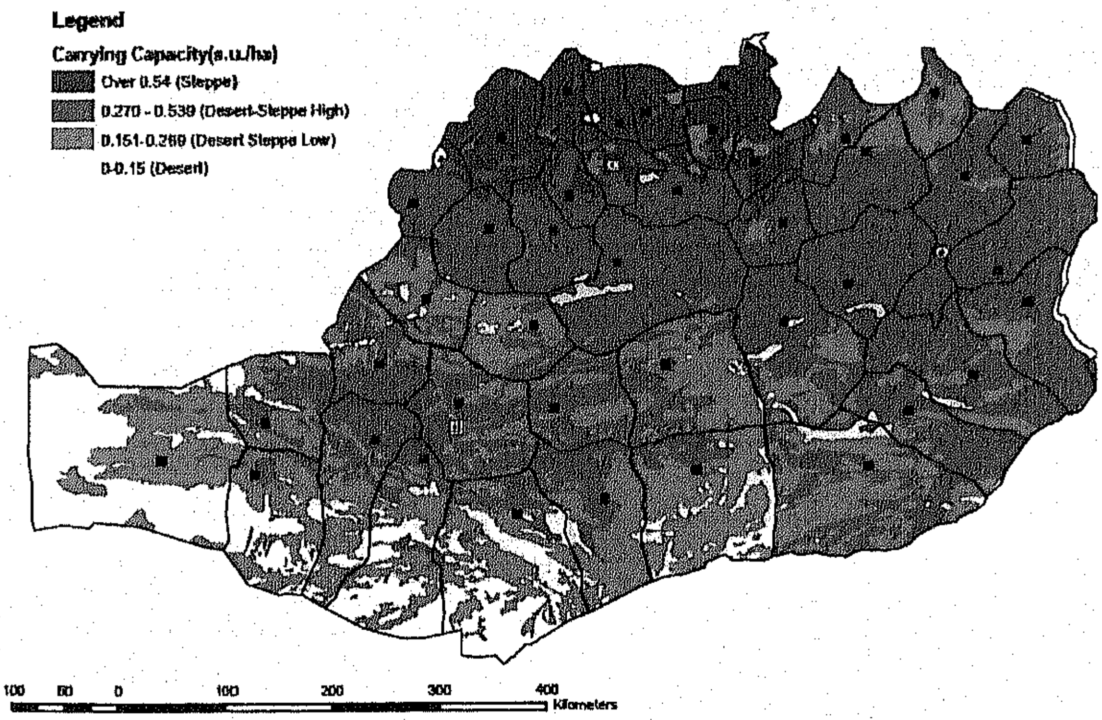


Fig. 2.5.5 Pasture Classification (Source : 2000 *Tserendersh* et.al)

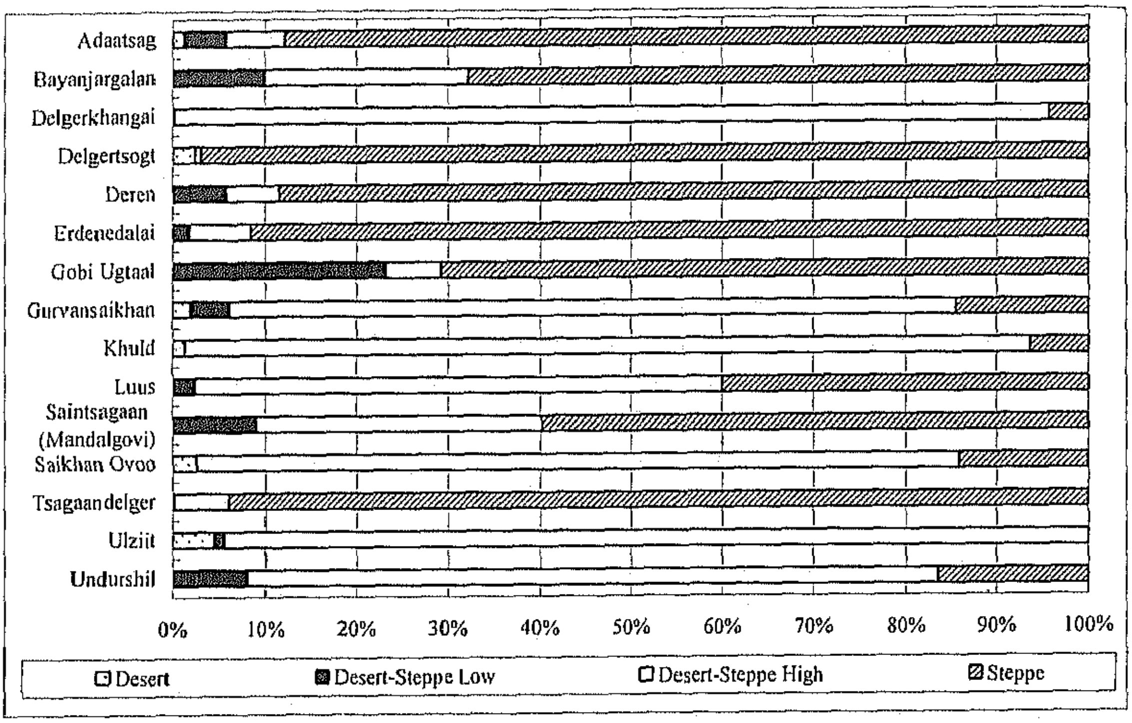


Fig. 2.5.6 Division of Vegetation in *Dundgobi*

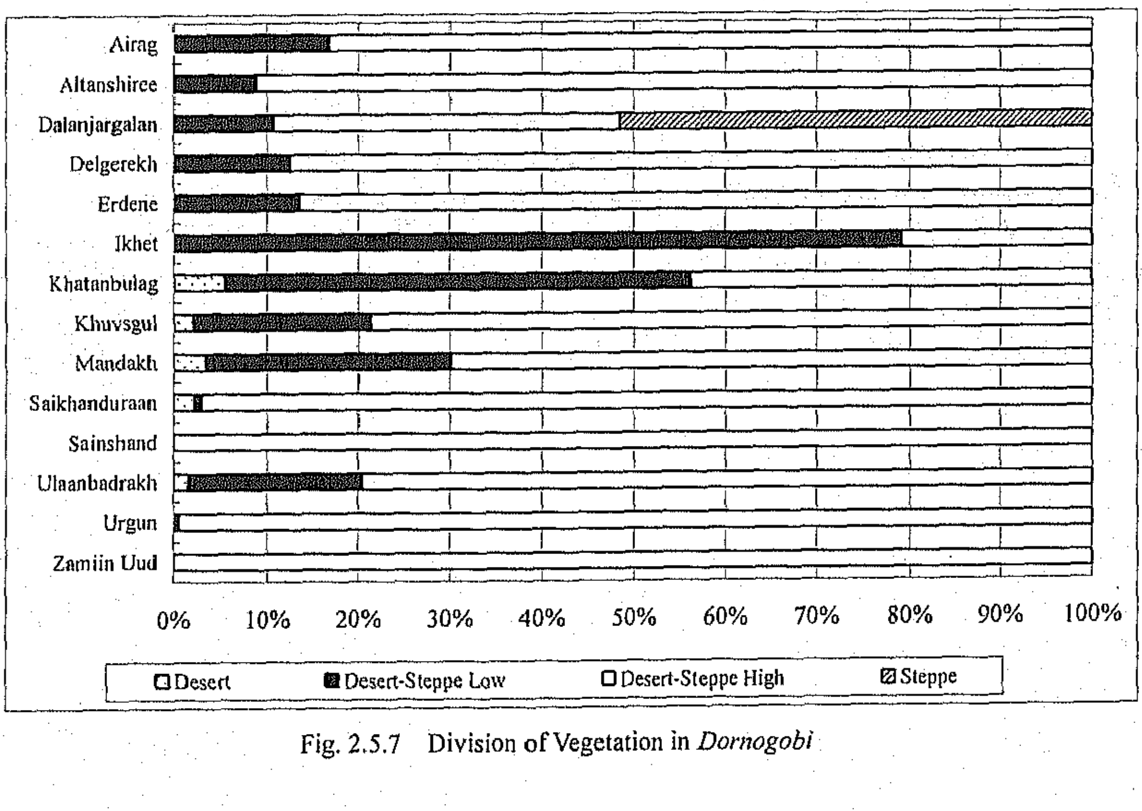


Fig. 2.5.7 Division of Vegetation in *Dornogobi*

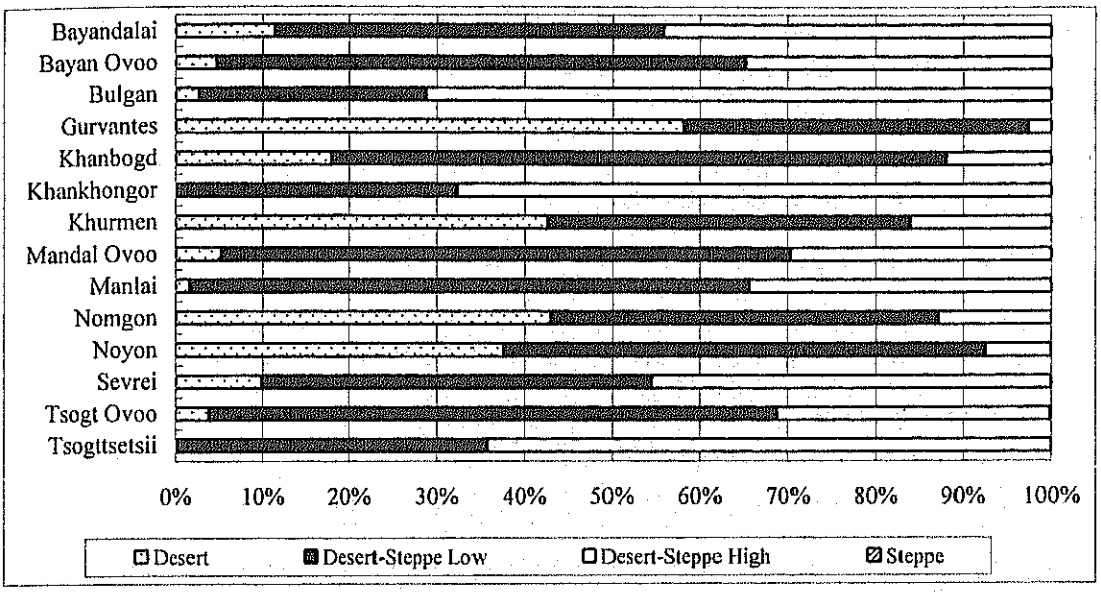


Fig. 2.5.8 Division of Vegetation in *Umnugobi*

i) *Dundgobi*

Northern *Soums* such as *Adaatsag, Bayanjargalan, Delgertsogt, Deren, Gobi Ugtaal, Erdenedalai, Saintsagaan (Mandalgobi), Tsagaandelger*, Steppe vegetation dominated by *Stipa* and *Clestogenes* of *Gramineae* is widely seen. Ratios of 60% to 97% are classified to Steppe divisions. Vegetative productivities estimated by carrying capacities are 290～335 kg/ha in the northern *Soums*. On the other hand, in the southern *Soums*, *Caragana, Artemisia* and *Allium* dominate. Vegetation is classified in the Desert-Steppe (High) division with ratios of 57%～96%. Estimated productivities on average are between 155 and 205 kg in the southern *Soums* which is rather lower than scores of northern *Soums*.

ii) *Dornogobi*

In the southwestern region including the center of Gobi, desert shrubs such as *Haloxylon* are widely spread. Estimated productivities of pasture on average are 150～180 kg/ha. In the north part of *Dalanjargalan* and *Ihhet* of the northeastern *Soums*, it belongs in the transitional region and *Stipa* and *Clestogenes* of *Gramineae* are dominant. Estimated productivities are 155～185 kg/ha and are almost in the same level or slightly higher comparing with southwestern *Soums*. In the whole *Aimag*, vegetation is overwhelmingly classified in the division of Desert-Steppe (High and Low), and ranges between 95% to 100% except in *Dalanjargalan*, shows 48.4%.

iii) *Umnugobi*

Estimated productivities of pasture vegetation are 118 kg/ha on average in all *Aimags*, which is the lowest in the three *Aimag*. Vegetation division of Desert-Steppe is dominant in northern region and productivities are 118～185 kg/ha on average. In the southern region, Desert vegetation is added to Desert-Steppe in vegetation and productivities are 86～160 kg/ha on average. Moreover, Gobi-Altai Mountain is crossing through *Aimags* and vegetation varies owing to mountainous climate. In vegetation, no *Soum* is classified as Steppe, and Desert-Steppe is the main division. In southwestern *Soums* such as *Gurvantes, Khurmen, Nomgon, Noyon,* the ratio of Desert is high and is the major division.

2) Carrying Capacity

Carrying capacity according to vegetative productivities is shown in each *Soum* in Table 2.5.7 to 2.5.9. In addition Production Wells, springs, ponds (lakes), Traditional Wells including Shaft Wells, which is also used as hand well at present are all considered as stable water sources. Three kilometers in radius is defined as stable water supplied pasture and buffer areas and carrying capacities are calculated using GIS.

Estimation of carrying capacity concerning water supply efficiency of each water resources is shown next. Each value point is interpreted as follows: Production (Shallow) Well 1.0, Shaft Well 0.9, Traditional Well 0.8, Spring 0.7.

Table2.5.6 Setting of Kind of Water Sources and Pasture Use Rate

Kind of water sources	Production Well, Shallow Well, Rehabilitated Shaft Well, Pond (Lake)	Hand-drawn Shaft Well	Traditional Well	Spring
Pasture use rate	1	0.9	0.8	0.7

i) *Dundgobi*

In northern *Soums* where Steppe vegetative division is dominant there is high carrying capacity per unit area of 50.1 s.u./km². On the contrary in southern *Soums* scores are relatively low, 33.0 s.u./km². Areas of southern *Soums* are rather large and carrying capacity (s.u.) is 1.43 million, almost as same level as 1.49 million in northern *Soums*. However, watered pasture rate is 53.1% in southern *Soums*, which is lower than 78.6% in northern *Soums*. Consequently, carrying capacity in total in stable water supplied pasture (3 km Zone in radius) at present is 0.68 million in southern *Soums* and 1.10 million in northern *Soums*. Pasture water rate in *Dundgobi* is outstandingly the highest in three *Soums*, 60.2%. Carrying capacity in stable water supplied pasture reaches near 1.8 million in sheep units.

ii) *Dornogobi*

Carrying capacity per unit area are unalterable, it varies between 29～35 s.u./km². Average of *Aimag* is 31.8 s.u./km², and northern *Soums* slightly higher(0.8 point) than that of southern *Soums* Since areas in southern *Soums* are larger than northern *Soums*, total carrying capacity in southern *Soums* is larger. But pasture water rate is higher in northern *Soums* (48.0%) so difference in number of areas and carrying capacity of stable water supplied pasture in northern and southern region are shortened as a result. Total carrying capacity of stable water supplied pasture is 1.293 million in sheep units in the whole *Aimag*.

iii) *Umnugobi*

Average carrying capacity per unit area in the whole area is the lowest, 22.6 s.u./km² of the three *Aimags*. It is higher in northern region (26.0 s.u./km²) and lower in southern region (19.1 s.u./km²). Area in southern region is 1.8 times larger than northern region. But in *Umnugobi*, there are national parks and pastures with low productivity such as desert vegetation; hence, it is required to consider appropriate grazing area. Water Pasture Rate, which is 38.8% is the lowest in the three *Aimags*. This is the inverse of large area in the whole *Aimag*, which is 2.2 times and 1.5 times comparing with *Dundgobi* and *Umnugobi* respectively; Total carrying capacity of Stable Water Supplied Pasture in *Umnugobi* is the lowest, 1.286 million in sheep units.

Table 2.5.7 Present Conditions of Carrying Capacity (*Dundgobi*)

	Average carrying capacity (s.u./km²)	Whole area (km²)	Pature rate within the whole area(%)	Average carrying capacity in total (s.u.)*	Stably used pasture (3km in radius) (km²)	Rate within the whole area (%)	Average carrying capacity in total (s.u.)	Stably used pasture (5km in radius) (km²)	Rate within the whole area (%)	Average carrying capacity in total (s.u.)
Adaatsag**	51.2	3,299	99.8%	169,000	2,519	76.4%	119,526	3,117	94.5%	135,841
Bayanjargalan**	46.4	3,189	99.7%	147,916	2,582	81.0%	114,487	3,084	96.7%	126,964
Delgerkhangai**	29.9	6,209	99.5%	185,859	3,324	53.5%	98,044	5,016	80.8%	126,446
Delgertsogt**	52.7	2,502	99.6%	131,852	2,237	89.4%	113,642	2,526	101.0%	122,294
Deren**	52.9	3,624	99.4%	191,664	2,776	76.6%	137,365	3,508	96.8%	158,997
Erdenedalai**	52.7	7,351	99.8%	387,723	5,675	77.2%	280,493	7,038	95.7%	319,660
Gobi Ugtaal**	46.2	2,707	99.2%	125,076	2,189	80.9%	93,089	2,623	96.9%	105,090
Gurvansaikhan***	32.6	5,416	99.8%	176,609	3,833	70.8%	117,406	5,148	95.1%	141,712
Khuld***	30.3	6,070	99.4%	184,198	2,972	49.0%	86,803	4,474	73.7%	112,673
Luus***	39.3	3,161	99.4%	124,076	1,967	62.2%	77,275	2,972	94.0%	98,766
Saintsagaan (Mandalgovi)**	45.9	3,406	98.6%	156,454	2,623	77.0%	115,875	3,271	96.0%	130,939
Saikhan Ovoo***	33.7	4,055	99.8%	136,790	2,379	58.7%	76,140	3,603	88.9%	99,671
Tsagaandelger**	52.8	3,428	99.3%	181,105	2,426	70.8%	123,491	3,004	87.6%	140,487
Ulziit***	29.3	15,421	95.9%	452,545	5,391	35.0%	150,829	9,816	63.7%	222,780
Undurshil***	35.6	4,832	99.8%	172,818	2,075	42.8%	74,031	3,657	75.4%	105,652
Northern Soums	50.1	29,506	99.5%	1,490,788	23,027	78.6%	1,097,969	28,171	95.5%	1,240,271
Southern Soums	33.0	45,184	98.3%	1,432,895	21,941	53.1%	680,528	34,687	76.8%	907,695
Total (Average)	42.1	74,690	98.8%	2,923,683	44,968	60.2%	1,778,497	62,858	84.2%	2,147,966

Note: * Total score in the whole area
** Northern Soums
*** Southern Soums

Table 2.5.8 Present Conditions of Carrying Capacity (*Dornogobi*)

	Average carrying capacity (s.u./km²)	Whole area (km²)	Pature rate within the whole area (%)	Average carrying capacity in total (s.u.)*	Stably used pasture (3km in radius) km²	Rate within the whole area (%)	Average carrying capacity in total (s.u.)	Stably used pasture (5km in radius) (km²)	Rate within the whole area (%)	Average carrying capacity in total (s.u.)
Airag**	31.5	7,442	98.6%	203,891	3,094	41.6%	83,599	5,314	71.4%	120,365
Altanshiree**	32.0	7,226	98.1%	202,014	2,731	37.8%	74,898	4,850	67.1%	110,601
Dalanjargalan**	35.1	4,046	98.4%	123,057	2,614	64.6%	81,769	3,707	91.6%	101,682
Delgerekh**	32.0	4,858	98.8%	135,253	3,204	66.0%	90,706	4,359	89.7%	110,735
Erdene**	31.1	9,592	86.8%	266,349	4,582	47.8%	121,410	7,387	77.0%	167,192
Ikhet**	29.9	4,152	98.7%	107,156	2,563	61.7%	67,027	3,765	90.7%	86,141
Khatanbulag***	28.9	18,669	88.3%	489,554	7,146	38.3%	176,206	12,041	64.5%	248,720
Khuvsgul***	32.9	8,377	94.0%	249,140	4,306	51.4%	121,190	6,587	78.6%	160,950
Mandakh***	29.9	12,661	96.6%	338,420	4,239	33.5%	105,443	7,571	59.8%	156,409
Saikhanduraan***	31.6	9,558	99.3%	266,108	3,909	40.9%	108,987	6,789	71.0%	156,561
Sainshand	34.5	2,343	63.7%	71,142	725	30.9%	22,241	1,504	64.2%	36,368
Ulaanbadrakh***	33.1	11,371	93.2%	337,517	4,826	42.4%	135,240	8,476	74.5%	197,923
Urgun**	33.4	8,690	97.0%	254,611	3,300	38.0%	99,563	5,976	68.8%	148,355
Zamiin Uud	29.8	487	34.5%	13,038	164	33.6%	4,306	362	74.4%	7,547
Norteastern Soums	32.1	46,006	95.8%	1,292,331	22,087	48.0%	618,972	35,358	76.9%	845,070
Southwestern Soums	31.3	60,636	93.5%	1,680,739	24,426	40.3%	647,065	41,464	68.4%	920,563
Total (Average)	31.8	109,472	93.5%	3,057,250	47,401	43.3%	1,292,584	78,683	71.9%	1,809,548

Note: * Total score in the whole area
** Northeastern Soums
*** Southwestern Soums

Table 2.5.9 Present Conditions of Carrying Capacity (*Umnugobi*)

	Average carrying capacity (s.u./km²)	Whole area (km²)	Pature rate within the whole area (%)	Average carrying capacity in total (s.u.)*	Stably used pasture (3km in radius) km²	Rate within the whole area (%)	Average carrying capacity in total (s.u.)	Stably used pasture (5km in radius) (km²)	Rate within the whole area (%)	Average carrying capacity in total (s.u.)
Bayan Ovoo***	23.4	10,751	69.3%	176,806	4,237	39.4%	83,712	7,428	69.1%	121,522
Bayandalai***	25.1	10,474	87.3%	187,692	4,904	46.8%	121,316	7,438	71.0%	154,244
Bulgan**	29.7	7,498	88.6%	164,557	3,655	48.8%	98,997	5,868	78.3%	133,822
Gurvantes***	13.6	27,967	35.9%	236,921	6,782	24.3%	94,632	11,627	41.6%	133,088
Khanbogd***	18.7	15,152	85.2%	257,700	5,802	38.3%	93,458	10,121	66.8%	136,686
Khankhongor**	29.2	9,932	92.1%	261,905	5,505	55.4%	139,649	8,576	86.3%	187,229
Khurmen***	18.6	12,393	63.4%	226,335	4,867	39.3%	86,217	8,173	65.9%	117,569
Mandal Ovoo**	22.7	6,433	80.6%	145,884	3,179	49.4%	65,826	5,224	81.2%	91,683
Manlai**	23.5	12,418	85.2%	292,263	6,192	49.9%	130,358	9,795	78.9%	177,025
Nomgon***	18.0	19,468	83.1%	233,904	4,170	21.4%	67,637	8,457	43.4%	109,440
Noyon***	16.6	10,550	75.0%	175,260	3,797	36.0%	59,134	6,592	62.5%	82,693
Sevrei**	24.9	8,096	82.2%	35,166	3,923	48.4%	88,765	6,151	76.0%	118,105
Tsogt Ovoo**	23.4	6,527	89.5%	152,554	3,166	48.5%	63,087	5,294	81.1%	90,287
Tsogttsetsii**	28.4	7,246	88.1%	205,961	3,800	52.4%	92,883	6,028	83.2%	126,902
Northern Soums	26.0	58,150	86.8%	1,258,290	29,420	50.6%	679,564	46,936	80.7%	925,054
Southern Soums	19.1	106,755	67.0%	1,494,618	34,560	32.4%	606,107	59,835	56.0%	855,241
Total (Average)	22.6	164,905	73.9%	2,752,908	63,980	38.8%	1,285,671	106,771	64.7%	1,780,295

Note: * Total score in the whole area
** Northern Soums
*** Southern Soums

(3) Actual Condition of Unused and Low Used Pasture

1) Reasons for Forming Unused and Low Used Pastures

Density of herder distribution causes, on one hand, overused pastures and on the on the other hand, huge unused and low used pastures.

The concrete reasons for becoming unused and low used pastures are the following:

i) Mal-distribution of water sources on the pasture
ii) Location far from central district such as *Soum* Center (Socio-economic factors)
iii) Low productivity of pasture vegetation

The above three reasons are interrelated with each other. But it can be considered that the mal-distribution of water sources is the most influential factor of herder distribution. Distribution of water sources and distance from *Soum* Center is shown in Fig. 2.5.9.

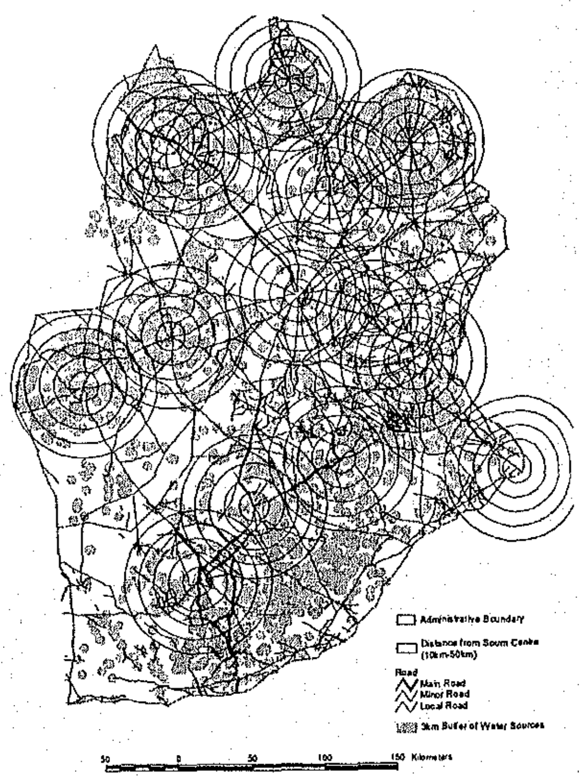


Fig. 2.5.9 Distribution of Water Sources and Distances from the *Soum* Center.

2) Areas of Unused and Low Used in each *Soum* and *Bag*

Based on calculation of distribution of water sources, ratio of areas of stable water supplied pasture (within 3 km in radius) and Low use or unused pasture (more than 3 km in radius) are shown in *Soums* or *Bags* in the tables below. *Dornogobi* is shown in its respective *Bags*.

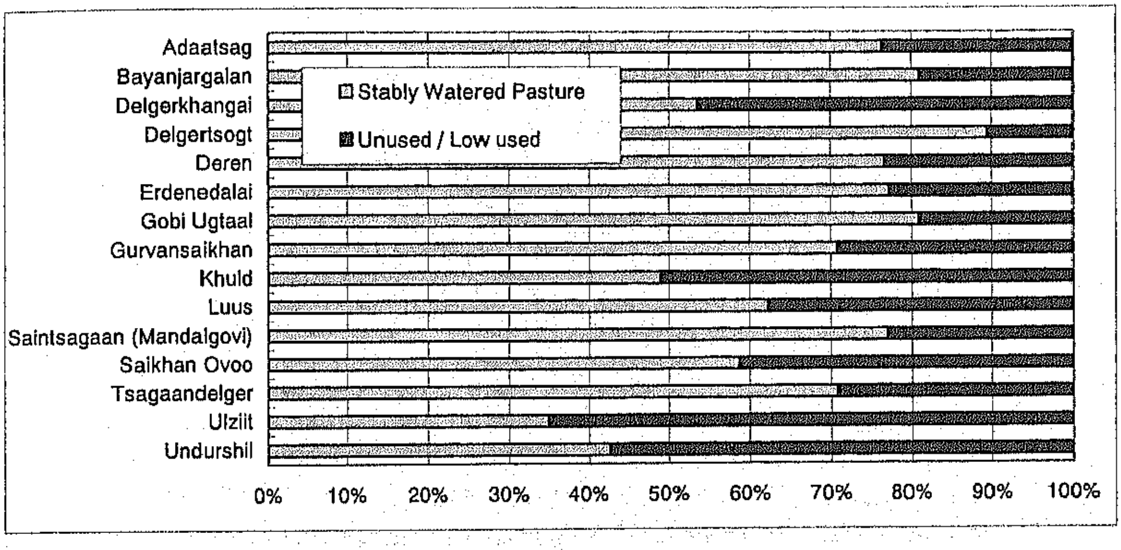


Fig. 2.5.10 Stable Water Supply Pasture and Unused and Low Used Pasture (*Dundgobi*)

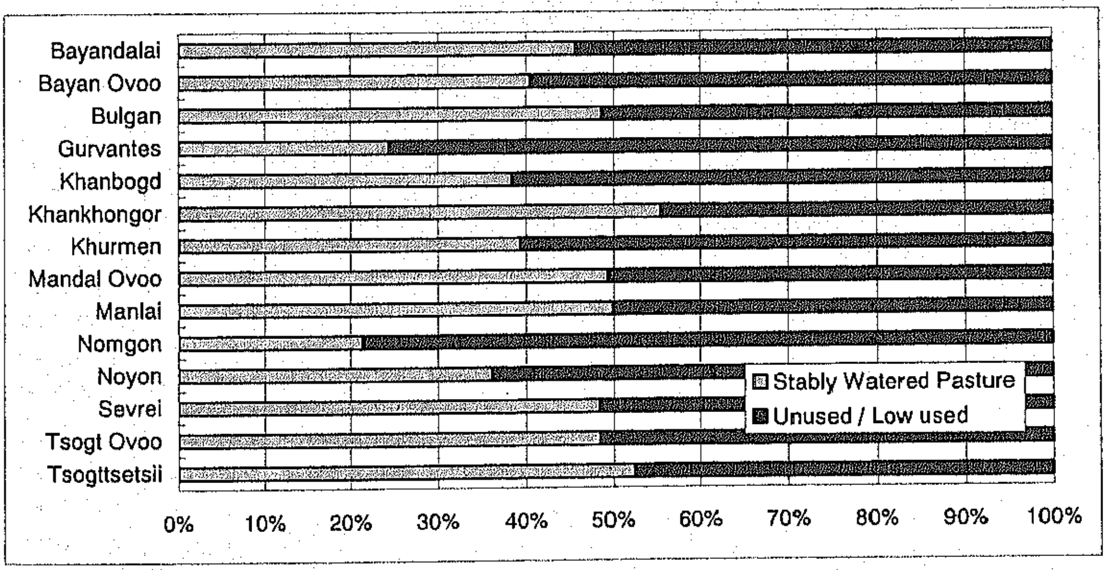


Fig. 2.5.11 Stable Water Supply Pasture and Unused and Low Used Pasture (*Umnugobi*)

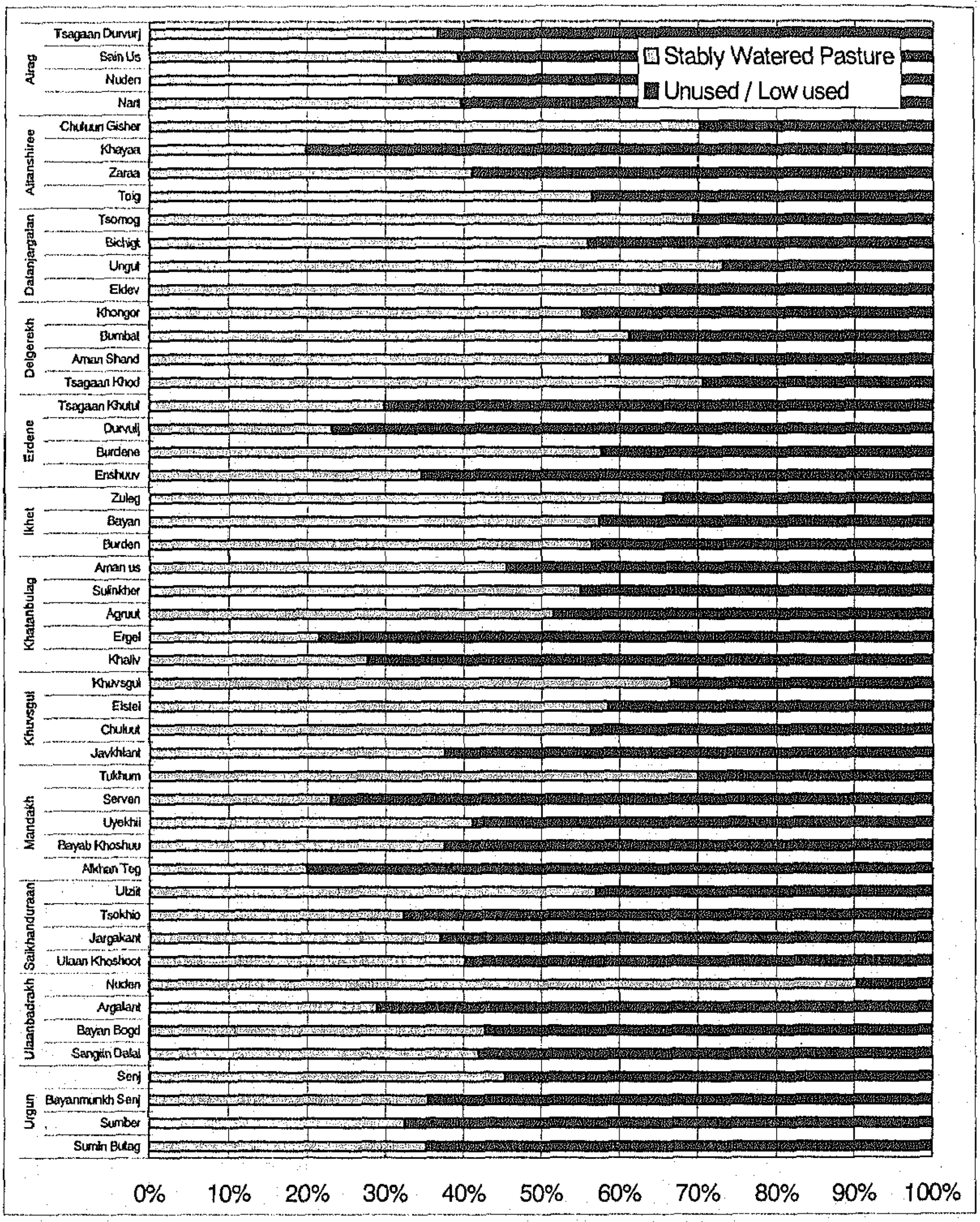


Fig. 2.5.12 Stable Water Supply Pasture and Unused and Low Used or Pasture (*Dornogobi*)

3) Expansion of Unused and Low Used Pasture

The area of the pasture without water sources accompanied with collapse of Production Wells has expanded compared with 1990, the transition period to market-oriented economy. Fig.2.5.13 to 2.5.15 show for the economy-transition period, the ratio of low use and unused pasture area without water sources out of total pasture area.

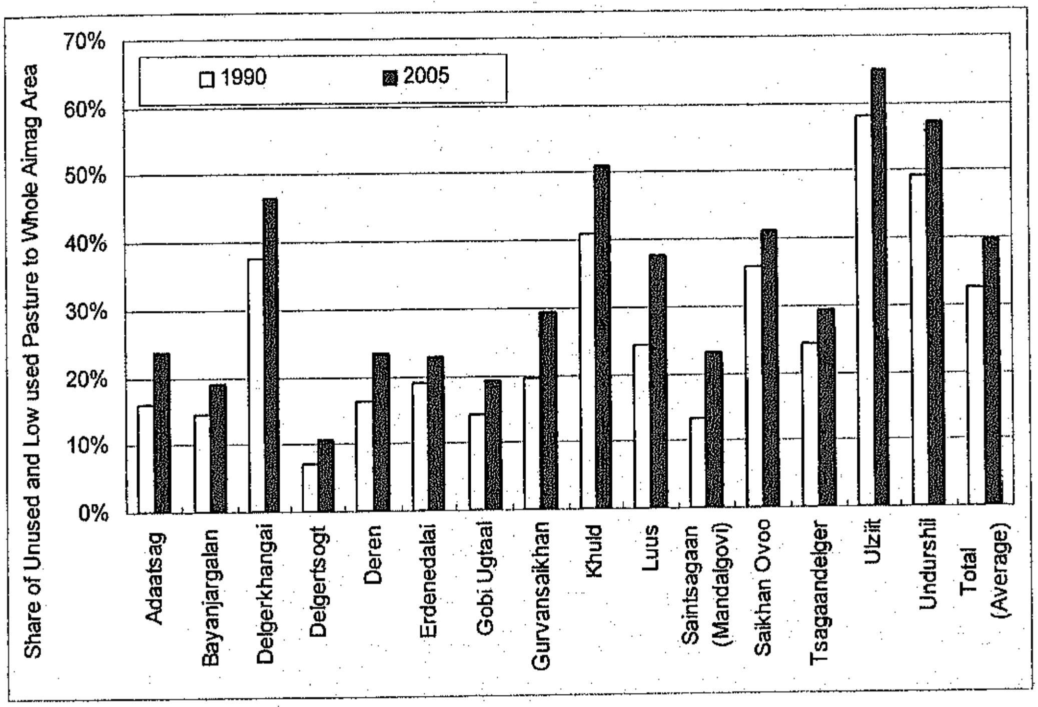


Fig. 2.5.13 Expansion of Unused and Low Used Pasture (*Dundgobi*)

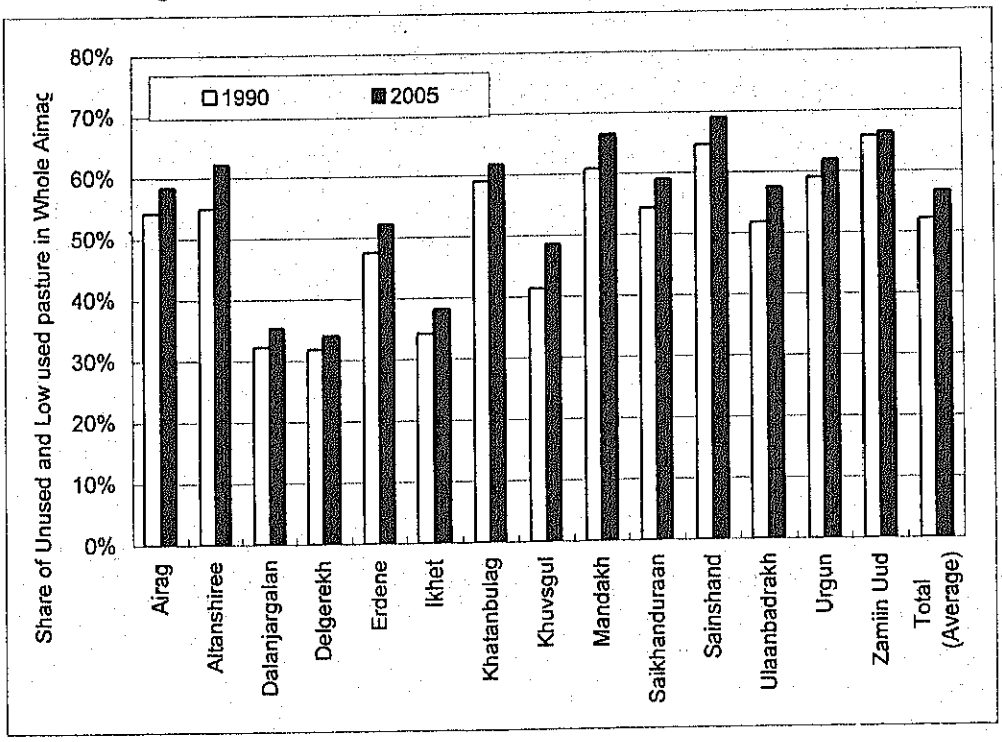


Fig. 2.5.14 Expansion of Low Unused and Low Used Pasture (*Dornogobi*)

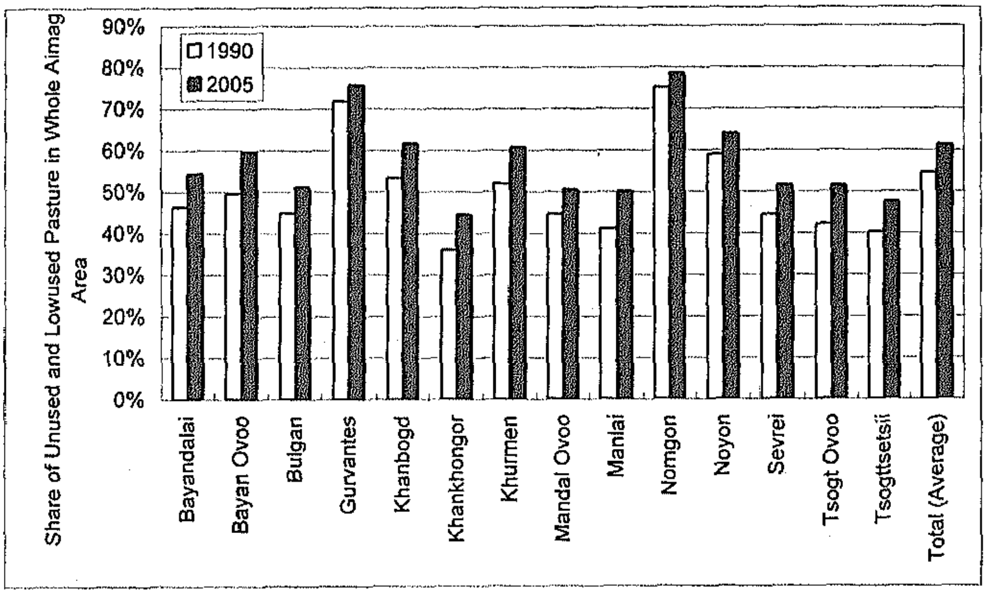


Fig. 2.5.15 Expansion of Unused and Low Used Pasture (*Umnugobi*)

4) Supplying Water to Pasture by Traditionally Used Water Sources

3km radius area from each traditionally used water source, such as Traditional Wells, ponds (lakes) and springs, are calculated as stable water supplied area using GIS. GIS data of springs and lakes is digitized data from topographic map scale 1:500,000 and capacities and water volumes are not considered in this calculation.

Ratios of water supplying by them are shown below by *Aimag*.

Table 2.5.10 Ratio of Water Supplying by each Traditionally Used Water Source

Dundgobi	Lake	Spring	Traditional Well
Northern *Soums*	30.2%	4.0%	65.7%
Southern *Soums*	45.1%	2.5%	52.4%
Total	37.0%	3.3%	59.7%
Dornogobi	Lake	Spring	Traditional Well
Northeastern *Soums*	1.4%	3.8%	94.8%
Southwestern *Soums*	0.2%	7.5%	92.3%
Total	0.7%	5.8%	93.4%
Umnugobi	Lake	Spring	Traditional Well
Northern *Soums*	32.4%	5.3%	62.3%
Southern *Soums*	10.9%	16.4%	72.8%
Total	20.9%	11.2%	67.9%

In *Dundgobi* and *Umnugobi*, ratios of lake and spring are rather high. In contrast, Traditional Well is very high ratios in *Dornogobi*.

Current pasture water rate by traditionally used water source is shown in comparison to whole stable water supplied pasture rate in the next figures by *Aimag*.

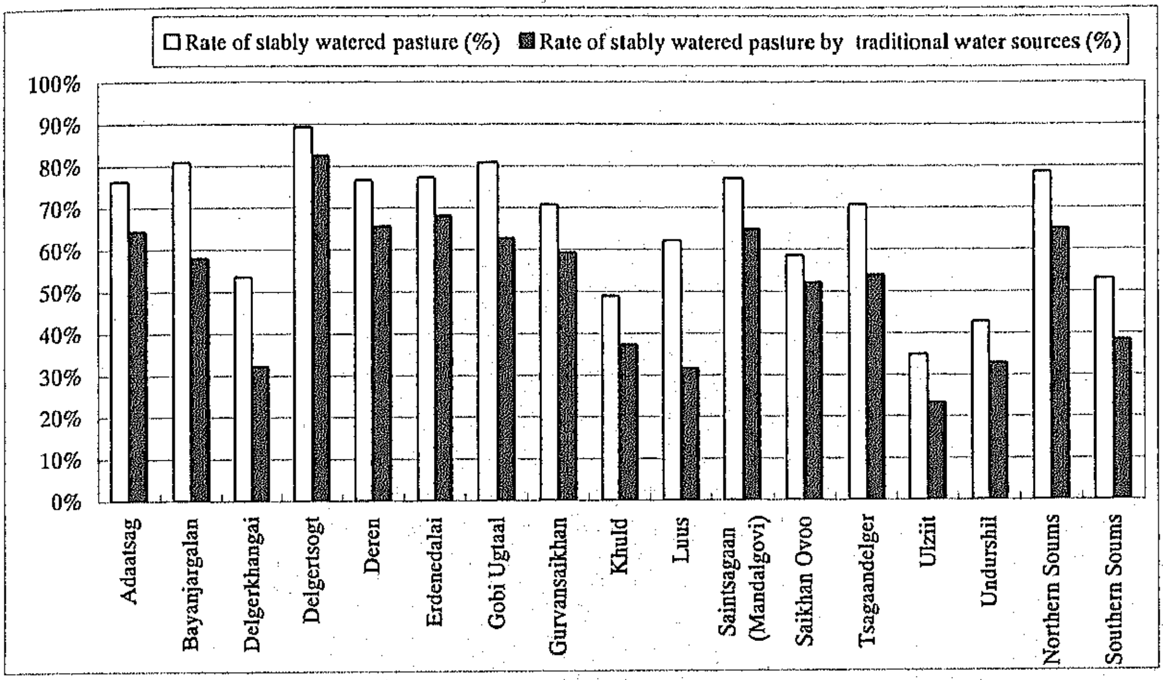


Fig. 2.5.16 Rate of Water Supply Pasture by Traditionally Used Water Sources in Comparison to Whole Stable Water Supplied Pasture. (*Dundgobi*)

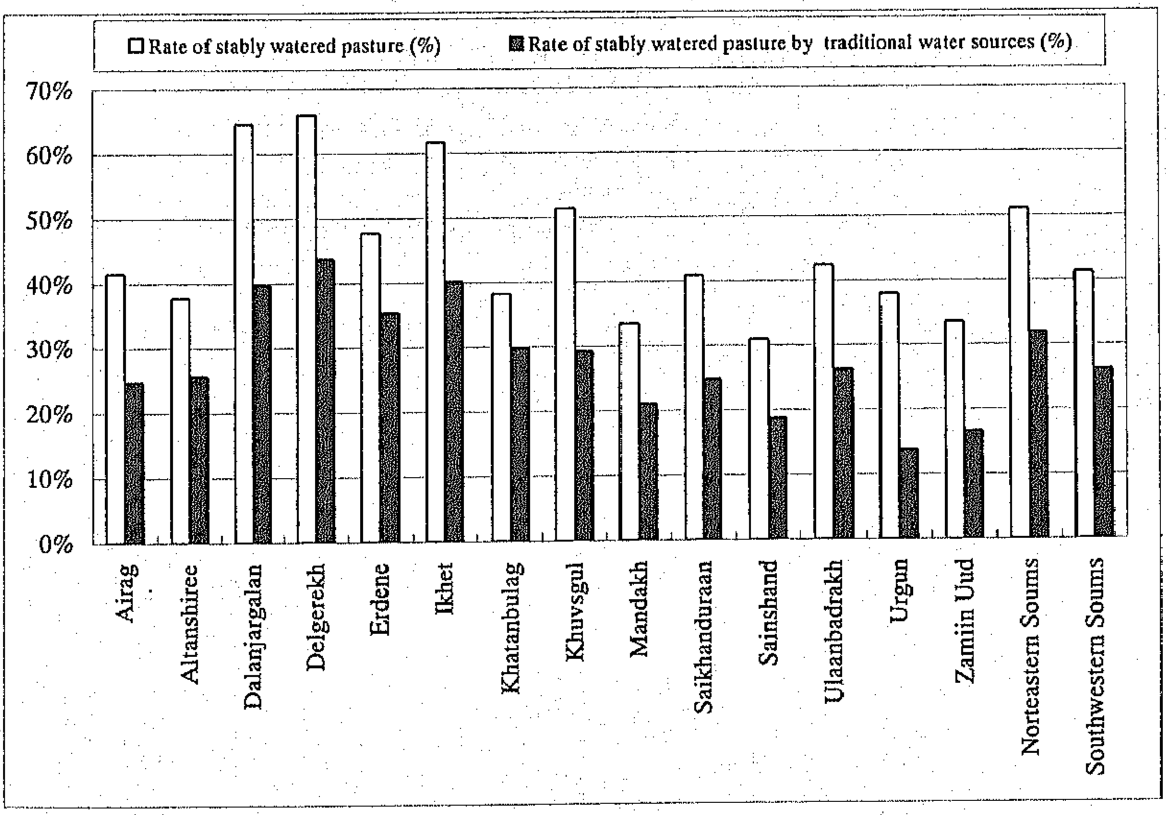


Fig. 2.5.17 Rate of Water Supply Pasture by Traditionally Used Water Sources in Comparison to Whole Stable Water Supplied Pasture (*Dornogobi*)

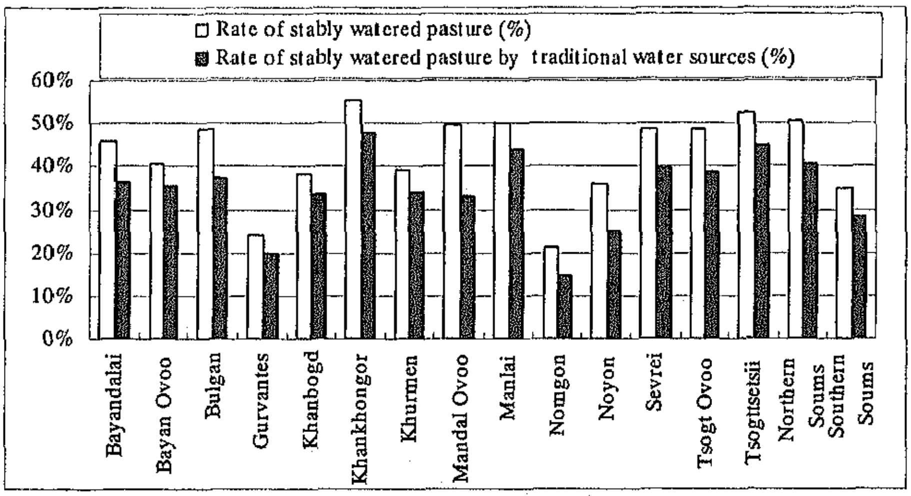


Fig. 2.5.18 Rate of Water Supply Pasture by Traditionally Used Water Sources in Comparison to Whole Stable Water Supplied Pasture (*Umnugobi*)

5) Location of Rehabilitated and Newly Constructed Traditional Wells

In the Pilot Study Area in three *Soums* (as far as *Soum* government grasp during season of 2004 to 2005), location of rehabilitated and newly constructed Traditional Wells (n=181) is shown in the next figure. In three *Soums*, differences range between 57.1% to 96.0%, but Traditional Well is located in stable water supplied pasture at the rate of 74.6% on average.

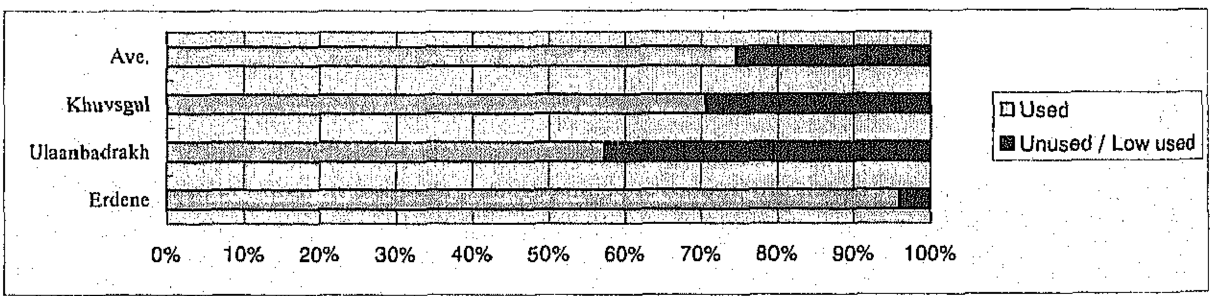


Fig. 2.5.19 Location of Rehabilitated and Newly Constructed Traditional Well

In comparison with the ratio of Production Wells of Pilot Study, ratios of rehabilitated and newly constructed Traditional Wells, which have contributed to development of Unused and Low Used Pasture according to seasonal use are shown in Fig. 2.5.20.

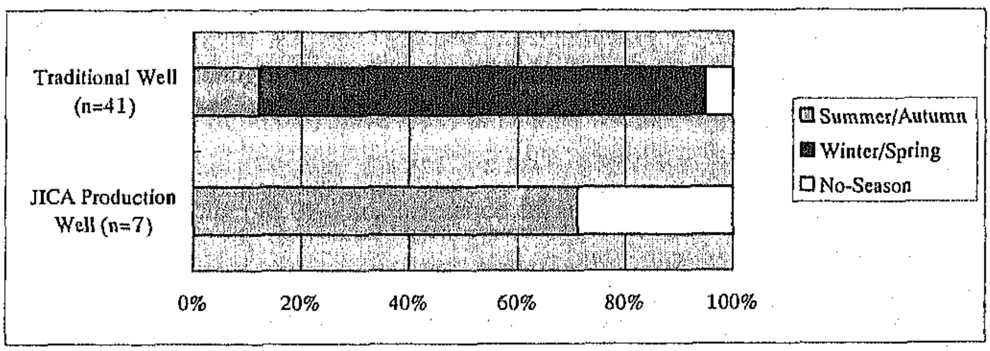


Figure 2.5.20 Using Season of Traditional Wells in the Unused and Low Used Pasture according to Seasonal Use

In the Pilot Study, development of Unused and Low Used Pasture area was conducted mainly in the summer or autumn pasture. More than 80% of Traditional Wells are located in summer or autumn pasture. Traditional Wells have rarely contributed to development of Unused and Low Used Pasture.

6) Geographical Distribution

The overlaps between distributions of winter and spring camps and water resources in *Erdene*, *Ulaanbadrakh*, and *Khuvsgul*, where the survey on the camp distribution was conduced, are indicated in the Fig. 2.5.21 below.

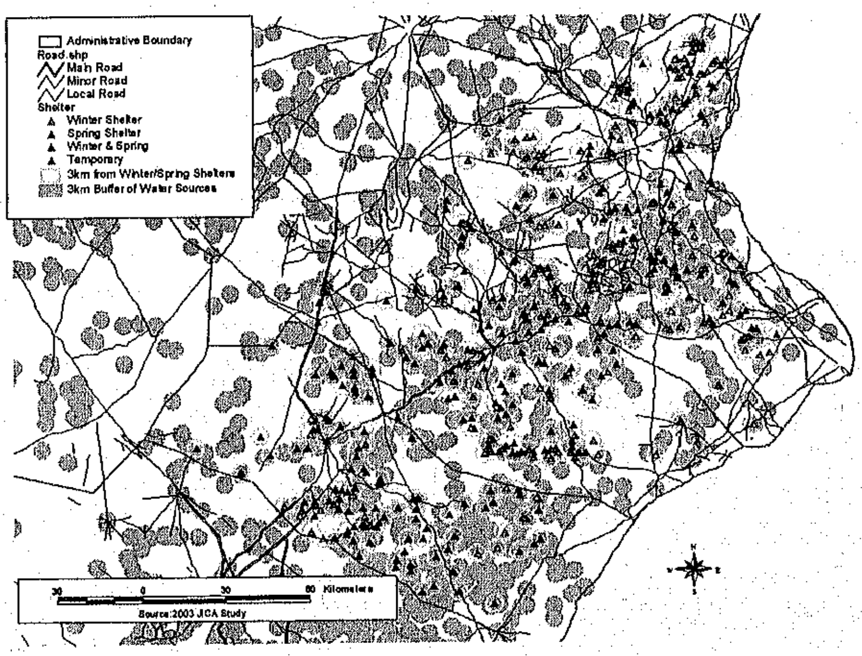


Fig. 2.5.21 Overlaps between Winter and Spring Camps and Water Sources

Distribution of winter/spring camps coincides with distribution of water resources, as it does throughout three *Aimag*. On the other hand, summer and autumn camps have mainly low water supply in the pastures and thus are low use and unused.

(4) Land Use in the Special Reserve Areas

Special consideration is required to the Land use in National Parks, nature conservation areas and border zone, it is mostly prohibited for herders to use pasture in Natural Parks and nature conservation areas. However in reality there are still winter/spring camps in the region, and they continue to use as before. On the other hand, it is restricted to enter border zone within 15 km buffer areas, except for the emergency cases such as years of drought. It is important to consider these matters in investigating carrying capacity in each *Soum*.

2.5.3 WATER SUPPLY FACILITIES FOR LIVESTOCK

(1) Kinds and Quantities of Water Supply Facilities

In Mongolia, surface water and groundwater resources are national property, and individual possession is not permitted. After the collapse of the socialist system, the number of wells largely decreased because well management was not sufficient as a result of confusion of the administration's competent authority for wells.

The wells in the Study Area are categorized into four kinds – Production Well, Shallow Well, Shaft Well and the traditional hand-drawn well (Traditional Well).

Table 2.5.11 Specification by Well Type in Mongolia

	Well Depth (m)	Yield (l/sec)	Average Yield (l/sec)*1
Production Well	40-200	<1.0	2.87*2
Shallow Well	18-40	0.3-0.6	0.79
Shaft Well	6-18	0.2-0.4	0.45
Traditional Well	2-9		0.24

Note *1: Average yield of the well in *Dornogobi Aimag* (Source: Institute of Geoecology, Well Database)
*2: Except large-scaled water supply facilities at 15 l/sec

1) Production Well

Production Wells are categorized into two kinds according to the difference of the pump equipped with it. In case of the well equipped with a submergible motor pump, water can be stored in a water storage tank with 10 - 20 m^3 capacity and transported by a water tank truck. And in case of the well equipped with a lift pump, water can be supplied from a concrete-made water storage tank of 1.5m × 1m× 1.5m (approximately 2.0 m^3) to a feed water tank through a pipe.

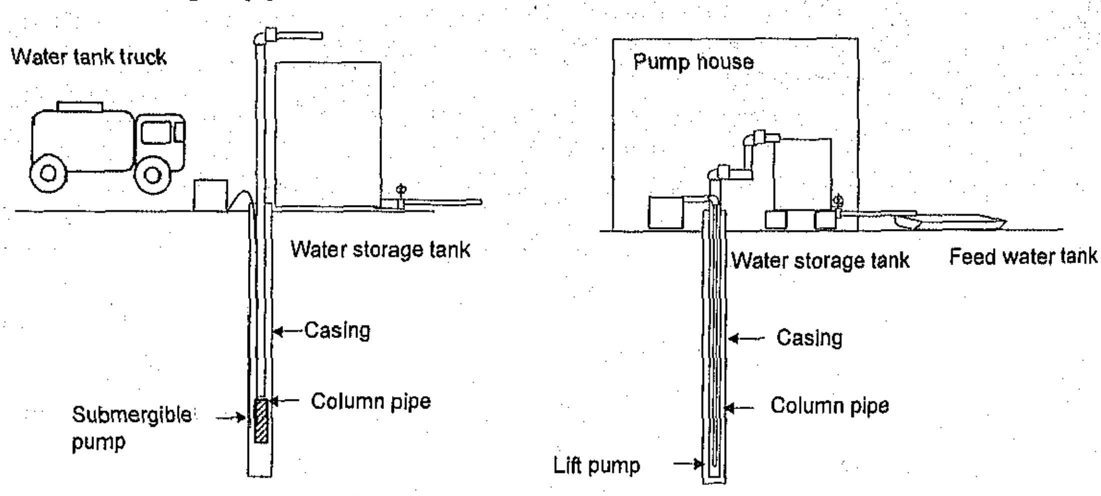


Fig. 2.5.22 General Map of Production Well Facilities

2) Shallow Well and Shaft Well

Although inner structure of Shallow Wells and Shaft Wells is different, rotary pumps actuated by livestock were installed at the both well. While a Shallow Well is a short-pipe well equipped with a cylindrical casing made of concrete measuring 1 m in diameter on the ground similarly as a Shaft Well, it is similar in structure to a Production Well with 168-mm-dia casing buried below the lower part of the concrete cylinder (approximately 2 m deep or deeper.) Shaft Well has the structure where concrete cylinders of one meter in diameter are built up at the bottom of the well. Moreover, the water supply method used for Shallow Wells, Shaft Wells is direct water supply to feed water tanks. The feed water tank is semi-cylindrical shaped and is 30 - 50 cm in diameter and 2.3 - 3.8 m in length (0.27 - 0.37 m^3).

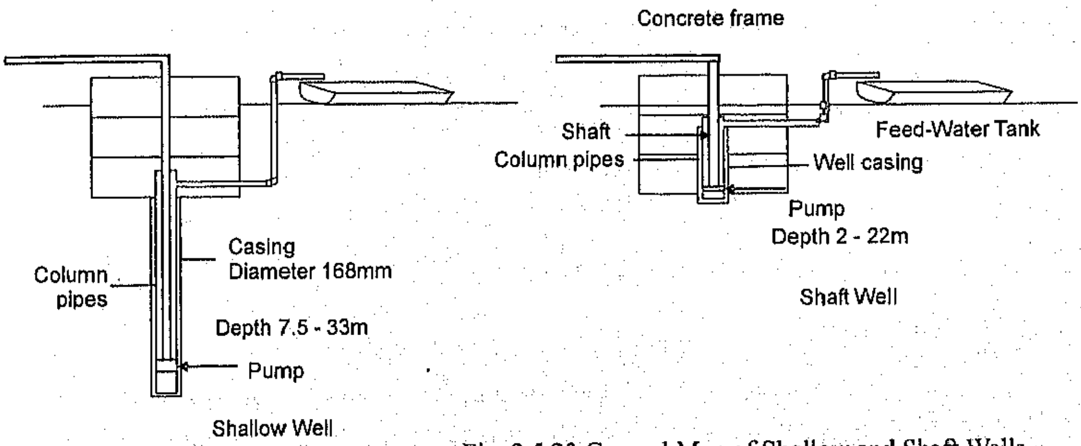


Fig. 2.5.23 General Map of Shallow and Shaft Wells

3) Traditional Well

In the Gobi region, Traditional Wells are constructed by digging approximately 7 - 8 m in deep cases and lining the well with stones. They use bucket to take water by hand-power. Capacity of Traditional Well is not so large, and it uses a shallow aquifer so that its yield is variable due to season and rainfall; however, it is very important for herders because it is free of operation cost.

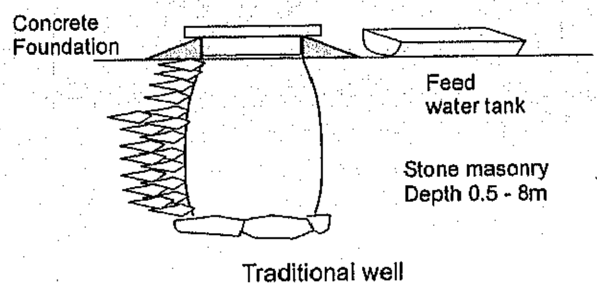


Fig. 2.5.24 General Map of Traditional Well

Traditional Well is operated and maintained by herders, not by Ministry of Food and Agriculture. However, it can not be individually owned and is used as public property.

The service life is said to be approximately 20 - 30 years and many wells are already in need of rehabilitation. In addition, since they are often constructed near a dry valley where groundwater is easily obtained, and they are likely to be buried by earth and sand flowing in when the dry riverbed is flooded, many wells have become unserviceable.

The wells that have been traditionally excavated by herders on their own, have been sluggish since 1970s – 1980s when Engineering Wells rapidly increased. In these years, the numbers of herders who have experienced in actual construction of Traditional Wells have been decreasing in every *Soum*. If the tradition of constructing Traditional Wells disappears and many wells need replacement, it would produce a critical situation for livestock farming.

Construction of Traditional Wells by herders has been encouraged by Ministry of Food and Agriculture through sponsoring a "Traditional Well" contest since 2002 and implementing water source prospecting in response to herder requests. It is said that herders can excavate wells as deep as approximately 7 m by themselves. But the average wells that they actually excavate are limited to approximately 3 m deep, even though an approximate groundwater level has been identified as a result of the water source prospecting, and Ministry of Food and Agriculture guides them to excavate deeper than 3 – 4 m.

(2) Damage Levels and Rehabilitation Method of Water Supply Facilities

1) Production Well

After well management was abandoned, engines, houses, water storage tanks in ground facilities remain destroyed or were disappeared by stolen and not to be reused.

Lightly damaged wells are considered to have the following conditions.

- The column pipes remain as they were, after Russian's lift pumps were broken.
- The broken submergible pumps are still left on the wells.
- Wells have been covered firmly by welding.

The lightly damaged wells can be rehabilitated by dredging buried objects inside the wells, cleaning them by using the air lifting method, and later mounting submergible pumps to them. However, significantly damaged wells require much time to be rehabilitated because objects dropped into them cannot be identified.

Dredging inside the casing by a tricone bit is an appropriate rehabilitating method for such wells. However, the cost is lower to newly excavate a well of 100 m deep than to rehabilitate a well that is full of uncertainty with unclear success rate when considering the period required to newly construct a well of 100 m deep is only approximately 15 days. While cost comparison between rehabilitation and new construction depends on the period required for rehabilitation dredging, if such metal pieces as pump parts have been put inside the casing, there may be wells that cannot be coped with including procurement of materials.

In this Study, a feasibility study on rehabilitation of 12 Production Wells was conducted and, as a result, expected pumping discharge was obtained on 11 wells. The remaining one well could not be rehabilitated because the lower part of the lift pump had been broken and the shaft remained buried in the well.

Well depth, static and dynamic water level, and appropriate pumping discharge of individual wells were surveyed before rehabilitating based on the data of management ledger of wells as basic data. After rehabilitation, the static levels were almost consistent with the basic data but the other data was not consistent in some wells. The following facts were found as causes for these inconsistencies: the depth of the well indicates a drilled length, which is different from the casing length (backfilling); since the dynamic water level and the pumping discharge were determined by airlift pumping, they varied depending on the capacity of the compressor. The well capacities before and after rehabilitation could not be precisely compared for these causes. However, when only buried sand was dredged and there was no sign of new inflow of sand through the screen in dredging despite the age deterioration of the wells, it was judged that the rehabilitated wells can sufficiently stand future use. It was found that rehabilitation of Production Wells will achieve a high success rate if rehabilitation feasibility is examined sufficiently in the advance field study.

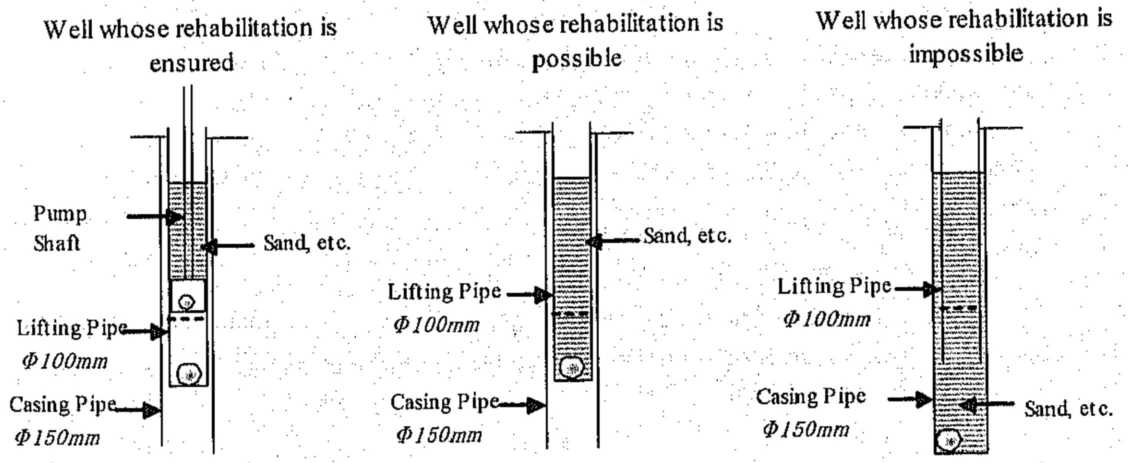


Fig.2.5.25 Judging Criteria on Propriety of Rehabilitation

After adopting the request of the well to be rehabilitated, possibility of the rehabilitation shall be examined according to the following process.

i) With reference of the existing situation and data of the well, the propriety of the rehabilitation shall be judged.

ii) When there is the existing lifting pipe, it shall be removed, and then well depth shall be checked.

iii) Uplifting test shall be done by using airlift. Based on the result of this test, capacity of the pump and specification of the generator shall be determined.

iv) After installing the pump and generator, a water tank and a feed water tank are set, and then protection box shall be constructed.

2) Shallow Well

Many Shallow Wells have been destroyed and they cannot be used by a hand drawing because their pumps, which are activated by livestock, were broken. As far as investigated in the field study, most of the destroyed wells have been buried and the cost will be lower to construct a new well than to rehabilitate the old ones in terms of their depths.

However, wells where foreign matters have not been thrown into the casing tube can be rehabilitated by airlift dredging and cleaning of buried sand in the casing.

3) Shaft Well

During the socialist era, a special excavator was used that could excavate the well of 1 meter in diameter to construct the Shaft Well, but this equipment is no longer in existence; therefore, only well rehabilitation shall be targeted. Originally animal powered pump was installed in the well; however, such pumps are no longer made at present. Now that pumps of the Shaft Wells are broken, many of them are currently used by hand-drawing, similarly to Traditional Wells. The water sources lie in shallow aquifers in river trails or river banks. The wells have become submerged and river sand flows into them when it rains heavily because the upper part of the ring-shaped concrete cylinders has often been removed to shorten the distance of hand drawing.

Also because their pumping discharge is originally small as their depth is shallow, and their screens are in an advanced state of clogging, it is considered difficult to secure a pumping discharge equal to a newly constructed well even if they are rehabilitated.

As a result of airlift dredging of the Shaft Wells conducted in the demonstration survey, water output quantity fell short and the wells were emptied. It is considered that airlift dredging is too difficult and manpower dredging is more appropriate for Shaft Wells. This method, where a worker will enter the well, scoop up buried sand by using a bucket and clean the screen section, requires a pump for drawing spring water and air to provide the worker with oxygen.

However, the rehabilitation of Shallow Well is judged difficult because the local contractor does not have appropriate materials and equipment; also because the screen will be cleaned from inside the well, the temporarily recovered screen is likely to be clogged again; and finally, the Shallow Wells are currently used as hand-drawn wells, and so reducing in pumping discharge is likely to cause trouble with herder managers.

As for the usage, while the wells with water levels lower than -4 m have been used by hand drawing, the wells deeper than that depth have been decreasing because it requires too much manpower. Because installation of pumps to the wells with low water levels will not lead to increase of livestock based on their small pumping discharge, the installation of the pumps cannot be justified in terms of cost burden. Continued use of wells with water levels deeper than -4m can only be considered by lightening their drawing efforts. However, since a well with insufficient pumping discharge will not be used even if they are equipped with a pump, pumping capacities of wells need to be surveyed to identify wells that can secure the required pumping discharge for equipping with pumps.

4) Traditional Well (Hand-drawn well)

Traditional Wells used to be constructed by excavation specialists in the era of socialist system; however, herders themselves have not really taken over the technology. In terms of the structure, since the inside of the well has been protected by building up stones, it is difficult to rehabilitate a section of it, and the time and the labor required for it is almost the same as new construction.

Even a specialist team needs approximately 15 days to construct a Traditional Well. In case of excavating a well in the sandy soil of the Gobi region, it is desirable to excavate Traditional Wells in December or April when the soil is frozen in order to prevent collapse of the well during the excavation. However, these wells are in many cases constructed by herders on their own from the end of June to August when schools are in vacation and manpower is available. In this case, since the groundwater level has risen, measures are required to prevent collapse of wells during excavation such as preparation of equipment to drain groundwater during excavation and use of casing made of lumber. Even in the case that groundwater has been identified by excavation conducted in summer (rainfall season), it will be difficult to use the well on a full year basis because of water depletion in winter unless the well is excavated 2 – 3 m deeper than the depth where the groundwater was identified in consideration of lowering of the water level in winter.

5) Water Storage Tank, Feed-water Tank, and a Pump House

Some water storage tanks and feed-water tanks are currently operated, but they are in an advanced state of deterioration, and some of them have difficulty to be reused. The water storage tanks are mostly made of concrete and have been constructed with mortar applied from inside and outside. Many of them have cracks on sides that have been repaired with mortar. However, these repairs are most likely to fall off as a result of freezing in winter, and therefore rehabilitation is considered to be difficult. Its repair was tried with liquid-glass or coal tar but both were not succeed. The feed-water tanks, which have been constructed of ferroconcrete, are in an advanced state of weathering and destruction because they have been left unmaintained for many years.

While pump house currently exist for wells that had been maintained by pump managers, pump houses for wells that had not been maintained by pump managers have been destroyed. The purposes of pump houses are protection of equipment and freeze-proofing of a water storage tank. Stove was placed inside for freeze-proofing in past.

(3) Relations between Herders and Water Supply Facilities

1) Existing Condition of Operation and Maintenance for Well

At present, ownership of Engineering Wells belongs to the *Soum* and Traditional Wells are recognized as public property in the region. However, the management representative for operation and maintenance of the Engineering Well is entrusted verbally by the person in charge of the well in *Aimags* among herders in the past. This person receives an administrative fee in-kind (as fuel, livestock animal, dairy products, crops, etc.) from the user of the well. In general, the fuel cost of generator of Engineering Well is shared evenly by the users. On the other hand, Traditional Wells are outside the control of the government and are managed by herders voluntarily.

Since written rules or agreements have not been made to manage and maintain Engineering Wells, each well has been managed based on the customary rules of herders. Hence, the well was abandoned when it was damaged seriously due to lack of repair budget from either herders or the government. According to the results of the study, the responsibility for well management and maintenance has been clear on the wells operating since the turbulent period after the systematic transition. For example, such caretakers are individuals or companies who took over well facilities from *Negdel*.

The idea that responsibility should be clear on well operation and maintenance, is common sense in Ministry of Food and Agriculture and for other donors concerned such as ADB. Thus, recently a written agreement has been made between the *Soum* and herders in case of newly constructed and rehabilitated wells for sustainable usage. Identification of the well users and owner was one of the aims of well inventory survey, which carried out in of 2003 by Ministry of Food and Agriculture.

Some wells found in this study could not be maintained due to lack of repair funds although the well had been rehabilitated recently and its representative was clear. Also, the importance of raising repair funds is not recognized enough and the funds are not collected among many of well user groups. Therefore, it is necessary to encourage herders to save money not only for operation, but also for maintenance as well as the establishing of the responsibility for the well operation and maintenance.

In addition to the issues above, the following matters identified through the study should also be considered in the preparation of a well maintenance plan.

- The well facilities constructed in the past are still operating due to continuous care by technicians. But it seems difficult for ordinary herders who do not have technical knowledge to maintain such old and large well system. Thus, it is desirable to design a well system with a maintenance-free structure as much as possible.
- Because of risks such as theft, the generator should be placed every using time or a pump house should be constructed to protect the generator. In all cases, the generator should be carried carefully to avoid dropping or damage.

- Charging for non-member use of the well should be considered in well utilization and maintenance rules. However, such price setting is related to co-existence of herders. Thus, it is better to make common rules in the region.
- Traditional Wells also require to be maintained and renewed due to dropping of foundation stones, decreasing of yield, collapsing of the inner wall, etc.

Examples of operation and maintenance by type of the well are as follows.

Table 2.5.12 Results of Well Maintenance Survey

		Responsibility on Well maintenance has been cleared.	Main User	Well User had been Organized.	Fund for Well maintenance and replace has been collected	Well use by non-member herder Existing of Charging for them	Rehabilitation	Note
Production, Shallow Well {Livestock}	*Khomutyn Khundi* [*Dornogobi*]	o	Herder Group (5 Families)	o	×	-	*Aimag*	Rehabilitated in 2001
	Tsagaan Ereg [*Dornogobi*]	o	1 Family	×	×	-	-	Managed by individual
	Buhel 1 [*Dornogobi*]	-	Unusable	×	×	-	Donor	Pump was broken and became unusable after rehabilitation.
	Yamagin Tsoh [*Dundgobi*]	o	Mainly 1 Family Small Livestock 200, Large 10	×	×	△1	-	Managed by individual
	Zuun Tugrug [*Dundgobi*]	o	Herder Group (6 Families) Large Livestock 400, Small 2000	o	o	o	NGO	Rehabilitated in 2000
	Mandinkhar [*Dundgobi*]	o	1 Family, Livestock: 1000	×	-	-	-	Supplementary use for Tradition Well
	Hairhan [*Umnugobi*]	o	-	×	o	o	User	
{Cultivation}	*Tsagaan Tsav*	o	Company	-	o	-	-	
	Khuiten	o	10 Families	o	×	-	-	Unusable
	18yn-Khudag	o	1 Family	×	o	Tg 1 / 1	-	Contract farming
	Ulaan Ereg [*Umnugobi*]	o	Company	-	o	T20g/ Month/ Sheep	-	Well in tourist camp. Surrounding herders can use it, but it is said that fee is expensive.
	Manlai [*Umnugobi*]	o	1 Family (5 person for vegetable growing)	o	×	×	Cooperative	Rehabilitated by loan. Cooperative consists of herders and agriculture cooperatives.
Shaft Well {Livestock}	*Zagd Ulaan*	×	3 – 4 Families	△2	×	-	-	Repair parts cannot be obtained
	Bor Khamar	o	7 Families	o	×	×	*Aimag*	Generator was broken after rehabilitation, It is impossible to be repaired
	Otson	o	Water supply for 400 sheep	△2	-	×	UNDP	Hand Pump
{Agriculture}	*Bayan Oyoo*	o	-	×	×	-	-	Repair parts cannot be obtained

- : No answer or uncertain, △1 : sharing only fuel cost, △2 : *Khot-Aile* (Source: JICA Study Team, 2003)

2) Production and Shallow Well

The most of the Production Wells operating for water supply in *Aimag* Center and *Soum* Center or for irrigating vegetable cultivation are operated and maintained by a resident manager around the well. Each of them is used by fixed users and the person in charge of its operation and maintenance is clear. On the other hand, since water users for livestock farming can use various types of water sources besides the specific well, they could survive although they are reluctant to pay for well management. Therefore, there are a few such Production Wells actually used by herders in each *Soum*.

3) Shaft Well

There are a very few Shaft Wells where shaft pumps remain. Since almost of them have no pump, they are actually used like a Traditional Well.

4) Traditional Well (Dug Well)

Traditional Well is the most popular among herders. Basically, a specific herder or herder group owns, operates and maintains it based on customary laws of ownership. They have no specific rules for operation and maintenance, but they deal with them case by case.

(4) Herder's Contribution and Well Use

A new joint decision was signed in 2005, June by Minister of Food and Agriculture, Minister of Natural Environmental and Minister of Finance. According to this decision, herder have to contribute a part of construction/rehabilitation cost of the engineering well. This contribution has to be paid before the construction works.

Herder's contribution was decided as follows: In the case of rehabilitation, it is more than 10% of construction expense. In the case of new well construction it is more than 5% construction expense.

This construction expense does not include equipment expense for pump and generator cost.

Rehabilitation / New Construction Cost					
Construction Expense				Equipment expense	
Drilling / Rehabilitation	Pumping test	Facilities	Setting and Adjustment	Pump	Generator

Source: JICA Study Team

Herder's contribution shall be 10%/5% of construction expense

Fig. 2.5.26 Composition of Rehabilitation/New Construction Cost and Herder's Contribution

As for well use by the herder who pays his contribution, the rights will devolve to the herder after 3-party signing by the *Soum*, well contractor, and the herder.

(5) Costs of Water Supply

1) Operation and Maintenance (O & M) Cost

O & M cost consists of fixed cost for installed equipment and variable cost for operation. Fixed cost includes depreciation cost for the equipment and re-supply of the parts, and variable cost is fuel expense.

In addition to daily operation cost and oil, accumulation for funds for overhaul and new purchase is required. The overhaul includes the exchange of parts, which is inevitably needed for operation, such as worn fans and seals. In the long run, new purchase of the equipment is required after 10 - 20 years. This cost should be included in the maintenance cost. Depreciation period is 10 years for a pump and 5 years for a generator. The cost of repair parts accounts for 3% annually for a generator.

Moreover, it is hard to employ an operator from the beginning of mounting a pump because of the cost. But the necessity of employing the operator can be considered for efficient utilization of the well in the future. Accordingly, the fixed cost including the personnel expense of the operator is also examined. The expense should be no less than the minimum salary. Therefore, it is, Tg 20,000 per month or Tg 240,000 per year. Consequently, fixed cost is shown in the table below.

Table 2.5.13 Fixed Cost for O & M (Annual Cost (Tg))

Type of Pump	Depreci-ation	Parts	Total (1)	Salary	Total (2)	Generator
AP12.40.04	268,400	25,620	294,020	240,000	534,020	KDE2000C
SP5A-12	396,500	29,280	425,780	240,000	665,780	KDE3300C
SP5A-8	338,550	29,280	367,830	240,000	607,830	KDE2000C
SP5A-6	305,000	29,280	338,280	240,00	574,280	KDE2000C

Fuel expense as variable cost largely depends on the number of feed-water livestock and days of pump operation. As for the number of livestock, 3 cases of herder groups were examined: namely, 1,000, 2,000, and 3,000 heads in sheep units. If the capacity of the pump is 60 l/sec and feed-water per sheep is 5 l/time, operation hours would be 1.4 hours for 1,000 heads, and fuel consumption/ hour would be 0.29 l and 0.42 l for generator types KDE2000C and KDE3300C respectively. When fuel expense is Tg 800/*l*, the costs of feed-water/ time are as follows:

KDE2000C: 0.29 x 1.4 x 800 = Tg 324.80

KDE3300C: 0.42 x 1.4 x 800 = Tg 470.40

Days of feed-water per year will be 105 days because the wells will be used every other day (totaling 75 days) for 5 months in summer and autumn and it is assumed that it is rarely used as totally 30 days for 7 months in winter and spring due to existence of snow. Thus, days of feed-water per year would be 105 days. Accordingly, annual fuel expenses for 1,000 heads are as follows:

KDE2000C: 324.80 x 105 = Tg 34,104.00

KDE3300C: 470.40 x 105 = Tg 49,392.00

In the same way, the calculations of annual pump operation cost, annual pump operation cost/sheep, and operation cost/time for 2,000 heads and 3,000 heads are summarized in the tables below respectively.

Table 2.5.14 Operation and Maintenance Cost of Pump without Payment for Operator (Tg)

Type of Pump	Fixed Cost	Variable Cost (Fuel)			Annual O & M Cost of Pump		
		1,000 heads	2,000 heads	3,000 heads	1,000 heads	2,000 heads	3,000 heads
AP12.40.04	294,020	34,104	68,208	102,312	328,124	362,228	396,332
SP5A-12	425,780	49,392	98,784	148,176	475,172	524,564	573,956
SP5A-8	367,830	34,104	68,208	102,312	401,934	436,038	470,142
SP5A-6	334,280	34,104	68,208	102,312	368,384	402,488	436,592
Type of Pump		Annual O & M Cost of Pump/ Sheep			Cost / Feed-water		
		1,000 heads	2,000 heads	3,000 heads	1,000 heads	2,000 heads	3,000 heads
AP12.40.04		328	181	132	3.12	1.72	1.26
SP5A-12		475	262	191	4.53	1.82	1.82
SP5A-8		402	218	157	3.83	2.08	1.49
SP5A-6		368	201	146	3.51	1.92	1.39

Note: Annual Operation Days: 105 days

Table 2.5.15 Operation and Maintenance Cost of Pump with Payment for Operator(Tg)

Type of Pump	Fixed Cost	Variable Cost (Fuel)			Annual O & M Cost of Pump		
		1,000 heads	2,000 heads	3,000 heads	1,000 heads	2,000 heads	3,000 heads
AP12.40.04	534,020	34,104	68,208	102,312	568,124	602,228	636,332
SP5A-12	665,780	49,392	98,784	148,176	715,172	764,564	813,956
SP5A-8	607,830	34,104	68,208	102,312	641,934	676,038	710,142
SP5A-6	574,280	34,104	68,208	102,312	608,384	642,488	676,592
Type of Pump		Annual O & M Cost of Pump/ Sheep			Cost / Feed-water		
		1,000 heads	2,000 heads	3,000 heads	1,000 heads	2,000 heads	3,000 heads
AP12.40.04		568	301	212	5.41	2.87	2.02
SP5A-12		715	382	271	6.81	2.58	2.58
SP5A-8		642	338	237	6.11	3.22	2.25
SP5A-6		608	321	226	5.79	3.06	2.15

Note: Annual Operation Days: 105 days

Among these calculations, the relation between the number of livestock and cost of feed-water/ sheep in case of SP5A-8 (about 40m in pump head) is shown in figure on right side.

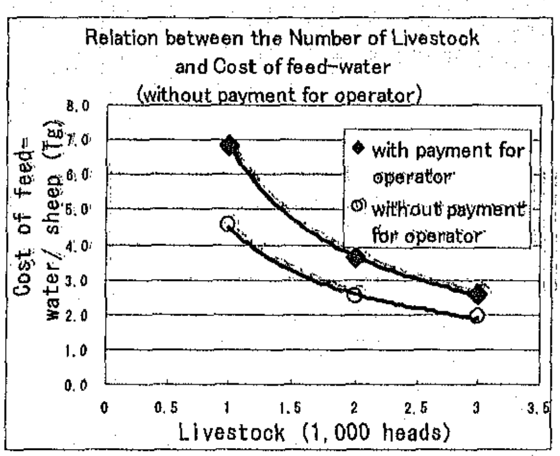


Fig. 2.5.27 Relation between the Number of Livestock and Cost of Feed-Water

The operation cost with the operator is about 1.5 times compared with that without the operator. Cooperation in the herders group is important to decrease the operation cost, for example, the other members taking care of the operator's livestock and rotating the post between members. Moreover, the pump operation cost drastically increases in the case of about less than 2,000 heads. If a pump is installed, a few users would have much burden. This would be an obstacle for sustainable use of the pump unless the system that many herders can use it efficiently is introduced.

(6) Problems of Water Supply Facilities

1) Seasonal Use of Water Source

Since the carrying capacity of pasture in Gobi region is small, herders move several times a year. The period of using a single feed-water point is short and the period of not using it is long in a year.

A well manager manages a power generator by carrying it, but a submergible pump left in a well. While leaving the submergible pump, it rusts within the pipe. This will speed up the abrasion inside the pump when reused. Furthermore, a part of the facility might be stolen in the absence of the manager.

2) Operation during Winter

Temperature sometimes falls to as low as -40 degrees Celsius in winter. At that time, a water storage tank and piping freeze. Therefore, people come to take water directly to a feed water tank without passing through the water storage tank. Since the capacity of the feed water tank is small, people frequently operate and shuts down the pump. As a result, abrasion of the pump speeds up.

3) Well Manager

Since it was a rule that the rehabilitated well was managed only by a manager, cooperation could not be obtained from herders for establishment of the funds. In consequence, there was a case where a broken pump had been left unrepaired.

4) Well Maintenance by Administration

According to the regulations, well maintenance should be responded by administration. However, it is carried out by consigned drilling company, since local administration does not have enough equipment. In this maintenance work, well inventory lists are used. Well inventory list is also obtained by previous study carried out by JICA Mongolia office. However original database may be same with list in such maintenance company and obtain one since difficulty to prepare it.

Although the wells coordination were measured using GPS in the Study, the differences in position were found in list the wells whose name and registration number is corresponded.

2.5.4 PROBLEM OF MARKET, TRANSPORTATION, AND LIVESTOCK PROCESSING

Although Mongolia converted to market economy 10 years ago, there is almost no marketing system in the rural areas, and people, especially the poor, do not have access to competitive markets. There is no or very weak infrastructure for supplying price information about primary processing, packaging, grading, collecting and receiving of agricultural commodities in rural areas. The situation is the same in three *Aimags*.

Livestock products are marketed and consumer goods brought to herders through the following channels:

(i) Marketing companies and cooperatives. They are active in some *Soums*, but their share in total marketing channels is very small.

(ii) Local authorized dealers of big processing factories. Cashmere and meat processing factories make efforts to procure their raw materials through their authorized dealers, but it is limited.

(iii) Producers directly supply the products. Big producers directly sell their products to processing factories. But this is not common. Small producers form cooperatives by pooling their produce and raw materials and sell it to the market to purchase production inputs at lower price.

(iv) Wholesale network. This is part of the Government's action program and is currently in the beginning stage with government support.

(v) Small private traders and middleman who do not belong to dealers of bigger processors in section (ii). This case is dominant in the Study Area; they have small capacity but are very mobile and usually visit herders households and collect raw materials.

The above marketing channels operate in different combinations in each *Soum*. For each raw product, the share of each channel varies significantly across *Soums* depending on a variety of reasons.

The *Umnugobi Aimag* government perceptively summarized marketing conditions as follows:

- Because of absence of processing capacities and remoteness from major markets, herders face serious difficulties in reaching markets.
- Traders who use border trade points which are open on a seasonal basis are dependent on the Chinese side.
- Absence of processing capacities in *Soums* causes both low prices and low quality of livestock raw products.
- Remoteness, high transportation costs and small-size of internal markets all worsen the situation of herders.

As for transportation, *Dornogobi* is unique because of the main railway that crosses the *Aimag* territory to China. Other *Aimags* have similar auto road conditions, with improved natural road connecting the centers of the *Umnugobi* and *Dundgobi Aimags* to *Ulaanbaatar* city. Road conditions are slightly better between *Umnugobi* and *Dundgobi Aimags* compared with that between *Ulaanbaatar* city and *Dundgobi Aimag*. The road connecting the *Aimag* centers with *Soums* is the same: a simple natural road.

The primary transportation means is automobiles primarily owned by wealthier herder households. Also it is not rare to use draft animals in organizing short-distance seasonal and otor migrations, and for other household needs.

In the Gobi region, most *Soums* in *Aimags* are located within 70 km or more from the *Aimag* center. Because of low pasture yields, most herders camps are located within 30 km or more from the *Soum* centers. Because of low cash income, barter trade is dominant in marketing transactions between herders and traders. Low bargaining power of small herders scattered over huge territory and barter trade means that herders are in a disadvantaged position and lose benefits from trading.

The capacity of processing industries in *Aimags* is very low. *Dundgobi Aimag* center has a small factory to process livestock intestines for export and a food processing factory to produce yogurt, ice cream and sausages. Small capacity felt-making units operate in 2-3 *Soums*. Other livestock raw materials such as hides and skins, wool and cashmere go to markets without any major processing. The *Aimag*'s intention to develop meat, camel wool and cashmere processing capacities has not been implemented because of lack of investors.

In *Umnugobi Aimag*, a primary processing factory for washing wool and cashmere with Chinese equipment was built up in 1992. The factory was washing 3-4 tons of cashmere, 6-7 tons of camel wool and 10 tons of sheep wool annually up to 1996, but since then its activities have declined because of failure to pay for electricity and taxes. After reorganization, the factory started to wash 100 tons of sheep wool in 2001-2002 but stopped again because of lack of working capital. A cooperative to produce *Ger* felt operates in the *Aimag* center and *Sevrei Soum*. The cooperatives buy 5-6 tons of sheep wool from herders and produce 240 pieces of *Ger* felt 5 m long for local markets.

Dornogobi Aimag has only small-scale ice cream units in the *Aimag* center, *Zamiin Uud* and *Ihhet Soums*. And *Ger* felt making are carried out by a cooperative in *Altanshiree Soum* and by private businessperson in the *Urgun Soum*.

2.5.5 LIVESTOCK FACILITIES (ANIMAL SHELTER)

Animal shelter is an important livestock facility which provides protection against low winter temperature and cold wind; especially in spring it protects pregnancy, livestock at birth period, and newborn babies. Most shelters were made in the socialist era and transferred to individual herders thus it has become personal properties now. They are made of stones, wood panels or faecal blocks (compressed faeces). The result of the shelter inventory survey in *Dornogobi* is shown in Table 2.5.16. Total capacity of all shelters in *Aimag* is enough to cover the total livestock, but the number of shelters per herder household is only 0.64 so 1 shelter is used by 2 to 3 households at present.

Table 2.5.16 Condition of Animal Shelters in *Dornogobi Aimag* (2003)

Total number	Total livestock number	Capacity of shelters (s.u.)	Shelter with roof	Shelter without roof	Construction / repaired		Average number of shelter for 1 herders household (No. of Shelter / household)	Number of herders household
					New constructed	Repaired		
2610	926,400	1,039,170	1792	818	38	710	0.64	4,092

(Source: *Dornogobi Aimag*)

CHAPTER 3 DIRECTION OF DEVELOPMENT IN LIVESTOCK FARMING SYSTEM IMPROVEMENT PLAN

In phase 1 Study, causal connections that cause of *Dzud*'s damage was studied, and in phase 2 Study for the targeted area of the *Dornogobi Aimag*, livestock farming system improvement plan was formulated from the view point of measures against *Dzud*'s damage, focusing on pasture use and its control plan, and well development plan. In this chapter, based on the result of the past study, constrains of the livestock farming in rural area can be clarified, and studied strategy of develop, and then frame of the whole plan will be formulated.

3.1 MECHANISM OF *DZUD* DAMAGE OCCURRENCE AND ITS MEASURES

Dzud's damage has continually been periodically repeated due to natural conditions such as drought and heavy snowfall. However, the reason why *Dzud* damage has increased since 1990s is due to various social changes which were brought about through collapse of *Negdel*, introduction of market economy, and privatization of livestock which were accompanied by end of the planned economy.

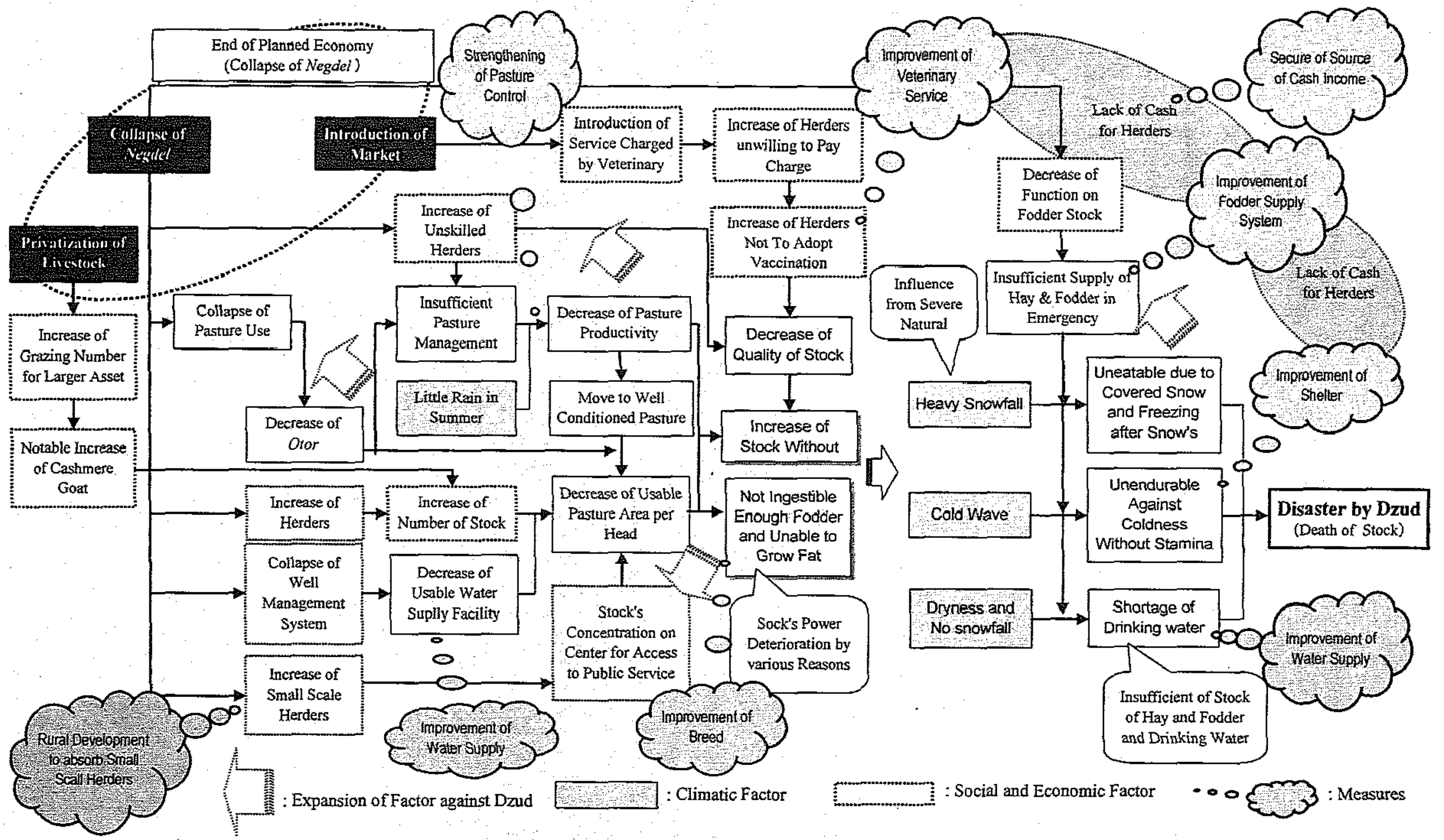
Collapse of *Negdel* has brought collapse of pasture use control, collapse of well management system, decrease of function of fodder stock system, and increase of unskilled herders. Introduction of market economy has brought about conditions that prevent anything from be done if there is no cash. Privatization of livestock has brought significant increase of cashmere goats that are easy to sell for cash. The most serious problem is that they caused consequently decrease of usable pasture area per head., and then livestock enter into sever winter without sufficient strength for wintering, and so more *Dzud* damage is liable to occur in comparison with the planned economy era.

To cope with *Dzud* damage, it is necessary to modify measures adopted in the planned economy era into measures that can be used in the market economy. However, since there was generous support from the government for the livestock farming in the planned economy era, the mentality of both of herders and the government side has not yet changed after shifting to the market economy. This is one of the obstacles to promote some measures, and so it is necessary to study measures covering a long timespan.

Next figure shows the outlines the mechanism of *Dzud* disaster and countermeasures.

Measures against *Dzud* that are shown in the figure are summarized below;

- Appropriate supporting system for livestock farming: improvement of pasture control system
- Improvement of facilities: Improvement of well and shelter
- Improvement of service system: Veterinarian service, Improvement of breed, improvement of fodder supply system
- Increase of employment opportunities: Promotion measures in the rural area to employ small scaled herders
- Securing cash income: Fostering entrepreneur ventures.



Structure of *Dzud* Disaster and its Countermeasures

Since cause of *Dzud* is extreamly intricate and measures are also various, measures against *Dzud* contain various hard and soft factors, which indicates the necessity to approach such implementation systematically.

3.2 CONSTRAINTS AND POTENTIALS

Through the field study implemented in Phase 1 and Phase 2 of this Study, and workshop between herders and the Study Team, constraints on the livestock farming in rural area were studied and result are summerised in Table 3.2.1. The main three constraints on the improvement of livestock farming system in rural area are the following: i) constraint on water and pasture resources, ii) constraint on livestock production, and iii) constraint on herders cash income. In addition, as the forth constraint that is related with these three constraints, "human resources and lack of their capability" was extracted. Each constraint is shown below.

Table 3.2.1 Problem Analysis on Improvement of Livestock Farming System in Rural Area

<table>
<tr><td rowspan="34">Livestock farming is not promoted in rural area (living standard of herder does not improve)</td><td rowspan="12">Pasture goes to ruin (Over grazing continues)</td><td rowspan="12">Livestock concentrates on narrow water resources</td><td rowspan="6">Water resources development is not promoted.</td><td rowspan="3">Number of Traditional Well is too few.</td><td>Traditional Wells are broken and unusable.</td></tr>
<tr><td>People want to construct Traditional Wells, but don't know where to dig.</td></tr>
<tr><td>They don't know how to repair Traditional Well, and have no implements to do so.</td></tr>
<tr><td rowspan="2">Number of Engineering Wells is insufficient.</td><td>Fund for Engineering Well construction is lacking (Construction cost is high).</td></tr>
<tr><td>Engineering Wells are broken and unusable.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="4">Pasture can't be used effectively.</td><td colspan="2">There is no water in low used and unused pasture.</td></tr>
<tr><td colspan="2">Herders are reluctant to use inconvenient remote areas.</td></tr>
<tr><td colspan="2">It takes a lot of time to supply water.</td></tr>
<tr><td colspan="2">They have no information on pasture (which pasture is usable, who uses it now, etc.). There is no public information.</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="11">Livestock production is unsteady.</td><td colspan="2" rowspan="2">Veterinary services are lacking (Expensive, lack of medicine and capability).</td><td colspan="2">Medicine for livestock, pest control and so on is lacking.</td></tr>
<tr><td colspan="2">Capability of veterinarians is insufficient and their number is small.</td></tr>
<tr><td colspan="4">They can't return livestock number reduced by the damage into stable herd.</td></tr>
<tr><td colspan="2">Livestock quality is inferior (There is a problem of inbreeding).</td><td colspan="2">Good kinds of livestock suitable for the Gobi environment are few. The study of breeding and its extension that is suitable in the Gobi environment are insufficient.</td></tr>
<tr><td colspan="4">Herders grazing skill and knowledge are insufficient.</td></tr>
<tr><td colspan="4">Feed stock is insufficient and feed is expensive too.</td></tr>
<tr><td colspan="4">Livestock insurance system is undeveloped, and herders don't understand how it works.</td></tr>
<tr><td colspan="4">They want to cultivate feed crop, but they have no skill or knowledge.</td></tr>
<tr><td colspan="4">Livestock pest control and epidemic prevention system are undeveloped.</td></tr>
<tr><td colspan="4">There is lots of livestock theft.</td></tr>
<tr><td colspan="4">There is no timely information on weather forecast, market, disaster, infection, and so on.</td></tr>
<tr><td rowspan="11">Herders cash income is small (They can't make opportunities to get cash except selling cashmere and meat).</td><td colspan="2" rowspan="2">They are lacking in ability to produce processed livestock products with added value (They can't sell at high prices).</td><td colspan="2">They have no or low processing skill. (Milk/Milk products, wool processing, meat processing, skin and hide processing, and so on)</td></tr>
<tr><td colspan="2">They don't have modern skills.</td></tr>
<tr><td colspan="2" rowspan="3">They can't start livestock processing business.</td><td colspan="2">They have no knowledge of starting business, etc.</td></tr>
<tr><td colspan="2">They can't collect money necessary for starting business, or the hurdle of finance is too high for herders.</td></tr>
<tr><td colspan="2">They can't provide materials necessary for starting business financially and physically (They are not sold in rural).</td></tr>
<tr><td colspan="2" rowspan="3">Their ability in continuous sales of processed livestock products is low.</td><td colspan="2">They are lacking of knowledge on economy and management.</td></tr>
<tr><td colspan="2">Khorshoo (cooperative association) is not workable.</td></tr>
<tr><td colspan="2">They are lacking knowledge and ability of systematic management.</td></tr>
<tr><td colspan="2" rowspan="3">They are compelled to sell livestock products to middleman.</td><td colspan="2">There has been a delay in market improvement.</td></tr>
<tr><td colspan="2">There has been a delay in improvement of social infrastructure of market and its circumstances.</td></tr>
<tr><td colspan="2">Market is remote. There are few large markets of raw livestock material nearby.</td></tr>
<tr><td colspan="3">Human resources and their ability are lacking.</td><td colspan="2"></td></tr>
<tr><td colspan="3">There is a drought in summer and heavy snow in winter (external factors).</td><td colspan="2"></td></tr>
</table>

3.2.1 CONSTRAINTS ANALYSIS

(1) Constraints of Water Resources and Pasture Resources

Annual mean rainfall in the Gobi region is generally small, furthermore, most rainfall is concentrated in summer, and the temperature of the summer is high and evaporation volume is large; therefore, aquifer charging is extremely limited. Managing with such low rainfall by using puddles in the summer and snow in the winter, herders are grazing by bringing various water resources. Among them, groundwater use, which is due to stable water resources, and supplied through the deep wells and Traditional Wells, is indispensable in the livestock farming, and the base of livestock farming. However, there are problems in that number of the wells are insufficient and the wells are broken and unused; consequently, "livestock concentrate on the limited wells", which causes the problem of overgrazing that "devastates pasture".

(2) Constraint on Livestock Production

There are lots of herders whose management scale is less than needed to enable to increase livestock stably above self-consumption, so small management scale is the constraint. One of the reasons why their management is small has been brought by loss of their livestock by *Dzud* that continued three years after the winter of 1999, and some herders have not yet made recovery.

The fact that "herders grazing skill and knowledge are lacking" especially among younger herders is pointed out; in addition, many herders hope for development of good livestock breeding suitable for the Gobi environment and its extension. This implies that skill and quality are constraints to increase production; therefore, such improvement is necessary.

On the other hand, aspects related to livestock health and hygiene such as "veterinary service is lacking" or "epidemic prevention and pest control are not developed", and system to reduce management risk for disaster such as "livestock insurance system" or "feed stock", etc. are not developed; all these are constraints to stable production.

(3) Constraints on Cash Income

After shift to the free economic system, herders were compelled to pay for the social services that had been basically free; so herders need for cash for education, medical services, consumption, etc. has increased. Since all of the income depends on livestock, every time they spend for necessities, they are forced to reduce the livestock. In addition, cash income opportunities of herders are limited to two seasons of cashmere sales in spring and meat sales in winter. Although a stable third income resource is necessary by diversifying management to break through such situation, they "can't start livestock processing business" because they can not get knowledge about companies or learn procures to get the necessary funds; in addition, "they have no ability to produce processed livestock products with added value". Furthermore, even if a company were established, sales would be unfavorable because "they are lacking knowledge of management and economy", and access to the market is worse because "there is a delay in improvement of markets" and "social infrastructure of markets and its circumstances" is undeveloped, which is a constraint to cash income.

(4) Constraint on Human Resources and its Development

One of the problems faced by the livestock farming system is lack of management capabilities of local administration and herders to effectively and efficiently resolve pressing issues. The problem has two basic dimensions: first, lack of capacities on the part of both local administration and herders, and second, lack of coöperation between them in dealing with pressing problems.

To increase efficiency of investment of the projects and to develop its results sustainably, building management capacities of both users of the projects and local administration should be emphasized.

There is much desire that herders want to learn basic economy, knowledge on management, and method to operate such systems. However, there is no base responding to such herder new desire locally. This is a very limiting factor in development of the livestock farming industry in rural are in the future.

3.2.2 DEVELOPMENT POTENTIAL

(1) Water Resources

According to the inventory survey carried out in 2003, there are lots of currently unused wells, and they increase as the structure of the wells becomes complicated. Moreover, even for Traditional Wells which were constructed using traditional method, unused wells are increasing.

Engineering Wells were physically broken during the confusion of transition period to market-oriented economy. Moreover, pumps and generators become easily unusable without appropriate Operation/Maintenance and re-supply of parts. Moreover, it is also fact that share of unusable Traditional Wells became high even though most of them were not using mechanical equipments. It is said that the operating life of Traditional Well is 20-30 years even if it is constructed carefully. When wells constructed from 1970 to 1980 outlive their usefulness, they will most likely be abandoned. Therefore, the number of unusable wells will increase.

Unusable Engineering Wells can be a big potential for the development of water sources and pasture if they are able to be rehabilitated because of the inexpensive cost compared with the new well construction. Nevertheless, the possibility of the rehabilitation is not obvious through observing its visual appearance, but sometimes it can only be identified after the survey of the casing inside. Therefore, it is necessary to clarify the possibility of rehabilitation on the wells classified into "Unused Well" in the inventory survey carried out in 2003, immediately. Only if the possibility of the rehabilitation is clarified, could the unusable Engineering Well have potential for water source and pasture development. However, the government budget allocated to the survey on the possibility of the rehabilitation or construction of wells is limited, and so progress seems to be delayed.

(2) Pasture Resources

Three factors why pastures are left unused and low used are as follows, i) Lack of stable water supplied areas, ii) Remoteness from densely populated areas such as *Soum* and *Aimag* center, and iii) Low productivity of vegetation in pasture. These factors have a cumulative effect on each other. Above all, the second factor (i.e. remoteness) is very much like a socio-economic factor. The third factor (i.e. low productivity of pasture) is affected by natural elements as a rule. The first factor (i.e. lack of stable water supplied pasture) is concerned with both natural and socioeconomic factors. The first factor has the highest potential of development compared with the other two factors, since the fist factor can be solved directly, if the other two factors are cleared.

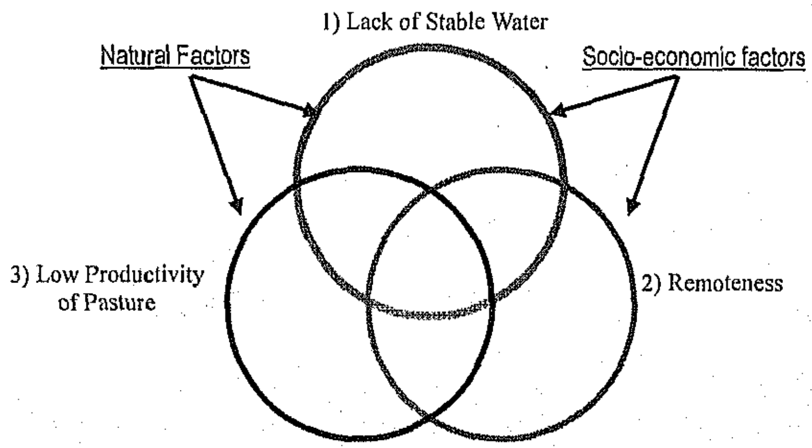


Fig. 3.2.1 Background of Unused and Low Used Pastures

(3) Potential on Revenue Opportunity Increase

The livestock processing industry in rural area is limited and not fully developed. Its current potential is not high because there are lots of issues on promotion of livestock processing industry, such as: there is neither training about livestock processing and its sale, nor sufficient technology, information and reliable electric power supply (three *Soums* are not yet connected to the central electric network in the *Dornogobi Aimag*), scale of the local market is small and scattered, etc. However, if a small livestock processing factory can be continuously operated, it would be a link to supplying a place for livestock raw materials, and creation of new income source for herders and the local residents. Herders' expectation in this field is very large, so it is an issue that should be tackled as a part of improvement plan of livestock farming system in rural area.

In the livestock processing industry, since herders and residents are largely expecting some felt processing and milk processing, some demand can be expected.

When herders usually make *Ger* felt by hand, lots of labor and expenses are needed, so they are apt to buy inexpensive *Ger* felt; thus, there is considerably high potential demand for *Ger* felt. Quality of the factory products is also better than hand-made ones.

In addition, dairy products were almost all self-consumed in the past, so these didn't contribute to cash income. However, sales of dairy products are increasing at the *Soums* along the railway, which implies that there is a high potential demand by the local city residents.

As for the aspect of the infrastructure, the *Dornogobi Aimag* is connected to *Ulaanbaatar* and China by the railway. Furthermore, pavement construction of the road from *Dornogobi Aimag* and connects *Zamiin Uud* and *Ulaanbaatar* has already started. In addition, a roadside station is planned to be developed at Erdene *Soum* along with the development the road; the plan is to sell regional goods and so on. There is a high potential that these projects (railway, the road to be completed, and roadside station) will have a good impact on the market.

3.3 DIRECTION OF DEVELOPMENT

Based on the results of the fact finding survey and its analysis, direction for the development of the livestock farming is summarized as follows;

(1) Establishment of Water Resource Development Plan Consistent with Pasture Management

The problems of present pasture use are closely related to the distribution of water sources. For the present pasture use, mal-distribution is observed, and the pasture devastation is caused by the increase of overuse around the limited water sources. Therefore, pasture development should be made consistent with water resource development.

Consequently, the well development plan will be implemented to improve pasture use ratio, to increase water supply efficiency with aim to increase carrying capacity, and to secure stable water resources in the unused and low used pasture.

(2) Comprehensive Approach

PCM·Workshop was implemented, and then herders proposed the projects for improving their own present condition and their understanding of the present status.

The workshop results are summarized at the figure shown below. "Core Problem" of all *Soums* is "Herders' living standard is low." The proposed projects for improving this situation overwhelmingly focused on pasture and water development (well development). But at the same time, the small scaled industry projects to create job opportunities for cash income were also proposed mainly by women groups.

It is necessary for improving the living standard of poor herders to increase the number of livestock, but there is no capacity to do it in a short term for all herders in this region. Moreover, the job opportunities in the rural areas are limited, so there is abundant surplus labor. Accordingly, job creation in the non-livestock farming sector is essential for the rural areas to become better off.

Progress of various conditions concerning livestock farming and infrastructure building, which has been delayed in the rural areas, is indispensable to improve herder living besides herder effort. Nevertheless, all aspects of the progressing level are low in the rural areas. Therefore, it is important to work steadily to gain concrete outputs and starting from possible measures. As for small-scale industry, sustainability of the projects/businesses should be taken into account in addition to the important needs of herders.

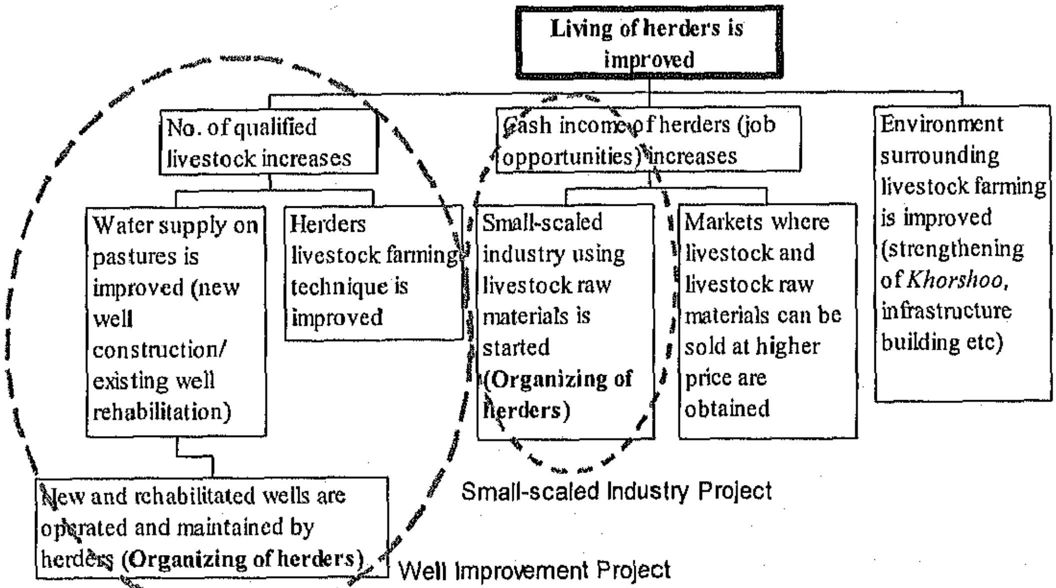


Fig.3.3.1 Process of Improvement of Herder Living

(3) Livestock Farming Improvement Plan from a Point of Poverty Alleviation and Number of Livestock

Out of the total number of herder households damaged by the *Dzud*, the rate of the poor households was 40.7% (2001) in *Dornogobi*, 51.4% (2000) in *Dundgobi*, and 61.0% (2001) in *Umnugobi* respectively.

The degree of poverty has negative correlation with the number of livestock. Although the indispensable number of livestock changes characteristically with the kind of livestock, family composition, etc., there are various ideas for addressing poverty. "Profile of Poverty[1]" published by Japan Bank for International Cooperation (JBIC) in February 2001 reports that herders need at least 100 livestock per household in order to produce economic profit in addition to livestock used for home consumption. In *Umnugobi Aimag*, they set one target to own 200 to 250 good quality livestock (interview in the *Aimag* Center, May, 2003). The report by Ministry of Finance and Economics studied in 2003 concluded that families with less than 150 livestock cannot meet their consumption needs but families with 300 livestock have a viable economic size and can increase this number further. The rural survey executed by the Study Team obtained the following livestock number. 225 animals for the average

1 Profile of Poverty in Mongolia: Japan Bank for International Cooperation (February 2001)

herding family (income: Tg 1,290,000)) and 315 animals for the wealthy family (Income: Tg 2,369,000). When the agricultural bank finances herders, loans are conditioned on owning 350 or more livestock.

The poverty scale of the overwhelming majority in the rural area is a small-scaled herding family which owns less than 150 livestock. In order to ease poverty in the rural area, it becomes indispensable to increase the livestock number of small scaled herding families.

The next issue is how future livestock numbers can be set. Concerning this point, as in the case of *Dornogobi* that formulated the detailed plan, the 260 maximum livestock numbers per household (1999) attained in the past in *Dornogobi Aimag* could become one target. If the number of herder households is assumed to be 3,900 to 4,000 houses, the livestock numbers become 1,014,000 to 1,040,000 animals, which is roughly equal to 1,088,000, the actual value in 1999.

Although "a rapid increase in livestock number" was one of the factors of the *Dzud* disaster, it was rather brought about by the fact that factors supporting livestock farming such as herding technology or wells development, etc. were lacking at that time. Therefore, it should be possible to reach the highest number of livestock recorded in the past by improving the circumference of the present livestock farming, and measures to achieve this number should be the contents of the short-term livestock farming improvement plan.

(4) Necessity of Organizing Herders and Increase of Ownership

Poverty problem of herders which became clear through investigation is summarized as follows.

Table 3.3.1 Arrangement of Poverty Problem of Herders

Type of Problem	Major Factors of Problem			Occurrence as a Result
Stature of Herder	**Non-Cooperativeness**	**Insufficient Skill and Experience**	**Few Leaders**	Escalation of Poverty
Livestock Number & Kind	Small Animals	Unbalanced Kind of Animals	Low Quality of Animals	Inability to Increase Livestock Number
Condition of Pasture	**Overuse of Pasture**	**Deterioration of Vegetation**	Lack of Well	Deterioration of Pasture & Expansion of Unused Pasture
Supporting System	Scarce Funds	Few Talents	**Little Information**	Inability to Take Necessary Measures
External Conditions	Difficult Access to Markets	Limited Employment Opportunity	Unfairness during Privatization Period	**Expansion of Disadvantageous Trading Conditions for Herders**
Boldface: Improvement of the problem is possible by training and organizing of herders.				

The livestock farming of many herders in the region has decreased in production with escalation of poverty for the reasons that the cooperativeness of herders is insufficient and herders do not collaborate, their skills are not improving, and external factors of changeable weather, etc. In order to cut off this flow, to expand production and to aim at poverty reduction, it is required to promote collaboration of herders, and to cope with the difficulty that individual herders can not solve by themselves, joining hands with herders and residents.

Motivating herders is required to strengthen herder organization. Newly carried-out projects may be enough to motivate such strengthening of the organization. Among these projects, "development of wells," which is the production and living infrastructure, is the most supported by herders and governmental administration, and is also easily understood. Moreover, it is also important to improve economic status that herders themselves take the lead and start a small scaled industry in the rural areas with a few job opportunities. It is expected that the power of herders will improve through this and at the same time, herder livelihood will improve gradually.

Enhancing of herder organization leads to production expansion. It is relatively easy to increase the number of livestock. However, unplanned increase of livestock might provoke serious *Dzud* damage. Therefore, in order of work is as follows: first, it is necessary to strengthen herder organization, second, to dissolve the overgrazing by wells development, which is the base of livings, under proper pasture management, and finally to emphasize improving the quality of livestock.

In addition, participants of the projects should be encouraged to develop the sense that they are owners of the projects implemented by them, with the accompanying beneficiaries contribution. With this sense, increased sustainability of the organizational activity can be expected.

(5) Toward Quality Improvement of Livestock

If the pasture condition is good and there is an intention to increase the number of livestock, it could drastically increase. In the past when the number of livestock increased radically in *Soums*, for example, the average in a *Soum* as a whole grew 15%. If the area is limited, the increase by around 30% could be assumed.

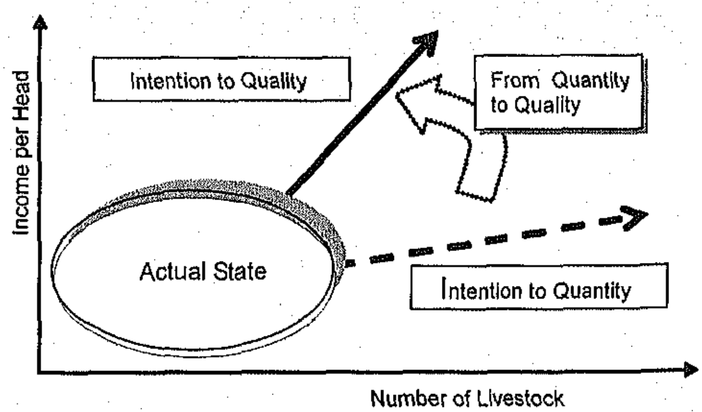


Fig. 3.3.2 Intention from Quantity to Quality

Currently, there are many herders who intend to increase the number of livestock as a reaction of the loss of livestock due to the damage of *Dzud*. But herders should strive to obtain income through changing the viewpoint from increase of quantity to the quality improvement of livestock, and boosting the income per head of livestock at this opportunity. Such an idea is understandable for both herders and governmental administration. Nevertheless, if they intend to obtain a certain level of the livestock number first, it would likely evoke a *Dzud* damage of the scale from 1999 to 2002.

(6) Inheritance of Traditional Herding and Environmental Conservation

In Gobi region where pasture production is low and risks are high, careless promotion of settlement could cause the deterioration of environment and the disruption of a herding system at high risk. Moreover, according to the survey of rural society, affluent herders often repeat *Otor* (migration) on the other hand, it increases the tendency of the other herders to herd throughout the year at winter camps. The risk, that this tendency drives devastation of the pasture has already been pointed out. In order to use pasture continuously, it is to promote the seasonal *Otor*, which has been carried out traditionally in the Gobi region.

The reasons for decreasing *Otor* are unavailability of basic social service in the remote areas, and lack of water on pastures. However, the decline in initiatives of herders is greatly affected. Thus, it is important for government administrations to announce herders importance of pasture management and to support herders so as to succeed with appropriate herding skills.

(7) Formulation of Development Plan Consistent with Upper Plan

Government Action Plan 2004 - 2008 aims to rehabilitate 1,900 wells and to construct 800 Traditional Wells. The improvement plan of livestock farming in rural area will contribute to this Government plan and also it is accord with the direction to call for beneficiary liability for the purpose of increase the herders and residents ownership for sustainable well use.

3.4 DEVELOPMENT COMPONENT AND PROJECT (DEVELOPMENT FRAMEWORK)

In consideration of above-mentioned probelem analysis and constraints and potential analysis, in order to improve the livestock farming system in rural area, based on the above-mentioned basic policy, it is necessary to build up frame of four components, as shown below. Each component consists of project.

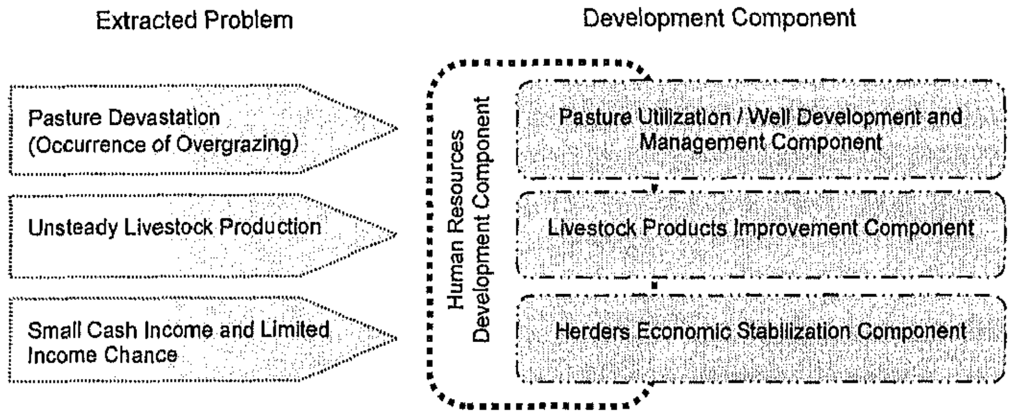


Fig 3.4.1 Four Development Components in Local Livestock Farming System Improvement

3.4.1 PASTURE UTILIZATION / WELL DEVELOPMENT AND MANAGEMENT COMPONENT

Effective utilization of pasture and water resources development are inextricably linked, and implementation of these components corrects the current imbalance, and alleviates occurrence of overgrazing. In addition, in order to secure sustainability of the project, it is essential to improve the well operation and maintenance system.

Therefore, this component consists of pasture utilization with well development and management; it is divided into three plans described below: i) pasture use and management, ii) well development, and iii) well operation and maintenance.

(1) Pasture Utilization and Management Plan

In order to utilize the regional pasture sustainably, it is necessary to realize proper distribution of the water resources. Hence, constraint on the pasture utilization to be reflected to well development and pasture development are specified. In addition, pasture utilization and management are issues to be tackled in the region; therefore, information collection, data stockpiling, publication, and so on is required to allow understanding of its importance in the region.

(2) Well Development Plan

The main points of the well development plan are "increase of water supply efficiency" to increase pasture utilization in quality and "well development at the unused pasture" to expand its area. Well development plan to meet these necessities will be formulated.

(3) Well Operation and Maintenance Plan

In consideration of sustainability of the project, the most important issue is "sustainable operation and maintenance of newly constructed and rehabilitated wells", and its realization is essential. Therefore, necessary measures and activities are planned in the well operation and maintenance plan.

3.4.2 LIVESTOCK PRODUCTS IMPROVEMENT COMPONENT

This component consists of four projects as described below.

(1) Veterinary Service Improvement Project

Although the field of the veterinary service was treated as a part of the state-run social services in the past, in the new economic system, it is facing various problems. Main problems include lack of quality and number of veterinarians, equipment, supply of veterinary medicine, market system, and expensive service fee. A plan is necessary to cope with these problems. It is necessary to comprehensively approach to veterinarians, the central and local governments, and herders.

(2) Superior Livestock Breeding Project

Study and extension of superior livestock suitable in the Gobi region is not enough, because sufficient number of superior livestock don't spread widely among herders; this situation was clarified through the Study. This plan aims to improve breeding improvement system and to "promote breeding of superior livestock".

In order to improve livestock production, it is necessary to do two things: one, to improve production technology, and the other, to increase the quality of the breed.

(3) Herding Technique Improvement Project

Herders herding technique improvement is to be done by offering technical guidance (training among herders) to young, inexperienced herders, herders without livestock and small scale herders.

(4) Capacity Building for Risk Management Project

Many risks are involved in the livestock farming in the Gobi region. In order to cope with risks with external factors (drought in summer and *Dzud* in winter) and risks such as livestock disease and livestock theft, the plan aims to build up and strengthen risk management capacity. Risk management is to be implemented by the central and local government and herders themselves.

3.4.3 HERDERS ECONOMIC STABILIZATION COMPONENT

This component consists of two projects: the livestock farming improvement plan and the market and distribution of livestock products improvement plan, which aims to create new herder income sources and to stabilize them.

(1) Livestock Farming Improvement Project

With the aim of "livestock products sales promotion and small scale business development", a system necessary for herders to start small scale livestock processing business is to be arranged and measures for herders to create new income source will be identified.

(2) Market and Distribution of Livestock Products Improvement Project

After changing economic systems, when the *Negdel* (food and livestock cooperative) shifted to *Khorshoo* (cooperative), the market system by *Negdel* in the past disappeared. Therefore, "livestock products market and distribution infrastructure improvement" is essential for livestock farming development; hence, this plan is necessary to formulate.

3.4.4 HUMAN RESOURCES DEVELOPMENT COMPONENT

Human resources development is done during the process of each project, so a separate project that treats only human resources development is not considered. However, human resources development has to be part of each project in the form of technology training or on the job training, and so on.

3.4.5 RELATION BETWEEN DEVELOPMENT COMPONENT AND EACH PROJECT

The following table shows relation between each component and project. The Pilot project was implemented to increase effectiveness of the improvement plan of livestock farming system improvement in rural area. The Pilot Project is described at the next chapter.

Table 3.4.1 Framework of Improvement Plan of Livestock Farming System in Rural Area

End Outcome	Development Component	Project
Improvement of Livestock Farming System in Rural Area (mitigation of *Dzud* damage and resolving of overgrazing)	**Pasture Utilization / Well Development and Management**	**Pasture Utilization and Well Development Project** Pasture utilization and management plan "Improvement of the surrounding in winter (spring) camps" "Development of unused and low-used pastures" Well development plan "Increase of water points in summer camps (places for *Otor*)" "Improvement of water supply efficiency in winter (spring) camps" Well operation and maintenance plan "Sustainable operation and maintenance of newly constructed and rehabilitated wells"
	Livestock Products Improvement	**Veterinary Service Improvement Project** "Recovery and improvement of veterinary service"
		Superior Livestock Breeding Project "Promotion of superior livestock breeding"
		Livestock Farming Technique Improvement Project "Improvement of herders' livestock farming technique"
		Capacity Building for Risk Management Project "Establishment and strengthening of management capacity"
	Herders Economic Stabilization	**Livestock Farming Improvement Project** "Promotion of livestock products and small scaled industry"
		Market and Distribution of Livestock Products Improvement Project "Development of market of livestock products and marketing infrastructure"
	Human Resources Development	Included in each project above.

3.5 PRIORITY OF DEVELOPMENT COMPONENT

Among the four development components, the top priority should be given to "pasture utilization / well development and management component". The effective utilization of pasture and water resources development are the foundation of herding in the region, and the fundamental basis for the stable livestock production. In addition, "livestock products improvement component" functions as complementary for stable growth, and contributes to realization of further stability and sustainable development of livestock farming. Since "herders economic stabilization component" can not be realized without stable livestock production and raw material supply, it makes a secondary or higher component though it can expect a large impact. The following figure shows relation between the four components.

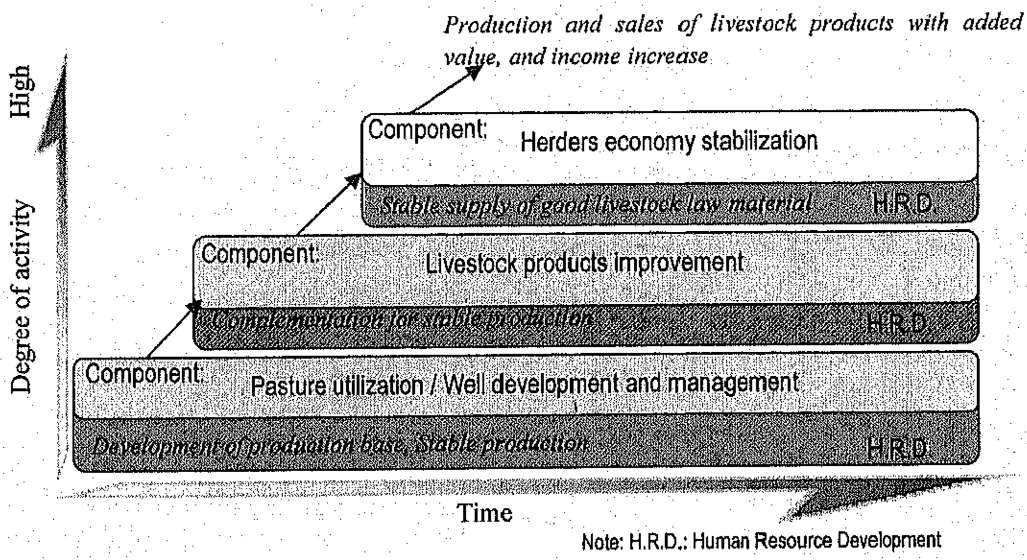


Fig 3.5.1 Priority of the Four Development Component