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Spatial Temporal GIS Based Analysis of the Pastoral Environment: A Preliminary Approach to the Transformation of Pastoral Sedentarization in a Suburban Area of Mongolia

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I. Introduction

Mongolia in the 20th century experienced a transition from a socialist economy to a market economy. Mongolia's traditional subsistence nomadic pastoralism has been playing an important role in mitigating social and economic chaos since the transition in the early 1990s. In fact, the pastoral sector has accepted a large number of people who became unemployed due to the privatization of state enterprises. On the other hand, it is faced with the difficult problems of poverty and environmental degradation.

In recent years, herders have been settled or semi-settled in suburban areas of the capital and secondary cities of Mongolia. This has led to some environmental problems such as pasture degradation caused by overgrazing and shortage of water and forest resources. Relevant studies have pointed out that the change from raising livestock collectively to raising livestock in individual households is a cause of pastoral sedentarization. Therefore, they have tended to focus on individual households' practices such as daily herding and seasonal movement. However, on the basis of my previous research, I suggest that pastoral sedentarization in suburban areas was strongly influenced by the socialist development policy that promoted the modernization of nomadic pastoralism. Based on this insight, it is necessary to investigate how natural resource management and use changed from the socialist era to the present day. It is these aspects which should be included in an analysis of environmental and social changes during this period.

Purpose and Methods

The purpose of this paper is to reveal the transformation of the pastoral sedentarization in a suburban area of Mongolia by using a spatial temporal GIS, called the DiMSIS-EX (Disaster Management Spatial Information System-Expansion).

DiMSIS-EX was developed for the rehabilitation and reconstruction of areas destroyed by the Great Hanshin-Awaji Earthquake of 1995. However, DiMSIS-EX is not only beneficial to earthquake disaster research but also to cultural and social sciences which include historical and anthropological research. The most distinctive feature of DiMSIS-EX is its ability to process both spatial and temporal information. It enables us to analyze and evaluate the combinations and relationships of various datasets with digitalized spatial and temporal

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phenomena. Furthermore, DiMSIS-EX is also different in that it allows us to create an application and to customize a program according to our specific needs.

This study has examined three different datasets: (1) terrain data (mountain, hill, river, and mountain stream), (2) environmental data (soil, temperature, and precipitation), and (3) human-social data (seasonal campsite, meadow, cropland, well, and village) stored in DiMSIS-EX. For the analysis, I followed three steps with Dr. Kakumoto's (Tokyo Institute of Technology) help. First, we converted the map of Mongolia with a scale of 1 to 200,000 into a form suitable for computer processing.[1] Second, we established the system to store, manage, and edit various types of data, such as text, image and visual files, on DiMSIS-EX. Third, we accumulated data on pastoral sedentarization. This paper is based on research I carried out in Orkhon district, Bulgan province, in the north of Mongolia. Of these, I selected Khaliun 2nd sub-district as my research area (Figure 1).

II. Overview of Research Area

1. Environmental Degradation in a Suburban Area of Mongolia

Orkhon district is located in the Bulgan province of Mongolia. It is located nearly 300km northwest of Ulaanbaatar, at 103°32' E longitude and 48°37' N latitude. It borders with the big cities such as Erdenet city which is the secondary largest city in Mongolia and Bulgan city which is the capital of the Bulgan province.

The country is divided into three climate zones: the north zone (forest steppe), the middle zone (steppe) and the south zone (dessert steppe). The north region of Mongolia is characterized by rugged terrain, abundant rainfall and lush vegetation. It is also vulnerable to damage caused by fires and heavy snowfall. Orkhon district has a total area of 4214 km^2, with coniferous forests which include larch and white birch comprising one third of its total area. It is on a plateau between 1078m and 2940m above sea level. The annual range of precipitation in Orkhon district is 200 - 300 mm. The mean January temperature is – 20.5°C and the mean July temperature is 16.0°C.

There is no evidence that the natural environment has changed from the socialist era to the present day in Orkhon district. However, it is possible to point out the following changes through interviews with local people and a survey of previous studies. First, grassland has been severely degraded by overgrazing. The Geographical Institute of the Mongolian Academy of Sciences reported that this overgrazing is more serious in the suburban area [Mongol Ulsyn Shinjilekh Ukhaany Akademi Gazarz'uin Khreelen 2007: 4]. Second, the quantity of water and forest resources has decreased. For example, a local resident explained a decline in the water-retaining function of the forest area accompanied by illegal logging has

1 After rasterizing the printed maps, I asked specialists to convert the various information described in the map into digital data usable for DiMSIS-EX.

caused a shortage of ground-water and river water. Furthermore, it is also affected by global warming and desertification on a national level.

2. Pastoral Development Policy and Local Society

In the Soviet Union and the other socialist countries, the structure of traditional society was changed to conform to control under the socialist system after the socialist revolution. In Mongolia, the government established pastoral cooperatives, called *negdel*, as the basic unit of social unity and pastoral production in the socialist era. It was intended to create new communities and a new economic structure.

The north area of Bulgan province was a vast administrative area called "Erdene Daichin chin Van" banner (*khoshuu*) under the Manchu rule [Monkh-Ochir 2012: 40]. At that time, ten monastic sites existed in the present territory of Orkhon district. However, they were dismantled by a radical socialist policy initiative in the early 1930s. In the late 1950s, the Mongolian government tried to collectivize traditional nomadic pastoralism. Herders became wage workers of pastoral cooperatives and their livestock was became the common property. In fact, four small pastoral cooperatives were organized in the research area. Later, in 1962, they were dismantled and incorporated into a new pastoral cooperative, called "Choibarsan", of the new district of Orkhon. At the same time, the settlement was first constructed at the center of the cooperative, and it came to play a role as a social and economic hub for the rural area. As a result, livestock produce from the rural areas was sent to the cities as food products and industrial materials, while, various products and services were sent from the cities to the rural areas.

However, the collapse of the socialist system led to the rapid dismantling of this domestic division of pastoral production. In the early 1990s, the government decided to privatize pastoral cooperatives and lift restrictions on livestock ownership. Furthermore, the state's procurement system was abolished and the market was allowed to play its role. As a result, each household became able to raise livestock by themselves instead of working in a pastoral cooperative.

III. Employing DiMSIS-EX to Analyze Natural Resource Management and Use

1. Pastoral Grazing Management

Unlike agrarian societies and urban societies which are based on the investment of labor and capital on their land, pastoral societies have minimized these investments on the land to sustain the environment. The quality and quantity of pasture resources fluctuate continuously in arid land and semi-arid land. Therefore, subsistence pastoralism follows ecosystem dynamics, whereby herders adapt to large spatial and temporal variations in climate and vegetation. These strategies determine not only livestock and pasture management practices

but also the cultural and social practices of Mongolia [Batkhishig et al., 2012: 121].

Before Mongolia's revolution in 1921, allocation and use of pasture resources were subject to customary and formal tenure regimes enforced by nobles and monasteries, as well as norms and customs enforced by local herder communities [Fernandez-Gimenez et al., 2007]. In those days, herders were allowed to graze their livestock in a larger administrative territory. However, because of lack of data, the pre-revolutionary seasonal movement pattern in Khaliun is unknown.

During the socialist era (especially in the collective period from 1960 to 1990), pastoral cooperatives played a significant role in the pasture management. Mongolian herders traditionally kept and used five species of livestock: sheep, goats, cattle, horses, and camels. The pastoral cooperatives would organize herds according to species, sex, age and so on, allot them to each herding group (*suur*) consisting of one or more household. Cooperatives also mandated the specific place where each herding group was expected to graze in each season. In this way, pastoral cooperatives made detailed subdivisions of land to expand livestock production by using natural resources rationally and effectively. Figure 2 is a satellite photo that shows the pastoral land use in Khaliun during the collective period. The each seasonal pasture is characterized as follows: summer pasture where it is cool enough to live comfortably in the north, autumn pasture where the grass is slow to dry up in the middle east, winter pasture where it is possible to avoid the seasonal northwest winds in the middle west, and spring pasture abundant in water resources in the south.

Today, in Khaliun, pasture land is managed by each sub-district. Figure 3 is a satellite photo that shows pastoral land use in Khaliun. By comparing the two figures it is clear that the current pastoral land use reflects the subdivisions of the land during collective period. However, there are two differences between them worth mentioning. The first is that the range of pastoral movement has decreased to approximately half of that of the collective period; the second is that herders now stay in the same campsite from winter to spring. One reason behind this is that part of the territory of Khaliun was provided for immigrants to Erdenet city in 1995. However, it is not the only reason.

2. Changes in Winter and Spring Pasture Use

Where and how to raise livestock from winter to spring is a major concern for herders. In fact, the harsh cold weather often inflicts considerable damage on their livestock. The Mongolian government made efforts to construct cold weather facilities and wells during the socialist era. This enables herders to use the ungrazed land as winter and spring pasture land. On the other hand, the increasing use of fixed facilities caused herders to depend on them during the severe winter and spring months. After the transition to a market economy, herders started staying at the same campsite from winter to spring. It is thought that this tendency is influenced by the

development policy of the collective period.

Cold Weather Facilities

A campaign to construct cold weather facilities during the severe winter and spring months started in the 1940s and was pursued through the collective period [Fernandez-Gimenez 1999: 331]. It involved constructing roofed wooden shelters (*saravch*) and corrals (*khashaa*). In Khaliun, the administration of the pastoral cooperative planned to provide two pairs of cold weather facilities for each herding group to enable them to exchange winter and spring campsites periodically. Unfortunately things did not go as planned. However, the pastoral cooperative continues to change the location of winter and spring campsites by constructing and dismantling several cold weather facilities every year.

Figure 4 shows the location of winter and spring campsites in 1986 (during the collective period) and 2008 (the present day) on a map of Khaliun. It can be seen from this figure that cold weather facilities have increased in west Khaliun from the collective period to the present day. Furthermore, more than half of these households stay at the same campsites from winter to spring because it is hard for them to acquire two different campsites (cold weather facilities) due to economic problems and lack of space.

Wells

Accessing water resources is also a major concern for herders, especially during the severe winter and spring months when rivers and springs are frozen over. During the collective period, wells were constructed in order to secure an adequate supply of water.[2] These included wells serviced by both mechanical (rotary) and motorized (coal- and diesel- fired) pumps. Figure 5 shows the location of wells in 1986 (the collective period) on a map of Khaliun. However, most of these public wells have broken down, and herders are unable to use them. About half of households get water from private wells they have dug themselves. However, each private well is only used by a few households, since the wells do not have a large supply of water. Therefore, herders tend to stay in the same campsite for a long period of time to protect their personal wells from trespassers. Moreover, a reduction in river and spring flows since the late 1990s may have accelerated this trend.

Hey and Fodder Production

An important point is that the pastoral development policy which was intended to sedentarize the nomadic pastoral economy was supported by the agricultural sector. The spread of fodder

2 On the other hand, there were also problems that some of water supply services ignored economic efficiency, such as by constructing unnecessary wells in order to achieve the quota, or transporting water over a long distance only to water livestock.

crops accompanied by the development of agriculture reduced the risk of damage caused by harsh cold weather to pastoral production in the socialist era [Konagaya 2007: 38]. Furthermore, the harvest of wild hay was being conducted systematically. For example, in Orkhon district, herders and workers from the settlement worked together during the season of cut grass (from July to September) and transported it to each winter or spring campsite (from September to October). Cooperatives provided the equipment and transportation necessary for the harvest of wild hay. However, after the collapse of the pastoral cooperatives, herders had to prepare food for their livestock by themselves. In such a situation, it is hard for individual households to provide their livestock with hay and fodder at both winter and spring campsites. Poor herders who cannot secure labor and transportation are more likely to be seriously harmed by the harsh cold weather.

As mentioned above, pastoral sedentarization was promoted by the socialist pastoral development policy to make the maximum use of livestock and land which are common property. In those days, the economic and environmental sustainability of pastoral production was assured through government institutions and support by public agencies. After decollectivization, herders had to take the work upon themselves. As a result, it became hard for herders to continue the former method of raising livestock. Therefore, herders have had to adopt various practices in order to compensate for the loss of formal institutions and support while they are still more or less based on the rules and norms they followed during the collective period. The pastoral sedentarization in suburban areas of Mongolia has emerged in such a background. However, many problems have emerged with it.

IV. Discussion: a New Approach to the Sustainable Pastoral Development

After the transition to a market economy, herders and their livestock have increased significantly in Mongolia. Such a sudden increase in pastoral production causes problems of poverty and environmental damage. It is not that the Mongolian government had taken no measures against them. In fact, various development programs have been conducted since the 1990s. However, the government has had to depend on foreign aid because of financial difficulties. Therefore, these programs have tended to fade away after a while without achieving the expected result [Promar Consulting 2011: 18].

Recently, there has been a change in the situation. The Mongolian parliament approved the “National Livestock Program” in May, 2010. This is a comprehensive economic program to achieve the sustainable development of pastoral production. Some of the contents of this program overlap with the policies of the socialist regime, such as species improvement, the establishment of a livestock veterinary service, hay and fodder production and water supply. The other plans focus on improving marketability, such as the standardization of livestock

products and the establishment of a sales network with its own transportation service. Moreover, this program has been characterized as emphasizing environmental preservation against the background of increasing attention to the management of the common pool resources. It adopts a basic policy to shift the extensive, nomadic pastoral economy into an intensive, sedentary one as a solution to such problems as land degradation by overgrazing and a shortage of water and forest resources in the suburban areas of Mongolia.

In fact, the "Peri-Urban Rangeland Project" has been conducted by the Mongolian government with the help of funding from the U.S. The key objective of this project was to come up with a model for sustainable pastoral production both economically and environmentally. This project aimed to encourage each newly organized herding group, such as enterprises and cooperatives consisting of a few households, to graze their livestock on a particular area of land. All of the 240 herding groups have signed pasture land use contracts for fifteen years in suburban areas of the capital and secondary cities.[3] For example, in Khaliun, which is one of the project sites, 7 herding groups (26 households) have already signed pasture land use contracts, and this has generated a new problem that these plots overlap with other herder's seasonal campsites and public meadows (figure 6). Such a clarification of boundaries of resources and user groups is inconsistent with Mongolia's tradition of open access pasture use that enables co-management of multiple, overlapping, and contingent resources [Fernandez-Gimenez 2002]. Therefore, it is necessary to continue to observe the course of this project.

V. Conclusions

This paper examines the features and transformation of pastoral sedentarization in a suburban area of Mongolia.

The pastoral society of Mongolia has changed significantly through its seventy-year-long socialist development. Subsistence nomadic pastoralism was transformed into a vital sector of the national economy by industrialization under the socialist regime. In such a situation, the traditional way of living and raising livestock has been sedentarized to make the maximum use of livestock and land which are common property.

During the collective period, the economic and environmental sustainability of pastoral production was compensated by public agencies. After the collapse of these organizations, herders had to take it upon themselves. As a result, in Khaliun, many households came to stay in the same campsites for a long time because of their inability to make all the necessary arrangements for winter and spring respectively. Moreover, the immigrants from remote areas have further complicated the situation.

3 Millennium Challenge Account-Mongolia, 2011, "240 Herder Groups Signed Pasture Land Use Contracts" (http://www.mca.mn/en/index.php?option=news&task=detail& parent =75&id=330 accessed on Sep.13, 2012.)

As a matter of course, the Mongolian government has taken measures to solve these problems although they have had to depend greatly on support from international organizations and donor countries. A case in point is the "National Livestock Program", a comprehensive economic program for the next decade which was approved by the parliament in the spring of 2010. In accordance with this policy, the "Peri-Urban Rangeland Project", which aims to allot a plot land to each herding group consisting of a few households, has been conducted in suburban areas of Mongolia. These efforts are expected to lead to a solution of the issues that face the pastoral society after its transition to a market economy. However, a further problem has been revealed as a result of this case study; namely, that a clarification of the boundaries of resources and user groups could limit open access to pasture land.

References

Batkhishig, B., Oyuntulkhuur, B., Altanzul, T. and Fernandez-Gimenez, M.E. 2012. "A Case Study of Community-Based Rangeland Management in Jinst Soum, Mongolia," in Fernandez-Gimenez, M.E., Wang, X., Batkhisig, B., Klein, J.A. and Reid, R.S. (eds.), *Restoring Community Connections to the Land: Building Resilience through Community-based Rangeland Management in China and Mongolia*, Cambridge: CABI, pp.113–135.

Fernandez-Gimenez, Maria E. 1999. "Sustaining the Steppes: a Geographical History of Pastoral Land Use in Mongolia," *The Geographical Review* 89(3), pp.315–342.

———. 2002. "Spatial and Social Boundaries and the Paradox of Pastoral Land Tenure: A Case Study From Postsocialist Mongolia," *Human Ecology* 30(1), pp.49–78.

Fernandez-Gimenez, M.E., Butbuyan, B. and Oyungerel, J. 2007. "Climate, Economy, and Policy: effects on pastoral mobility patterns in Mongolia," in Sun, X. and Naito, N. (eds.), *Mobility, Flexibility, and Potential of Nomadic Pastoralism in Eurasia and Africa*, Kyoto: Graduate School of Asian and African Area Studies, Kyoto University, pp.3–24.

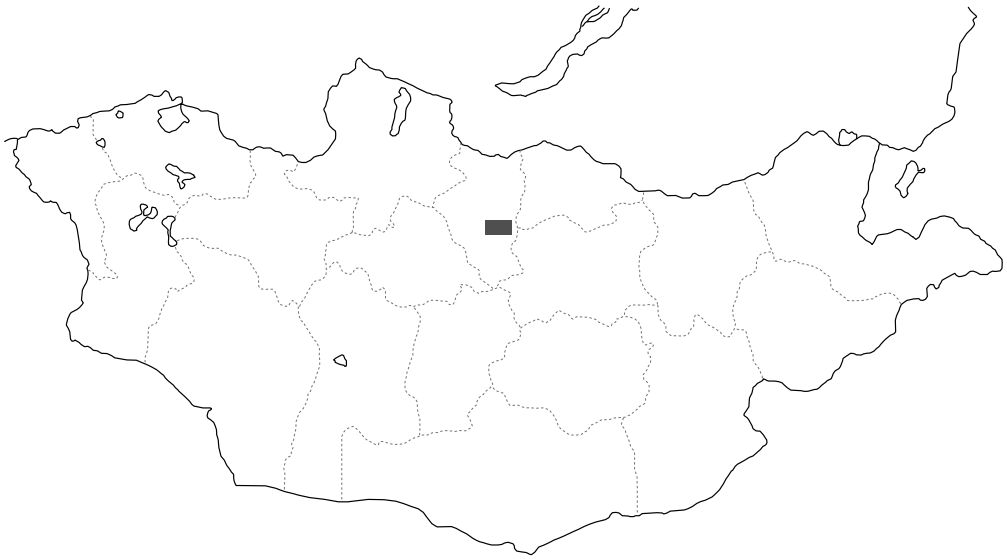
Konagaya, Yuki. 2007. "Mongol Bokuchiku Sisutemu no Tokucho to Henyo (Characteristic and Transformation of Pastoral System in Mongolia)," *E-journal GEO* 2(1), pp.34–42. (in Japanese)

Mongol Ulsyn Shinjilekh Ukhaany Akademi Gazarz'uin Khreelen. 2007. *Bulgan Aimgiin Belcheer Ashiglalt, Belcheeriin Talkhlagdlyn Sudalgaa* (The Research on Land Use and Land Degradation in Bulgan Province). unknown publisher. (in Mongolian)

Monkh-Ochir, Dondogjal. 2012. *Mongol Ulsyn Aimag, Khoshuu, Soumyn Lavlakh* (The List of Province, Banner, District in Mongolia). Ulaanbaatar: Mongolyn Ugsaa Garval Sudlalyn Tov. (in Mongolian)

Promar Consulting. 2011. Mongoru ni okeru Nourinsuisangyo to Nourinsuisanseisaku tou no Chousa Bunseki (The Research and Analysis on the Agriculture, Forestry and Fisheries Industry and Polices of Mongolia), (http://www.library.maff.go.jp/ITAKU/2010/60100014/60100014_00.pdf). (in Japanese)

Figures



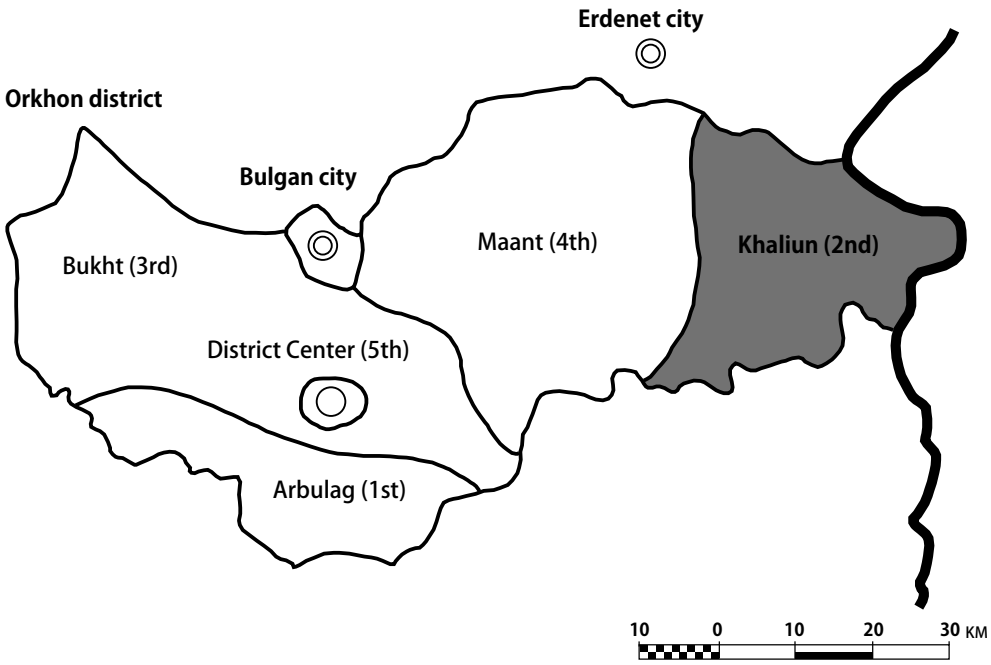


Fig.1. Location of Orkhon district, Bulgan, Mongolia.

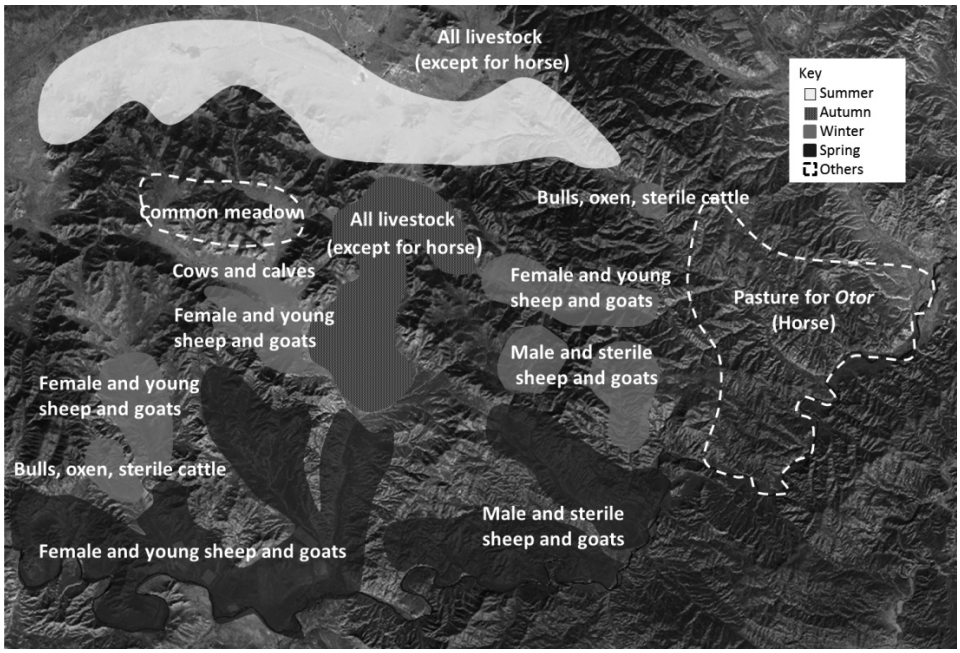


Fig.2. Pastoral land use during the collective period

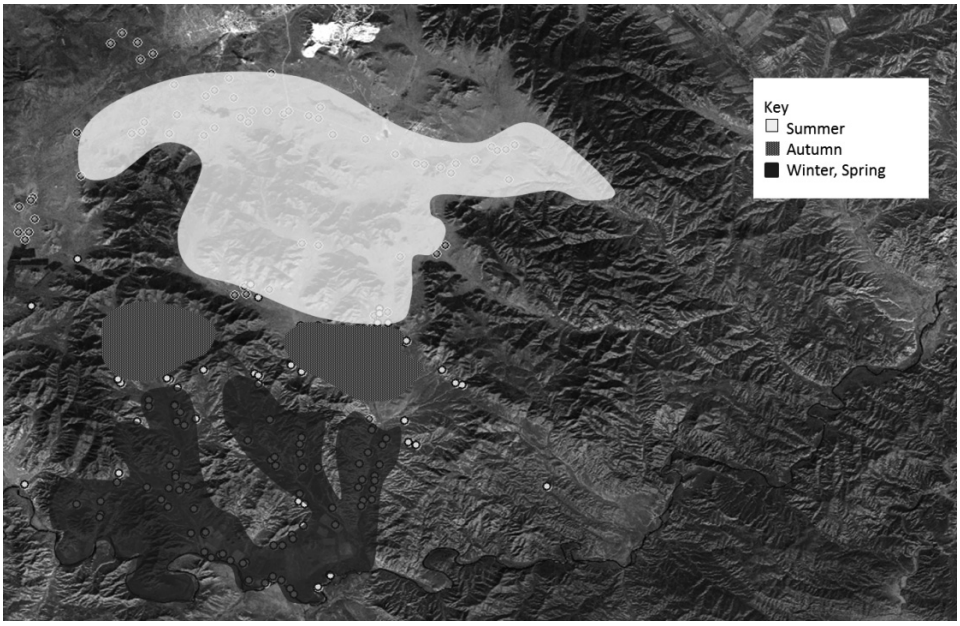
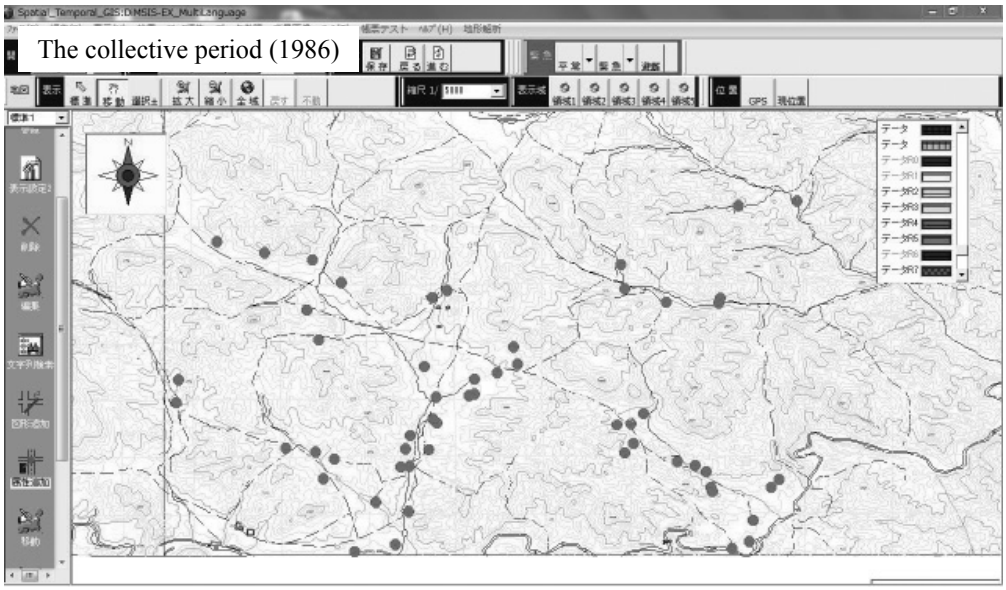


Fig.3. Pastoral land use in the present day



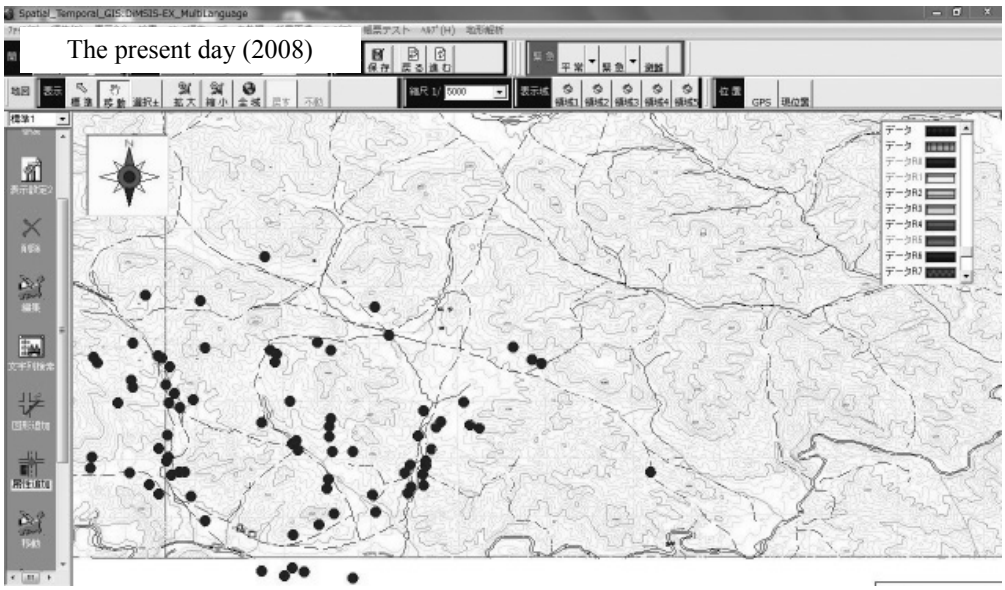


Fig.4. Map showing the location of cold weather facilities

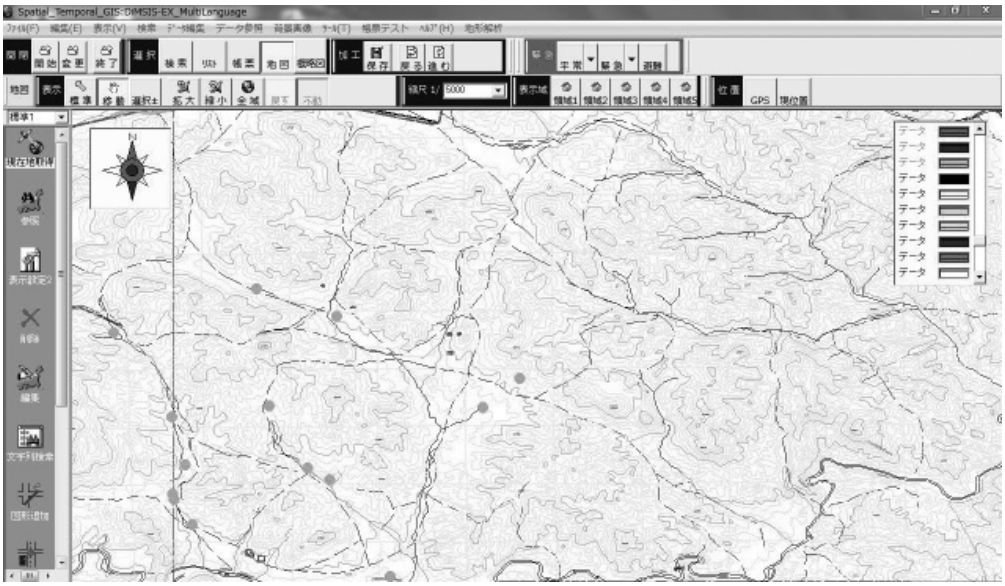


Fig.5. Map showing the location of wells during the collective period (1986)

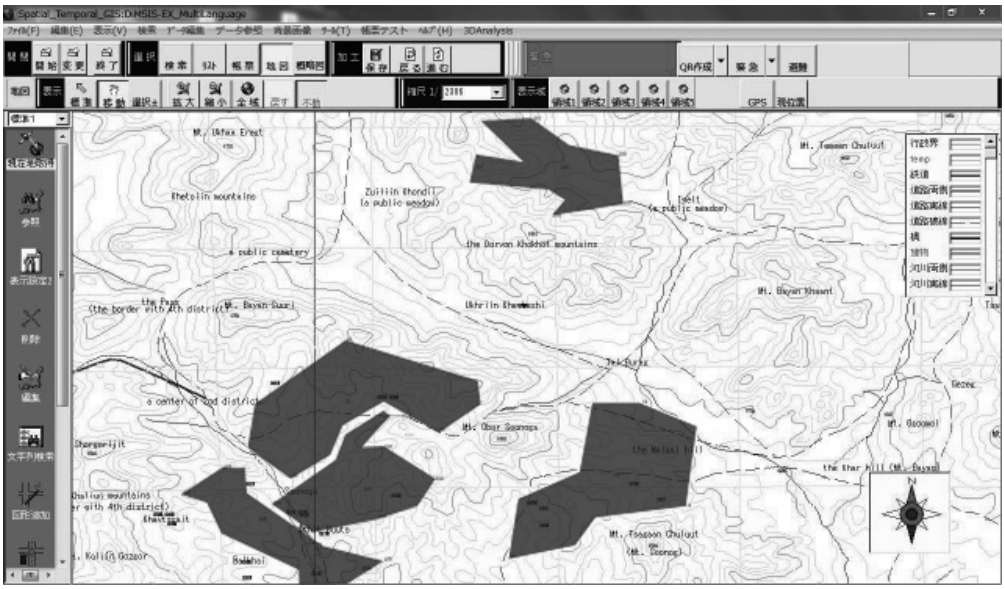


Fig.6. Map showing the plot lands allotted to herding groups