

INTERIM REPORT

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Land Use in North-East China in the 1930s and After

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INTRODUCTION

Land use in much of North-East China in the 1930s has been reconstructed and compared with that of today. North-East China, which was once called Manchuria in Japan or elsewhere, was a place of invasion and colonization by Japan till the end of World War II. This region currently comprises of Liaoning, Jilin and Heilongjiang Province and Neimongol Autonomous Region (see Figure 1). The study area corresponds to the territory covered by the 1:100 000 topographic maps produced by Japan in the 1930s, and it covers 81% of Liaoning, 76% of Jilin, 27% (southern part) of Heilongjiang, and 9% (eastern part) of Neimongol. The study area covers the entire Northeast Plain, the Changpai Shan Mountains in the east, and the barren Neimongol arid region in the west.

I. RECONSTRUCTION OF THE LAND USE IN THE 1930s

1. Basic Data

Some 420 maps at 1:100 000 have been used as basic source of land use information. The survey for this map series was mostly carried out between 1932 and 1935, i.e. soon after the notorious Manchurian Incident. The maps thus produced belong to what are called "gaiho-zu" in Japan. The land use classification in this map series is close to that which was used in the 1:50 000 topographic maps of pre-war Japan. Most of the maps used in this study were copied by courtesy of the Institute of Geography, Tokyo University, and the Diet Library.

2. Production and Analysis of the Data Files

Each map is first coloured according to the land use or land cover type identified from the symbols and other clues on the maps, then digitized and recorded in raster form for each of the grid squares drawn on the maps (see Figure 2). The size of a grid square is approximately 2 cm x 2 cm on the map, or 2 km x 2 km on the ground. The land use information recorded for each grid square includes the land use at the top-left corner, 1st, 2nd and 3rd largest uses and all other uses within the grid square.

The data files produced as above are assembled into a system called LUIS-C, or Land Use Information System for China. LUIS-C has a number of programmes which are easily operated by menu-selection procedures. It enables one to produce various kinds of maps as listed below.

- 1) Dominant land use in each grid square (see Figure 3).
- 2) Land use existing in each grid square (including trace elements).
- 3) Land use at each grid point.
- 4) Complexity of land use structure in each grid square.
- 5) Combination of different types of land use

LUIS-C also offers the total extent of each land use type for each province, as shown in Table 1. The figures in Table 1 are entirely based on the data produced in the current study, so they should be regarded as such. It is noted that the 1:100 000 maps ignore plots smaller than 100-200 m, hence the types of land use that tend to exist in small plots tend to have smaller areal figures than in reality. LUIS-C is revised from time to time with additional data and programmes. It will become available to the academic community in 1997.

The 1930s figures are compared with the figures of 1990 which have been taken from "Land Use in China" (Wu & Guo, 1994), in the following chapters. The land use classifications of the two data sources are not exactly the same, but it is nevertheless possible to compare the two data sets in some ways. Other major information sources for the study include "1:1 000 000 Land Use Map of China" (Wu, 1988)

II. DISTRIBUTION OF URBAN LAND USE

1. Settlement

"Settlement" refers to the area that is shown as such by dots or stripes on the map. Industries, schools, temples etc. are also included in this category, but roads and railways shown on the map are treated separately. Low-density settlements are shown by dots, so the exact extent of them is difficult to identify without additional information obtainable from the field survey etc. The areal figures of settlement in Table 1 are therefore subject to change as the study progresses.

Settlement occupied 2,900 km² in the 1930s, which is 0.6% of the whole study area. At this period the region was still predominantly rural, and only a few settlements, such as Harbin, Jilin, Changchun and Shenyang, exceeded 2 km² in areal size. The North-East Plain was dominated by agricultural land, but there were many rural settlements in it. As settlements were so numerous that most of 2 km x 2 km grid cells in the Plain had at least one settlement. On the other hand, the semi-dry area to the west of the Plain and the mountainous areas to the north and east of the Plain had only very few settlements. The mountainous area in the south, however, had some distribution of settlements, indicating the relative affluence of the area because of its better climatic and economic conditions.

Settlement occupied 6.1% of Liaoning and 3.0% of Jilin in 1990, as against 0.9% and 0.6% in the 1930s. The 1930s figures will become a little smaller if the areas outside the

study area (mostly forest) are included. Therefore, the increase in Liaoning is about eight times and that in Jilin is about six times.

A more detailed study on the urbanization is underway.

2. Roads and Railways

Roads and railways are usually exaggerated on the map at 1:100 000. It has been decided, however, to count all the sample points falling on them in the map. It is therefore likely that the areal figures obtained here are larger than actual figures. The accuracy of the data will be improved in the future study.

Roads occupied 12,030 km² (2.5%) in the 1930s. They were found in most grid squares except in the mountain areas dominated by forest. As against the case of settlement, they existed in the areas dominated by rough land. This fact indicates that human activity was already widespread throughout the region by the 1930s.

Railways occupied 240 km² in the 1930s. The total length of the railways in the region was about 3,800 km, so the areal figure obtained here is a little too large, as predicted.

III. DISTRIBUTION OF AGRICULTURAL LAND USE

Agricultural use occupied 152,560 km², or 32% of the total study area, in the 1930s. The agricultural land predominated the whole area of the Northeast Plain, and extended as far south as to the Liaotung Peninsula. It was also seen along the valleys in the western arid upland region in Liaoning, where rough land is the main physical feature. It was also visible in the valleys in the Changpai Shan Mountains in the south-east Jilin. These facts suggest that much of the land cultivable by then conventional means was already cultivated by 1931, when Japan established the colonial rule there. Agricultural development progressed in the region since then, but the development sites are mainly in the saline arid zone in the west, flood-prone lowland along the great rivers, and mountainous region in the east.

Agricultural use occupied 49.3% of Liaoning and 34.1% of Jilin in 1990, as against 44.5% and 28.3% in the 1930s. The 1930s figures will become a little smaller if the areas outside the study area (mostly forest) are included, as in the case of settlement. Therefore, the increase in Liaoning is estimated to be around 30%, and that in Jilin is estimated to be around 50% or more.

According to the "Statistics of China" (Nakajima, 1994), agricultural land increased only in Jilin (+9%), Heilongjiang (+2%) and Yunnan (+3%) Province between 1980 and 1990. In Jilin, where the increase rate of agricultural land was the highest in the country, the cultivation of maize and rice increased. During the same period, Neimongol and Liaoning lost 5% and 8% of their agricultural land, respectively.

1. Dry Field

Dry field occupied 152,300 km², or 99.8% of agricultural land, in the 1930s. The region has a cold winter which is not suitable for agriculture, but the summer is warm

enough for agriculture. It was already a major agricultural area in China in the 1930s. Main crops in the region are soy beans, wheat, maize, and kaoliang, now. Soybean production accounts for some 40% of the country's total. Kaoliang production has been declining in recent years, but Liaoning still produces 30% of the country's total.

2. Paddy Field

Paddy field occupied 220 km², or less than 1% of agricultural land, in the 1930s. It was only marginally observed along the Songhua River in Heilongjiang, in the Yanji Basin in the east of Jilin, and in the Liaotung Peninsula in Liaoning. It is far more widespread now, due to the government's policy of promoting rice production and the increasing demand for rice. Rice production in Liaoning is said to have started as far back as in 400 B.C., but the area of paddy field there was only 20 km² in the 1930s. The figure is now 5,160 km², i.e. more than 250 times as much as in the 1930s. In fact, the increase in paddy field is the most significant change in the agricultural land use in North-East China after the revolution in 1949.

Most of the paddy field in Liaoning exists in the vicinity of the mouth of Liaohe River, where dry field was predominant in the 1930s. In Jilin Province, paddy field increased from 40 km² to 2,800 km² in the same period. About 40% of paddy field exists within Jilin City. Again, most of the new paddy field exists where dry field was once predominant. Paddy field occupied 3,550 km² in Heilongjiang in the 1980s, and about half of it exists in the study area. Most of the paddy field in Heilongjiang is concentrated in the drainage basin of the Songhua River. The paddy field area within the study area in Heilongjiang was 150 km² in the 1930s, so the increase was more than ten times.

3. Orchard

No symbol of orchard is visible in the 1930 maps, although it is found in the land use classification of these maps. There were some orchards in the 1930s in reality, but they were all too small to be shown on the 1:100 000 maps.

According to "Land Use In China", orchard occupied 0.8% of the country in 1990. Liaoning produced 6% of fruits in 1992 (no. 4 in China). mainly in the south and west. Main fruits in Liaoning today are apples (no. 2 in China), pear (no. 3), grape (no. 4). Orchard is still rare in Jilin and Heilongjiang.

IV. DISTRIBUTION OF FOREST

Forest was mainly found in the altitude range above 400 m, namely in the mountainous region in the east and north, in the 1930s. This situation is basically unchanged till today. The forest area was 95,460 km², or 20% of the whole study area, in the 1930s. Forest existed in the Plain as well, but it was only minor.

Jilin had 51,710 km² of forest within the study area, which was mostly in the mountainous east, in the 1930s. The area of forest in the whole of Jilin Province in the 1930s is estimated as about the same as the current figure, which is 86,670 km². In other words, the forest area in Jilin has not changed much in the last sixty years. In Liaoning a

major increase in forest was observed in the inland part of the Liaotung Peninsula. The percentage area of forest in the 1930s in the whole of Liaoning Province is estimated as about 18%, as compared with the 1990 figure of 33%. The increase is therefore estimated to be about 80%. In Heilongjiang, a major increase in forest was observed in the mountain area south-east to Harbin.

1. Broad-leaved Forest

Broad-leaved forest occupied 56,290 km², or 12% of the whole study area, in the 1930s. It forms 59% of forest, and was mainly found in the altitude range of 400 m - 1,400 m. Broad-leaved forest was also seen around settlements or along roads, but they were usually narrow or small. In Jilin, the area of broad-leaved forest was 22,500 km² in the 1930s.

Broad-leaved forest increased a little since the 1930s. In Heilongjiang Province, much of the rough land observed south-east to Harbin in the 1930s has become broad-leaved forest. In Jilin Province, farmland shelter forest increased in the western part (Zhang, 1994). In Liaoning Province, a notable change was that much of the rough land observed in the Liaotung Peninsula in the 1930s has been converted to broad-leaved forest. According to "The Conservation Atlas of China" (Fan, 1990), much of the new forest in the Liaotung Peninsula is now regarded as commercial forest.

2. Coniferous Forest

Coniferous forest occupied only 580 km² in the study area. It was mainly found in the altitude range over 1 000 m.

3. Mixed Forest

"Mixed forest" here refers to such area where symbols of coniferous and broad-leaved forests are mixed. In the 1930s, it occupied 38,590 km², or 8% of the whole study area. The distribution was concentrated in the altitude range over 1,000 m. In Jilin Province it formed 56% of forest. In Liaoning Province and Neimongol Autonomous Region, no notable distribution was found in the 1930s.

It is noted that the definitions of "mixed forest" in the Land Use Map of China and in the "gaiho-zu" are not exactly the same, and the differences in the two sets of maps should not always be regarded as changes. More detailed study is obviously needed in order to identify changes more precisely. With this in mind, however, it may still be useful to compare the two sets of land use maps. Following are the findings:

- 1) The mixed forest in Jilin Province in the 1930s is now 70% broad-leaved forest, 10% coniferous forest.
- 2) The mixed forest in Heilongjiang Province in the 1930s is now 40% broad-leaved forest, 20% coniferous forest, and 10% sparse forest.

Sparse forest extends in the plains-piedmont area.

V. ROUGH LAND

"Rough land" refers to unused land with poor vegetation. It occupied 190,040 km², or 39% of the whole study area, in the 1930s. It surpassed agricultural land and forest in area size. It was widely seen in the western part of the Northeast Plain. The bulk of rough land area corresponds to the area with the annual precipitation below 400mm. In the eastern part of Neimongol Autonomous Region, rough land occupied 80% of the land. The figures are 38,620 km² (33%) in Liaoning, 36,760 km² (26%) in Jilin, and 35,320 km² (29%) in South Heilongjiang.

It is noted that "grassland" in the Land Use Map of China is nearly equivalent to "rough land" of the 1930s data. The comparison of the 1930s data with the Land Use Map of China revealed the following:

- 1) Most of the rough land prevalent in 124- 125E in Jilin in the 1930s was converted to dry field.
- 2) Part of the rough land west of 124E in Heilongjiang in the 1930s was converted to dry field.
- 3) Much of the rough land to the south-east of Harbin in the 1930s was converted to either broad-leaved forest or sparse forest.
- 4) Most of the rough land in the western part of Liaoning was converted to broad-leaved forest.
- 5) Most of the rough land in the eastern part of Neimongol remains as it was in the 1930s.

REFERENCES

- Himiyama, Y., H. Ito, T. Honma, T. Kikuchi (1995) Land Use in North-East China in the 1930s, Reports of the Taisetsuzan Institute of Science, No. 30, pp. 25-35.
- Fan, Z. ed. (1990) The Conservation Atlas of China, Science Press, 238 pp.
- Nakajima, S. (1994) Statistics of China, JETRO, 464 pp.
- Wu, C. ed. (1988) 1:1 000 000 Land Use Map of China, Science Press.
- Wu, C. & Guo, H. eds. (1994) Land Use in China, Science Press, 422 pp.
- Zhang, B. (1994) The Structure and Dynamics of the Land Resources System in the Farmland Shelter Forest Region in the NorthEast Plain, Chinese Geographical Science, Vol. 4, No. 4, pp. 322-332.

Table 1. Land-Use Structure in the Study Area in North-East China in the 1930s (km²)

LandUseType	Whole	Jilin	Liaoning	S.	E.
				Heilongjiang	Neimongol
Urban	15161	6022	3590	4196	1353
settlement	2894	839	1006	932	117
road	12030	5106	2511	3180	1233
railway	237	77	73	84	3
Agricultural	152563	40385	52710	48930	10538
paddyfield	217	41	20	146	10
dryfield	152303	40323	52677	48778	10525
orchard	0	0	0	0	0
othertreecrops	6	6	0	0	0
grassland	37	15	13	6	3
Forest	95461	51712	18841	23536	1372
broad-leaved	56292	22498	17597	14888	1309
coniferous	582	127	202	223	30
mixed	38587	29087	1042	8425	33
Other	212886	40929	41591	44594	85772
roughland	190043	36762	38620	35317	79344
rockyland	5621	232	1255	33	4101
wetland	12494	2643	767	7200	1884
water	4728	1292	949	2044	443
No Information	5308	3701	1607	0	0
Total	481379	142749	118339	121256	99035

(after Himiyama et. al., 1995)

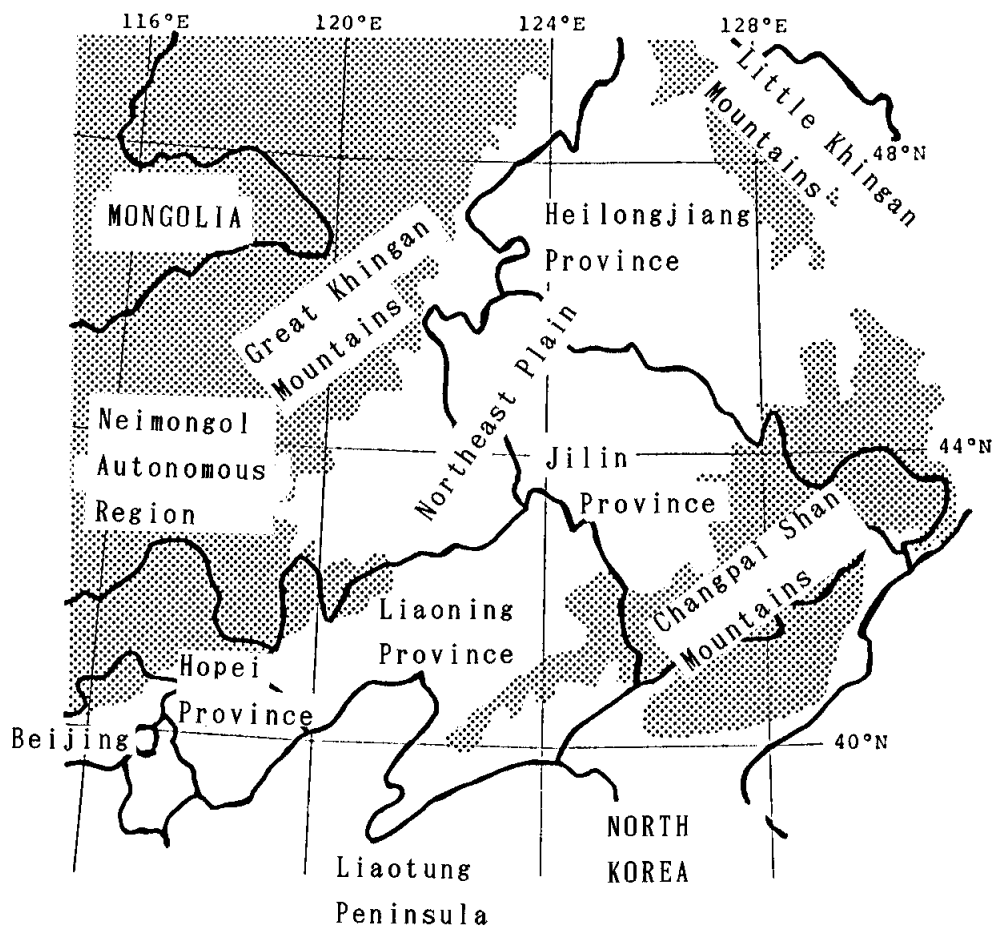


Figure 1: Setting of North-East China

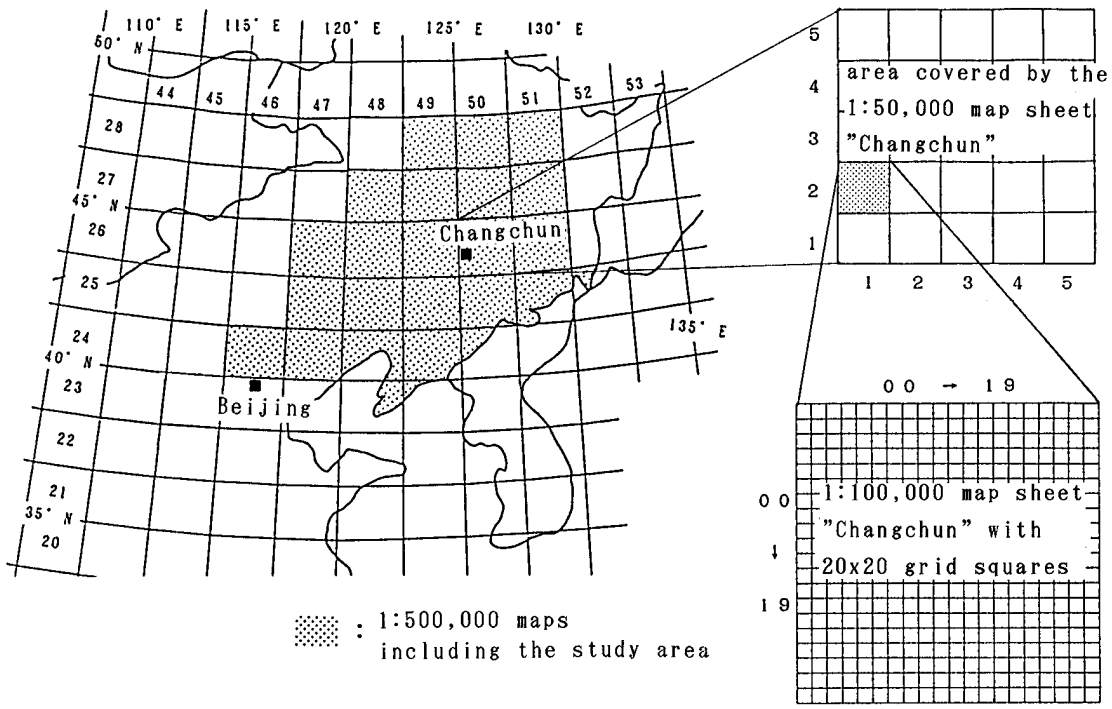


Figure 2: Grid System for Data Coding

Figure 3. Land Use in North-East China in the 1930s (after Himiyama et al., 1995)

