A GEOGRAPHICAL STUDY ON THE USE
OF THE PLAIN FORESTS IN THE KANTO PLAIN

by
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CHAPTER I

INTRODUCTION

I-1 Purpose of this Study

In the Kanto plain, there are forests of red oaks (Quercus acutissima Carruth), konara oaks (Quercus serrata Thunb.) and Japanese red pines (Picea densiflora Sieb. et Zucc), for the most parts, on the diluvial uplands, on hilly lands covered with the Kanto loam, and in the regions of upland farming. These forests are generally called "plain forests" and one of the most distinctive land uses in the upland farming regions in the Kanto plain. Most of the plain forests is owned and used by farmers mainly as farm forests until the 1950s. Farmers generally used the forests not solely for forestry, but for getting various kinds of useful materials for farm products and daily lives. The forests also conserved farms and settlements from the damages by strong wind or drought.

During the rapid economic development in the 1960s, however, the urbanization and industrialization lead to a great change in the significance of the plain forests. As modernization of agriculture and rural life style decreased the demand for farm forests, some farmers conversed the
CHAPTER I

plain forests, for higher income, into such agricultural lands as rikuden, stock farms, meadows and orchards, as well as into such urban land uses as industrial, residential, recreational and public. Despite a remarkable decrease of the plain forests, however, some districts still maintain large plain forests as important resources for raising farm products. Other districts, whose land price has rapidly been rising, the farmers keep the forests as fortune and have completely quit using them. Comprehending the multiform ways of use and conversion of present plain forests, therefore, will give us one of the most relevant keys to make clear the regionality of the land uses in the Kanto plain rural communities.

Recent urbanization of rural areas made Japanese people aware of the importance of the remaining plain forests which play manifold public functions. Since the urbanized districts have been expanding in the Kanto plain, the remaining plain forests are highly evaluated as living open-space forests which must be preserved. We should be in haste to make projects of the preservation. As a prerequisite for the preservation, it is indispensable to survey the regional characteristics of the remaining plain forests in terms of distribution, the ways of their use, and the surrounding physical and social conditions.

This study aims at clarifying, first, what function the
present plain forests have in the rural spaces in the Kanto plain; second, in what conditions the plain forests now exist in their own respective districts; and, last of all, the general aspects concerning the uses of the present plain forests.

I-2 The Previous Studies of Plain Forests and their Problems

The studies on the plain forests have long been made from the point of view of agricultural economics and forestry. Especially, after World War II, from the sides of the farmland ownership reformation and the policies such as post-war land-reclamation, the plain forests, which occupied a considerable area, drew an interest of the national government and prefectures, and became the target of investigation and study (Fukasaku, 1969). From 1950 to the beginning of 1960s, the detailed analyses on the uses of the plain forests were made concerning the cycle of the organic matters in the management of individual farmers, for the cycle was closely connected with the method of the maintenance of soil fertility (Mitsui, et al., 1950; Hayashi and Minami, 1951; Hayashi, 1955; Kanagawa Prefecture, 1957; Kanto-Tosan Agricultural Experimental Station, 1959; Takatsudo, 1961; Hinata and Takatsudo, 1961).

These studies report that the plain forests have been
used as farm forests mainly for farmyard and barnyard manures as well as for fuel wood. Hayashi and Minami (1951) and Hayashi (1955) especially emphasized that the upland field farming, in comparison with paddy field farming, is difficult to keep the balance of organic matters, and that forest lands must be included in the farming for producing manures. Kamino (1962) pointed out that, in general, the higher the agricultural productivity becomes, the less farmers depend upon the wild grasses and fallen leaves.

This kind of studies, however, gradually decreased as the plain forests became less used for farm forests in the 1960s. Agricultural economists, therefore, have not fully investigated in the changing processes of the use of the plain forests in response to the change of farming and household economy and other various problems.

After the 1960s, the studies were centered upon the conversion of the plain forests into commercial forests (Ibaraki Prefectural Guidance Center of Forestry Management, 1960; Ibaraki Prefectural Forestry Experiment station, 1964) and their possibility of exploitation for agricultural uses (Kanto Agricultural Administration office, 1967 and 1976). In recent years, the many plain forests have been left unused as farm forests, and some of them have been increasingly encroached, without any definite principles, for urban land uses. Accordingly, it has come to pass that
the investigations and studies are made in order to preserve
the plain forests for open spaces (Forestry Agency, 1984 and
of all, prescribing the plain forests as municipal forests,
has been studying them about their function of increasing
importance as forest open spaces.

According to Kanto Agricultural Administration Bureau
(1976), previous studies had various definitions and
estimated acreage of plain forests. It was difficult,
therefore, to identify the present situation of the plain
forests and to make effective policies for suitable forests
use. In the years following the report, nevertheless, the
definition of the plain forests has still been left
unsettled and, consequently, the area and other attributes
have not been clearly identified from statistical point of
view.

Although the plain forests have been one of the most
distinctive land uses in the Kanto plain, and have played an
important part as farm forests in the rural communities, few
geographers have studied them because geographers generally
have little interest in the forest land and because it is
difficult to collect accurate quantitative data. The
fragmentary descriptions about plain forests have been made
by such agricultural and settlement geographers as Odauchi
A few geographical studies examined the plain forests as their main study objects, Tateishi (1972), a pioneering work, proposed a new definition of plain forests, which will be quoted in Chapter II-1, by carefully examining and improving previous ambiguous usages by agricultural economists. He also described the situation of the plain forests in the Kanto plain since the period of the rapid economic development by emphasizing that the forests were rapidly converted into urban lands.

Tateishi and Sawada (1975) reported that, since the period of the rapid economic development, the forest lands in the Kanto plains have been rapidly turned into industrial and residential sites. Sawada (1981) reported that plain forests were being converted into industrial estates in his case study of Moka-shi, Tochigi prefecture. These studies, however, did not go beyond morphological studies on land uses, although they identified the fact that plain forests were turned into urban facilities under the influence of the urbanization under rapid economic growth. The common
factors of the conversion of the plain forests into new land uses involve such conditions as physical setting, agricultural techniques, and farmers' economy. No study has examined plain forests in relation to these complex factors working in agricultural regions.

Studies on the use of the plain forests also exist in other countries, especially in Europe, quite different from Japan, almost all the forests, except for the Alpine and Scandinavian countries, are situated in the plains because Europe has vast structural plains. Accordingly, the studies on the uses and exploitations of the forests are those of the plain forests. A French forester, Devèz (1975) has made researches on the changes of the uses and area of the forests in France and in all of the European areas from macroscopic point of view.

In the field of geography, Dietrich (1928) talked about the distributions and uses of the forests in European countries, from the point of forest products such as fuel wood and timber. Darby (1956) scrutinized the studies made on the uses and exploitations of the forests in the fields of European Geography and history, and reported the notable decrease of the forests because of the exploitations which had been made since the Ancient Times or Middle Ages. In his study Darby introduced Schlüter (1952), who treated of the conspicuous decrease of forests due to the expansion of
the agricultural land uses, by contrasting the forest distribution map of A.D. 900 in Central Europe with that of A.D. 1900. Coppock (1960) reported that, in the Southern Highland of England, the afforestation had been spreading for a decade after World War II. Darby (1977) made a research of historical geography on the forests used for the hunting grounds of British royalty and aristocracy and on woodlands which for common farmers chiefly used for grazing pigs. As the reclamation and exploitation of European plain forests thus began in the Ancient Times or Middle Ages, the studies on the uses of farm forests were mainly by historical geographers.

In the U.S.A., as in Europe, no geographical research or report exists on the plain forests used as farm forests. In forestry, Mochida (1984) made a research on the decrease of forests in connection with the development of the U.S.A., from the standpoint of land reclamation for agricultural use and the growth of pulp industry.

Although there are some studies of the plain forests on the forestry uses in Europe and the U.S.A., only a small number of studies in European historical geography examined them as farm forests.
The author supports the idea by Yamamoto et al. (1981) that the land use is the result of the activities by the residents who, with the background of the cultural and technological levels of the age, evaluate the natural and regional conditions and change the land into resources. The land uses once established becomes, in turn, the conditions of the next land use. The agricultural land use, including the plain forests, therefore, is the manifestation of the farmers' chooses of various environmental conditions with the background of the agricultural technological levels. Since the rapid economic development, different commercial farmings have been advanced in various districts with the backgrounds of different regional conditions for agriculture. Even in a same rural community, farming practice has been diversified among farmers. With these changes, the use of the plain forests as farm forests has also been differed reflecting the local and regional characteristics. In other words, the regionality seen in the uses of the plain forests reflects the quality of the agricultural region. The survey in the uses of the plain forests is geographically significant because it can reveal the characteristics of regions. In order to identify the regionality, the use of farm forests must be discussed in
connection with various environmental conditions, land resources, the way of land use, and the farmers' social and economic attributes.

In contrast with previous geographical studies on the plain forests, which have been centered upon the ways of land-uses, this study examines the uses of the plain forests in relation to the whole structure of the agricultural region. Although the uses of the plain forests are manifold but the enumeration of many facts alone cannot elucidate the essential qualities of the plain forests. It is requisite to discover some kind of systems in the uses of the plain forests, which are typical in the respective regions, and to classify the regional types of the uses, by means of detailed case studies. In order to achieve this goal, the following procedure is taken. First, after an exact definition of plain forests is made, many specific qualities, such as the acreage, should be expressed statistically. Based upon the numerical data defined in this way, the area of the plain forests, the ratio of the artificial forests, the ratio of forest land, and tree species in the Kanto plain are analyzed. Second, typical districts with large areas of plain forests are chosen, in the Kanto plain, to discuss the ways of uses. After identifying traditional ways of the plain forests use, the present forms of the forests use in each district are
characterized in relation to their traditional forms. The factors of the present forest use, in the agricultural regions where the plain forests are still maintained in their traditional forms are then examined in relation to the whole region with the scope of analysis even upon the individual farmers and their practices.
Characteristics of Plain Forests in the Kanto Plain

II-1 The Definition of Plain Forests

The definition of plain forests has not clearly been made as Tateishi (1972) and Kanto Agricultural Administration Bureau (1976) already pointed it out. The definitions have been varied by researchers; some defined them by tradition, while others defined them by judgments and the customs of the altitudes and gradients of the placement. Ibaraki Prefecture (1981), for instance, defined plain forests as "the forests under the altitude 150m and the gradient 15°, situated mainly in the diluvial uplands and alluvial lowlands." Tochigi Prefecture (1978) defined them as the forests in the gentle sloped lands even over the altitude of 400m. The Forestry Agency (1984) defined them what people generally "plain forests" or "suburban forest" which are situated in the plain or in the suburbs. The agency characterized them "the forests in the villages, towns and cities occupying more than 75% of lands which are located under the altitude 300m and less than the gradient 15°." In the northern Ina basin and the Matsumoto basin, Nagano prefecture, even the forests on gentle slopes around the altitude of 800m were called "plain forests" (Ichikawa,
Because all definitions were given to the flat lands with gentle slopes and in comparatively low altitudes, this study adopted the definition of Tateishi (1972): the plain forests are restricted to the forests existing on the lowlands, upland, and hilly lands, according to the land form classification of the National Land Research Law, and on the gentle slopes of the piedmonts among the mountain areas. As a result, based upon the land classification map (the land form classification map) issued by the Section of the National Land Research in the Economic Planning Agency, the districts with the plain forests in the Kanto plain (which are called 'plain forest regions') and the districts with the mountain forests (which are called 'mountain forest regions') have been accurately determined. As for the boundary line of the plain forest regions and the mountain forest regions, the altitude and gradient are identified by 1:50,000 topographical maps. The result is that, in the Kanto plain, the districts in which the plain forests remain are recognized to be situated under the altitude of 300m above the see level and on less than 15° gradient.
CHAPTER II

II-2 Characteristics in the Distributions of the Plain Forests

From the 1:200,000 land use map issued by the Geographical Survey Institute, the author identified forest lands in the plain forest regions and then drafted Fig. 1, which shows the present distribution of plain forests.

According to Fig. 1, many plain forests can be seen in the upland farming regions on the diluvial uplands and hilly lands, which are covered with the Kanto loam. Those areas include the Sagamihara upland, the Musashino upland, the Omiya upland, the Hitachi upland, the Shimosa upland and the Nasunohara upland. Nevertheless, few plain forests are found in the Osato upland in the northern part of Saitama prefecture and in the Isezaki upland in the southeastern part of Gunma prefecture, because forests have been converted into mulberry fields since the Meiji Era (Birukawa, 1960).

Generally speaking, more plain forests are located in the hilly lands and uplands in the Kanto plain than in the urban fringe of Tokyo. Much more plain forests are seen in the eastern part of uplands and hilly lands in the Kanto plain than in the western part. The western part has been under the influence of the urbanization and industrialization in Tokyo and its suburbs.

In contract with above-mentioned parts, few plain
Fig. 1  Distribution of plain forests in the Kanto Plain (1982)

1. plain forest, 2. mountain land, 3. upland and hilly land covered with volcanic ash soil, 4. alluvial lowland
forests are distributed in the alluvial lowlands on the valleys of the Ara, the Tone and the Tama rivers as well as in the Kujukuri coastal plain, for in these districts the paddy rice farming has long been practiced.

In the uplands of the Osaka plain with advanced reservoir irrigations, people had exploited paddy fields since the Middle Ages. In the uplands and hilly lands of the Kanto plain, by contrast it was only after World War II that people could exploit paddy fields on a full scale. In Kanto, the paddy field reclamation was greatly hindered because irrigation was not easily available and because the thick Kanto loam accumulation allowed the leakage of water (Koide, 1973).

The soil in the farmlands on the uplands and hilly lands is pale-colored Kuroboku whose parent material is the Kanto loam of volcanic ash soil. This is acid light soil, full of active aluminum and with low fertility, devoid of much phosphoric acid and humus. When the soil is not made fertile with such organic fertilizers as farmyard manure, it is impossible to produce crops next year. In addition to that problem, it is difficult to keep the balance of organic matters in the upland field farming, in comparison with the paddy rice farming in the alluvial lowland. The upland farming, therefore, was more dependent upon the forest lands, which could provide manure, than the paddy field
farming. Furthermore, the plain forests were indispensable as watershed protection forests on high and dry uplands and hilly lands. They were also valuable as windbreak forests which could keep the farmlands from the wind erosion of the winter monsoon. These are the chief factors of plain forests in the uplands and hilly lands in the Kanto plain.

II-3 Various Characteristics of the Plain Forests

(1) The Method of Grasping the Plain Forests Statistically

In order to identify the regional differences in the preservation of the plain forests in the Kanto plain, it is necessary to grasp the various attributes of plain forests such as acreage. In the *Fuken-tokeisho* (Annual Prefectural Statistics) of each prefecture published in the 1880s in the middle of the Meiji Era, the acreage of the forest lands and grassy lands in each *gun* (county) was published in three different categories: mountain forests, plain forests, and *Kusayama* (grassy land). Although the definitions of these statistical items are not clear, they tell us that in the 1880s there existed about 250,000 *cho-bu* plain forests in the Kanto plain (Table 1).

Ibaraki prefecture was ranked first in ownership, and had about 30% of the total area of the plain forests in the Kanto plain. The three prefectures, Ibaraki, Tochigi and
Table 1  Forest land area in Kanto region (1887)

<table>
<thead>
<tr>
<th>Prefecture</th>
<th>Amount of forest land area</th>
<th>Government forest land</th>
<th>Non-government forest land</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>Ibaraki</td>
<td>103,509</td>
<td>13,306</td>
<td>90,203</td>
</tr>
<tr>
<td>Tochigi</td>
<td>373,735</td>
<td>195,907</td>
<td>177,828</td>
</tr>
<tr>
<td>Gunma</td>
<td>564,456</td>
<td>453,491</td>
<td>110,965</td>
</tr>
<tr>
<td>Saitama</td>
<td>231,576</td>
<td>146,970</td>
<td>84,606</td>
</tr>
<tr>
<td>Chiba</td>
<td>141,435</td>
<td>10,284</td>
<td>131,171</td>
</tr>
<tr>
<td>Tokyo</td>
<td>3,908</td>
<td>74</td>
<td>3,832</td>
</tr>
<tr>
<td>Kanagawa</td>
<td>150,786</td>
<td>24,766</td>
<td>126,020</td>
</tr>
<tr>
<td>Total</td>
<td>1,568,403</td>
<td>844,778</td>
<td>724,625</td>
</tr>
</tbody>
</table>

Unit: chou, ( % )

Source: Fuken-tokeisho (Annual Prefectural Statistics) of each prefecture in 1888
CHAPTER II

Chiba had three fourth of all the plain forests in the Kanto plain. Fig. 2 shows the percentage of the plain forest areas to total areas of gun. It shows that the high ratio districts occupied the eastern part of the Kanto plain such as the southeastern Tochigi, the entire Ibaraki and the northeastern of Chiba.

On the contrary, the guns spreading in the mountain lands and alluvial lowlands along rivers have small percentages. Compared with the eastern districts, the western ones have generally small percentages. Among them, however, old Kitatama-gun and Niiza-gun in the Musashino upland have high ratios. The distribution in those days, therefore, is almost the same as the present one shown in Fig. 1. In later days, however, plain forests have not been included in statistic items of Fuken-tokeisho. It is impossible, therefore, to identify the area of the plain forests directly from statistics today.

The plain forests are regarded as the forests, with satisfying conditions, which occupy 75% or more area of cities, towns, and villages. The total area of the plain forests is estimated by aggregating all the existing forests. The reason the present villages (mura), towns (machi) and cities (shi) are made the units in statistics is that it is convenient to calculate the statistic items in the Forestry volumes of 1960, 1970, and 1980 World Census
Fig. 2  Distribution of the percentage of the plain forests by the old gun in the Kanto plain (1887)

Source: Fuken Tokeisho (annual Prefectural Statistics) of each prefecture in 1887
of Agriculture and Forestry. As the area of the present villages, towns, and cities are wider because of merger, it is desirable to use former units of villages, towns and cities. Because of the limitation of using data, however, present units are used in this study. Although the World Census of Agriculture and Forestry is the statistics of personal principles and different from the numbers of the area in the statistics by the territorial principles, the census is the most easily available source of data, in which investigations are done in the same accuracy in the nationwide scale. This census data are used in this study because of the availability of many statistical items in different years; it is easy to identify the changes after 1960.

Concerning all the villages, towns and cities in the capital and 6 prefectures in the Kanto plain, the following (1) - (7) items in the Forestry Volume in the World Census of Agriculture and Forestry are calculated by computer.

(1). Total areas (1960, 70 and 80 Census)
(2). Forest land area (1960, 70 and 80 Census)
(3). Constitution of the tree species (1980 Census)
(4). Rate of the artificial forest area to the total forest land areas (1960, 70 and 80 Census)
(5). Area by types of the owned forests (1980 Census)
(6). Number of forest holding farm households by the size of owned forest (1980 Census)
(7). Conversion areas of forests by purpose in 1975 to 80 (1980 Census)
CHAPTER II

The capital and 6 prefectures in the Kanto plain consists of 453 villages, towns, wards (ku) and cities, and the total area is 3,190,000 hectare. The plain forest districts among them are 315 villages, towns, wards and cities, and occupy 1,640,000 hectare (51.3%) of the total area (Fig. 3).

(2) The Area of Plain Forests and Its Change

In 1980 300,000 hectare of plain forests occupied 21.0% of the total forests land areas. Ibaraki prefecture had the largest plain forest area, which occupied about 40% of the total plain forest area in the Kanto plain (Table 2). The area of plain forests in Ibaraki was 130,000 hectare in 1960 and 120,000 hectare in 1970, which were the largest in the Kanto plain and occupied about 40% as in 1980. Next to Ibaraki, Chiba prefecture has about 30% of plain forests in the Kanto plain in any year. Ibaraki and Chiba alone in Kanto, there was more area of the plain forests than that of the mountain forests, in all the area of the forests in the prefectures. In 1980 the total area of plain forests in three prefectures, Ibaraki, Chiba, and Tochigi, occupied about 80% of the total area of the plain forests in Kanto, and the plain forests were mostly situated in the eastern parts.

By examining the change of the plain forest area in
Fig. 3 Plain forest regions and mountain forest regions

1. plain forest region, 2. mountain forest region,
3. boundary between the plain forest regions and
   the mountain forest regions
Ut. Utsunomiya-shi, Mi. Mito-shi, M. Maebashi-shi,
U. Urawa-shi, T. 23-wards of Tokyo, C. Chiba-shi,
Y. Yokohama-shi.
Table 2  Changes of the plain forest and mountain forest area in Kanto region (1960~80)  

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mountain forest</td>
<td>Plain forest</td>
<td>Total</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>Ibaraki</td>
<td>88,739</td>
<td>129,768</td>
<td>218,507</td>
</tr>
<tr>
<td></td>
<td>(40.6)</td>
<td>(59.4)</td>
<td>(100.0)</td>
</tr>
<tr>
<td>Tochigi</td>
<td>328,855</td>
<td>56,300</td>
<td>385,155</td>
</tr>
<tr>
<td></td>
<td>(85.4)</td>
<td>(14.6)</td>
<td>(100.0)</td>
</tr>
<tr>
<td>Gunma</td>
<td>412,009</td>
<td>5,817</td>
<td>417,828</td>
</tr>
<tr>
<td></td>
<td>(98.6)</td>
<td>(1.4)</td>
<td>(100.0)</td>
</tr>
<tr>
<td>Saitama</td>
<td>109,532</td>
<td>24,792</td>
<td>134,324</td>
</tr>
<tr>
<td></td>
<td>(81.5)</td>
<td>(18.5)</td>
<td>(100.0)</td>
</tr>
<tr>
<td>Chiba</td>
<td>70,236</td>
<td>96,444</td>
<td>166,680</td>
</tr>
<tr>
<td></td>
<td>(42.1)</td>
<td>(57.9)</td>
<td>(100.0)</td>
</tr>
<tr>
<td>Tokyo</td>
<td>44,800</td>
<td>17,410</td>
<td>62,210</td>
</tr>
<tr>
<td></td>
<td>(72.0)</td>
<td>(28.0)</td>
<td>(100.0)</td>
</tr>
<tr>
<td>Kanagawa</td>
<td>82,326</td>
<td>22,658</td>
<td>104,984</td>
</tr>
<tr>
<td></td>
<td>(78.4)</td>
<td>(21.6)</td>
<td>(100.0)</td>
</tr>
<tr>
<td>Total</td>
<td>1,136,497</td>
<td>353,189</td>
<td>1,489,686</td>
</tr>
<tr>
<td></td>
<td>(76.3)</td>
<td>(23.7)</td>
<td>(100.0)</td>
</tr>
</tbody>
</table>

Unit: ha, (%)  

Source: World Census of Agriculture and Forestry in 1980
the Kanto plain from 1960 to 1980 (Table 2), it is identified that the plain forests decreased much more greatly than the mountain forests. Table 3 shows that the decrease ratio of the plain forests from 1960 to 1970 is high in Kanagawa, Tokyo, Saitama, and Tochigi. From 1970 to 1980, however, the decrease ratio decreased in Kanagawa, Tokyo and Saitama, while the decrease ratio rose in Gunma and Chiba. In Tochigi, the decrease ratio was high in the decade from 1960 to 1970, whereas in Ibaraki, the ratio was less than 5% in two decades. That is because the districts in the western and southern parts of the Tokyo Metropolitan area were early influenced by the urbanization and necessarily the plain forests decreased. Then the urbanized districts spread from the north to the east by centrifugal expansion (Yamaga, 1967).

In the period of the rapid economic development in the 1960s, as the urbanization proceeded on, the forests as well as the farmlands were converted into other uses. Most of the mountain forests were legally protected by the designation as protection forests such as watershed protection and erosion and torrent control. Unprotected forests, however, were rapidly converted into golf courses as well as residential, industrial, recreational and public facilities. Most plain forests were exploited into other uses because they had no legal restrictions.
Table 3  The ratio of decrease of the plain forest and the mountain forest area in Kanto region (1960~80)

<table>
<thead>
<tr>
<th>Prefecture</th>
<th>Mountain forest</th>
<th>Plain forest</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ibaraki</td>
<td>-6.0</td>
<td>1.2</td>
<td>-4.7</td>
</tr>
<tr>
<td>Tochigi</td>
<td>1.0</td>
<td>2.3</td>
<td>3.4</td>
</tr>
<tr>
<td>Gunma</td>
<td>0.6</td>
<td>0.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Saitama</td>
<td>-0.1</td>
<td>1.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Chiba</td>
<td>-14.4</td>
<td>-1.4</td>
<td>16.0</td>
</tr>
<tr>
<td>Tokyo</td>
<td>0.4</td>
<td>0.5</td>
<td>0.9</td>
</tr>
<tr>
<td>Kanagawa</td>
<td>5.8</td>
<td>-1.4</td>
<td>4.5</td>
</tr>
<tr>
<td>Total</td>
<td>-0.4</td>
<td>0.9</td>
<td>0.5</td>
</tr>
</tbody>
</table>

This was impressive enough to make the people recognize the value of the forests as open space and public welfare. As a result, in 1974, "Permission System Law in Developing Forest lands" was decreed. According to the law, the permission of the governor of the urban and rural prefectures was required when people exploited more than 1 hectare of forests, even if they were not protection forests (Forest Conservative Section, Forestry Agency, 1987). But even this law could not keep the plain forests from the exploitation. After the enforcement of this law in 1974 as much as 7,700 hectare plain forests in Kanto region, which is 1.8 times of the converted mountain forests, was converted into other uses from 1975 to 1980 (Table 4). In Ibaraki with the largest forest area in Kanto, 3,486 hectare was converted into other uses, while in Chiba with the second largest forest area 2,577 hectare was converted. The smallest one is Gunma, whose converted area is 109 hectare. In Ibaraki and Tochigi, most forests were converted into agricultural lands. In Gunma, many were converted into industrial, residential, or public facilities. In Saitama, about 60% of the converted plain forests were golf courses. In Chiba, also, 40% were golf courses. In Tokyo, most of the plain forests were converted into public facilities.

The converted forests are categorized into the lands for agricultural use and the lands for urban use at every
<table>
<thead>
<tr>
<th>Prefecture</th>
<th>Amount of conversion of forest</th>
<th>Urban land use</th>
<th>Agricultural land use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area of conversion</td>
<td>Industry site</td>
<td>Residential site</td>
</tr>
<tr>
<td></td>
<td>(ha)</td>
<td>(ha)</td>
<td>(ha)</td>
</tr>
<tr>
<td>Ibaraki</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>3,486</td>
<td>419</td>
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</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(12.0)</td>
<td>(29.4)</td>
</tr>
<tr>
<td>Mountain forest</td>
<td>643</td>
<td>4</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(0.6)</td>
<td>(21.9)</td>
</tr>
<tr>
<td>Total</td>
<td>4,129</td>
<td>423</td>
<td>1,165</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(10.2)</td>
<td>(28.2)</td>
</tr>
<tr>
<td>Tochigi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>521</td>
<td>73</td>
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<td></td>
<td>(100.0)</td>
<td>(14.0)</td>
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<tr>
<td>Mountain forest</td>
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<td>148</td>
<td>66</td>
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<td></td>
<td>(100.0)</td>
<td>(10.7)</td>
<td>(4.8)</td>
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<tr>
<td>Total</td>
<td>1,910</td>
<td>221</td>
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</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(11.6)</td>
<td>(3.5)</td>
</tr>
<tr>
<td>Gunma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>109</td>
<td>22</td>
<td>55</td>
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<tr>
<td></td>
<td>(100.0)</td>
<td>(20.2)</td>
<td>(50.5)</td>
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<tr>
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<td></td>
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<td>(3.9)</td>
<td>(7.9)</td>
</tr>
<tr>
<td>Total</td>
<td>902</td>
<td>49</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(6.1)</td>
<td>(13.7)</td>
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<tr>
<td>Saitama</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>251</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(9.2)</td>
<td>(2.0)</td>
</tr>
<tr>
<td>Mountain forest</td>
<td>359</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(2.5)</td>
<td>(10.9)</td>
</tr>
<tr>
<td>Total</td>
<td>610</td>
<td>32</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(5.2)</td>
<td>(7.2)</td>
</tr>
<tr>
<td>Chiba</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>2,577</td>
<td>14</td>
<td>602</td>
</tr>
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<td></td>
<td>(100.0)</td>
<td>(0.5)</td>
<td>(23.4)</td>
</tr>
<tr>
<td>Mountain forest</td>
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<td>8</td>
<td>89</td>
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<td></td>
<td>(100.0)</td>
<td>(1.9)</td>
<td>(21.5)</td>
</tr>
<tr>
<td>Total</td>
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<td>22</td>
<td>691</td>
</tr>
<tr>
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<td>(0.7)</td>
<td>(23.1)</td>
</tr>
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<td>Tokyo</td>
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<tr>
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<td>( - )</td>
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<td>(100.0)</td>
<td>( - )</td>
<td>( - )</td>
</tr>
<tr>
<td>Total</td>
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<td>( - )</td>
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<td>Kanagawa</td>
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<tr>
<td>Plain forest</td>
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<td>41</td>
<td>192</td>
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<td>124</td>
</tr>
<tr>
<td></td>
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<td>( - )</td>
<td>(18.9)</td>
</tr>
<tr>
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<td>41</td>
<td>316</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(3.4)</td>
<td>(26.2)</td>
</tr>
<tr>
<td>Total</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
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<td>595</td>
<td>1,878</td>
</tr>
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<td></td>
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<td>(24.4)</td>
</tr>
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<td>Mountain forest</td>
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<td>514</td>
</tr>
<tr>
<td></td>
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<td>(4.7)</td>
<td>(12.2)</td>
</tr>
<tr>
<td>Total</td>
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<td>791</td>
<td>2,392</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(6.8)</td>
<td>(20.1)</td>
</tr>
</tbody>
</table>

Source: World Census of Agriculture and Forestry in 1980
Fig. 4 Conversion of the forest lands in Kanto region (1975-80)

1. mountain forest region, 2. boundary between the plain forest regions and the mountain forest regions.
CHAPTER II

village, town, and city (Fig. 4). In the western part of the Kanto plain, there are many cases of conversion into urban facilities, for it is situated at the piedmont of the mountain land. Most of the land is exploited into golf courses, industrial, or residential sites. Many forests are characteristically converted into farmlands in the villages, towns, and cities in Nasunohara upland in the eastern part of Tochigi, the Enna hilly land in the southeastern of the same prefecture, the Hitachi upland around the lake Kasumigaura and the lake Kitaura in Ibaraki, and the Shimosa upland in the northern of Chiba. Most of them are rikuden (Ishii and Yamamoto, 1987), and orchard such as chestnut fields (Oyagi and Ishii, 1980), which will be elucidated in Chapter IV.

(3) The Rate of Forest Lands, the Constitution of Tree Species and the Rate of Artificial Forests

Fig. 5 is the ratio of forest lands in every village, town, and city in 1980. The districts with more than 50% forest land are mostly in the mountain lands. The ratio in the districts with plain forests is generally less than 50%. In the villages, towns, and cities situated in the piedmont slopes near mountain lands in Kanagawa, Tokyo, and Saitama which are located in the western part of Kanto, the ratio is
Fig. 5  Distribution of the ratio of the forest land area in Kanto region (1980)

Source: World Census of Agriculture and Forestry in 1980
20 to 50%. The ratio is between 10% and 20% in the villages, towns, and cities, in the north of Musashino upland in the south of Saitama, and in the Sagamihara upland and Tama hilly lands in Kanagawa. The category of less than 10% dominants other districts.

Nevertheless, the majority of the districts in the Shimosa upland and the Hitachi upland in Chiba and Ibaraki in the eastern Kanto have the ratio of 20 to 50%. In the eastern Kanto, very few districts have less than 10% ratio. The ratio is exceptionally high in the Shimosa upland because the land-use was extensive as been observed in Sakura 7 pastures and Kogane 5 pastures in the Edo period, and because the land was used as the military land till World War II.

The tree species in the plain forests are coniferous trees in Chiba and Ibaraki in most cases. Generally there are many broad-leaved trees in the southern Tochigi, Gunma, Saitama, Tokyo, and Kanagawa (Fig. 6). Most coniferous trees in the eastern Kanto are pines. In the pine plain forests in the inland districts, many Japanese red pines are to be seen, and in the littoral districts, there are many Japanese black pines (*Picea thunbergii Parlat*.). In the east of the Shimosa upland in Chiba, Japanese cedar forests are seen in some particular localities. These are centered upon Sanbu-machi of Sanbu-gun in Chiba, and they are called "the
Fig. 6  Distribution of tree species found most in the plain forest regions (1980)

1. mountain forest region, 2. broad-leaved trees, 3. pines
4. Japanese cedar and Hinoki cypress, 5. others
6. boundary between the plain forest region and the mountain forest region

Source: World Census of Agriculture and Forestry in 1980
CHAPTER II

Forestry of Sanbu" which are considered to have been started in the middle of the 18th century in the middle Edo period (The Forestry Section, Agricultural and Forestry Division, Chiba Prefecture, 1979). This Sanbu forestry made it a rule to provide lumber for furniture and fittings, and cut down the cedars of 100 to 200 years of age at cutting season. Since this forestry technique could be developed only under special social relationship, it did not prevail upon the whole district of Kanto which was originally unfit for cedar-growing (The Editorial Committee of the History of Sanbu-machi, 1988).

Many deciduous broad-leaved trees in the western part of Kanto are red oaks and konara oaks\(^{14}\). As the above-mentioned instances show clearly, the tree species are greatly different from each other in the east and west plain forests in the Kanto plain.

As the northern part of the Kanto plain is situated in the transition area of the warm-temperate forests and the temperate forests, most of the natural vegetation belongs to the evergreen broad-leaved trees which are the class of \textit{Camelliotea} (Yoshino, 1968; Oba, 1969; Miyawaki, 1977). Consequently, most plain forests in the Kanto plain, which consist of saplings of red oaks, konara oaks and Japanese red pines, are not natural vegetation but secondary forests (Okutomi et al., 1976).

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When the ratio of the artificial forests in the whole area of Kanto, including the mountain regions, the districts with more than 68% ratio are not in the mountain forests, but in the plain forest districts with Japanese red pines in Ibaraki and Chiba in the eastern part of the Kanto plain (Fig. 7). Among the plain forest districts, in the western parts such as Saitama, Tokyo, and Kanagawa, whose forests are made of red oaks and konara oaks, most of the ratio are 13%.

As the Japanese red pines sprout scarcely after being felled, the farmers must plant young trees to revive the plain forests. In the plain forest districts in the eastern part of Kanto, where there are many Japanese red pines, the ratio is supported to get higher. Red oaks and konara oaks sprout easily, and so the farmers are able to revive the plain forests by the sprout regeneration. In the western plain forest districts, therefore, the ratio is comparatively lower than in the eastern districts.

(4) Types of Ownership and the Sizes of Owned Forests

Table 5 shows the area of plain forest and mountain forest by the type of ownership in the Kanto plain in 1980. About 30% of the total 1,432,119 hectare of forest area in the Kanto plain is national forest, while the rest (70%) is
Fig. 7  Distribution of the ratio of the artificial forests in Kanto region (1980)

Source: World Census of Agriculture and Forestry in 1980
Table 5  Plain forest and mountain forest area
\[\text{by the type of ownership in Kanto region (1980)}\]

<table>
<thead>
<tr>
<th>Prefecture</th>
<th>Amount of forest land</th>
<th>National forest</th>
<th>Non-national forest</th>
<th>Forest owned by farmer ((B/B\times100))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit: ha, %</td>
<td>Total</td>
<td>Private forest (A)</td>
<td>Communal forest</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ibaraki</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>117,669</td>
<td>15,468</td>
<td>102,202</td>
<td>99,024</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(13.1)</td>
<td>(86.9)</td>
<td>(84.8)</td>
</tr>
<tr>
<td>Mountain forest</td>
<td>92,052</td>
<td>31,378</td>
<td>61,576</td>
<td>58,117</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(33.8)</td>
<td>(66.2)</td>
<td>(62.5)</td>
</tr>
<tr>
<td>Total</td>
<td>210,037</td>
<td>46,844</td>
<td>163,778</td>
<td>158,041</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(22.2)</td>
<td>(77.8)</td>
<td>(75.1)</td>
</tr>
<tr>
<td>Tochigi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>39,774</td>
<td>2,721</td>
<td>37,053</td>
<td>35,345</td>
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<td></td>
<td>(100.0)</td>
<td>(8.8)</td>
<td>(93.2)</td>
<td>(88.9)</td>
</tr>
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<td>Mountain forest</td>
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<td>197,392</td>
<td>174,178</td>
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<td></td>
<td>(100.0)</td>
<td>(37.9)</td>
<td>(62.1)</td>
<td>(54.8)</td>
</tr>
<tr>
<td>Total</td>
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<td>123,119</td>
<td>224,445</td>
<td>209,523</td>
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<td>(100.0)</td>
<td>(34.4)</td>
<td>(65.6)</td>
<td>(68.7)</td>
</tr>
<tr>
<td>Gunma</td>
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<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>5,017</td>
<td>349</td>
<td>4,668</td>
<td>4,284</td>
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<td>(100.0)</td>
<td>(7.0)</td>
<td>(93.0)</td>
<td>(85.4)</td>
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<td>183,361</td>
<td>224,658</td>
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<td>(44.9)</td>
<td>(55.1)</td>
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<tr>
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<td>413,036</td>
<td>183,710</td>
<td>228,326</td>
<td>206,655</td>
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<td></td>
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</tr>
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<td>Saitama</td>
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<td>20,697</td>
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<td>20,357</td>
<td>19,179</td>
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<td>(1.6)</td>
<td>(98.4)</td>
<td>(95.3)</td>
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<td>17,708</td>
<td>90,210</td>
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<td></td>
<td>(100.0)</td>
<td>(16.4)</td>
<td>(83.6)</td>
<td>(71.6)</td>
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<tr>
<td>Total</td>
<td>128,613</td>
<td>18,046</td>
<td>110,567</td>
<td>96,488</td>
</tr>
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<td>(14.0)</td>
<td>(86.0)</td>
<td>(75.4)</td>
</tr>
<tr>
<td>Chiba</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>88,738</td>
<td>527</td>
<td>88,211</td>
<td>85,199</td>
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<td></td>
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<td>(0.6)</td>
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<td>(96.0)</td>
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<td>9,460</td>
<td>71,633</td>
<td>64,205</td>
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<td>(100.0)</td>
<td>(12.1)</td>
<td>(87.9)</td>
<td>(78.8)</td>
</tr>
<tr>
<td>Total</td>
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<td>10,387</td>
<td>159,844</td>
<td>149,404</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(6.1)</td>
<td>(94.9)</td>
<td>(87.8)</td>
</tr>
<tr>
<td>Tokyo</td>
<td></td>
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</tr>
<tr>
<td>Plain forest</td>
<td>13,555</td>
<td>1,357</td>
<td>12,198</td>
<td>11,613</td>
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<td>(100.0)</td>
<td>(10.0)</td>
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<td>(85.7)</td>
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<td>Mountain forest</td>
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<td>20</td>
<td>44,370</td>
<td>33,188</td>
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<td>(0.1)</td>
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<td>(74.8)</td>
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<tr>
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<td>1,377</td>
<td>56,568</td>
<td>44,601</td>
</tr>
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<td></td>
<td>(100.0)</td>
<td>(2.4)</td>
<td>(97.6)</td>
<td>(77.3)</td>
</tr>
<tr>
<td>Kanagawa</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>15,452</td>
<td>286</td>
<td>15,166</td>
<td>14,125</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(1.9)</td>
<td>(98.1)</td>
<td>(91.4)</td>
</tr>
<tr>
<td>Mountain forest</td>
<td>78,667</td>
<td>11,231</td>
<td>67,426</td>
<td>47,208</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(14.3)</td>
<td>(85.7)</td>
<td>(70.0)</td>
</tr>
<tr>
<td>Total</td>
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<td>13,557</td>
<td>82,565</td>
<td>61,333</td>
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<td>(65.2)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>300,000</td>
<td>21,048</td>
<td>270,955</td>
<td>207,299</td>
</tr>
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<td>(7.0)</td>
<td>(93.0)</td>
<td>(89.8)</td>
</tr>
<tr>
<td>Mountain forest</td>
<td>1,311,217</td>
<td>370,862</td>
<td>940,355</td>
<td>653,236</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(28.1)</td>
<td>(66.9)</td>
<td>(57.7)</td>
</tr>
<tr>
<td>Total</td>
<td>1,611,217</td>
<td>391,908</td>
<td>1,301,315</td>
<td>896,172</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(27.6)</td>
<td>(72.4)</td>
<td>(64.5)</td>
</tr>
</tbody>
</table>

Source: World Census of Agriculture and Forestry in 1980
CHAPTER II

non-national forest¹⁵, among which 90% is private forest. On the contrary, 7.0% of 300,902 hectare plain forest is national forest, while all the rest is non-national and 96.6% of it is private forest. In all the plain forest districts in the Kanto plain, the ratio of the forest area held by farmers in the area of the private forests is 57.0% on the average. In Chiba it is 47.1%, but in Gunma, Tochigi, and Saitama it is more than 60%.

The average size of the plain forests owned by an individual farmer is 1.2 hectare in all the places in the Kanto plain (Table 6). Since the average area of the mountain forests by an individual farmer in Kanto is 2.8 hectare, the size of the plain forests is less than one half of the area of the owned forests. Examining the area of the plain forests by each farmer in the capital and the 6 prefectures, Tokyo is the largest (1.8 hectare), while Saitama is the smallest (0.9 hectare). In Ibaraki, Tochigi, Saitama, Tokyo, and Gunma, the difference between the size of the owned area of the plain forests and that of the mountain forests is obvious. In Chiba and Kanagawa, on the other hand, the difference between them is small.

As for the size of the owned land by individual farmers, almost 70% of farmers in Kanto possess less than 1 hectare, which means that they are the poor landed peasants. Especially in Saitama, Gunma, and Kanagawa in the western
<table>
<thead>
<tr>
<th>Prefecture</th>
<th>Number of farm households by the size of owned forest land</th>
<th>Forest land area owned by farm households</th>
<th>Forest land area per a farm household</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.1~1ha</td>
<td>1~5ha</td>
<td>5~10ha</td>
</tr>
<tr>
<td>Ibaraki</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>36,144</td>
<td>12,989</td>
<td>1,472</td>
</tr>
<tr>
<td>Mountain forest</td>
<td>2,987</td>
<td>3,012</td>
<td>387</td>
</tr>
<tr>
<td>Total</td>
<td>39,131</td>
<td>15,991</td>
<td>2,859</td>
</tr>
<tr>
<td>Tochigi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>8,323</td>
<td>4,878</td>
<td>708</td>
</tr>
<tr>
<td>Mountain forest</td>
<td>8,534</td>
<td>8,588</td>
<td>1,906</td>
</tr>
<tr>
<td>Total</td>
<td>16,857</td>
<td>13,466</td>
<td>2,614</td>
</tr>
<tr>
<td>Gunma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>2,283</td>
<td>594</td>
<td>66</td>
</tr>
<tr>
<td>Mountain forest</td>
<td>12,258</td>
<td>8,741</td>
<td>1,704</td>
</tr>
<tr>
<td>Total</td>
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<td>9,335</td>
<td>1,770</td>
</tr>
<tr>
<td>Saitama</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
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<td>718</td>
</tr>
<tr>
<td>Total</td>
<td>14,413</td>
<td>6,212</td>
<td>1,303</td>
</tr>
<tr>
<td>Chiba</td>
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<td></td>
<td></td>
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<tr>
<td>Plain forest</td>
<td>28,745</td>
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<td>908</td>
</tr>
<tr>
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<td>4,690</td>
<td>572</td>
</tr>
<tr>
<td>Total</td>
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<td>15,298</td>
<td>1,480</td>
</tr>
<tr>
<td>Tokyo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>2,867</td>
<td>983</td>
<td>111</td>
</tr>
<tr>
<td>Mountain forest</td>
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<td>849</td>
<td>203</td>
</tr>
<tr>
<td>Total</td>
<td>3,945</td>
<td>1,832</td>
<td>314</td>
</tr>
<tr>
<td>Kanagawa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain forest</td>
<td>5,550</td>
<td>1,722</td>
<td>124</td>
</tr>
<tr>
<td>Mountain forest</td>
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<td>2,198</td>
<td>382</td>
</tr>
<tr>
<td>Total</td>
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<td>506</td>
</tr>
<tr>
<td>Total</td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>34,470</td>
<td>3,575</td>
</tr>
<tr>
<td>Mountain forest</td>
<td>42,224</td>
<td>31,410</td>
<td>6,286</td>
</tr>
<tr>
<td>Total</td>
<td>128,723</td>
<td>65,880</td>
<td>9,861</td>
</tr>
</tbody>
</table>

Source: World Census of Agriculture and Forestry in 1980
Kanto, the farmers with less than 1 hectare occupy about 75% of all farmers with forest. In this way, the characteristics of the plain forests in the Kanto plain is that most of them are small size of forests owned by most individual farmers.

(5) Distribution of Plain Forests and their Relationship with Agricultural Regions

In the rural communities on uplands and hilly lands in Kanto, the different ways of farming have been practiced with the background of various regional and circumstantial conditions, ever since the period of the rapid economic development. This change caused the uses of the plain forests as farm forests to vary according to the regional differences. Making use of the Digital National Land Information and 1km² mesh data in the Agricultural Census, the author assumed in what agricultural regions the plain forests remained nowadays. First, the meshes with the average altitude of lower than 300m and average gradient less than 15° were sorted out as the meshes of the plain forest districts. These 12,553 meshes were 77.6% of all the meshes in the whole Kanto plain. Next, the area of the plain forests owned by the farmers, the area ratio of the ordinary upland fields to total operation areas, and the agricultural land productivity were calculated by using 1km².
mesh data in 1980 Agricultural Census; and their inter-
relationship was analyzed. Because there are no determinate
data such as the agricultural gross income and the
agricultural sales, the author estimated agricultural
productivity according to the method by Yamamoto et al.
(1983).17

As for the area of the plain forests owned by the
farmers, more than 7 hectare per 1 mesh area was defined as
"large area," while the area less than that was termed
"small area." As to the area ratio of ordinary upland
fields to total operation area, the standard of 48.2% per 1
mesh area was chosen to distinguish high and low class. As
to the agricultural land productivity, 1,557,000 yen or
more per mesh area is defined as high productivity, while
less than that is defined as low productivity.18 The
"large area" meshes of the farmers' plain forests were
6,047, which are 48.1% of all the meshes of the plain forest
districts. Fig. 8 shows the distribution of "small area"
meshes and "large area" meshes of the plain forests owned by
the farmers. Generally speaking, the districts with small
meshes, as shown in Fig. 1, are in the alluvial lowlands in
the valleys of the rivers, in the coastal plains, and in the
urbanized districts. The large mesh districts are in the
uplands and hilly lands in the urban fringe of Tokyo, and in
the piedmonts and the agricultural areas in the uplands and
hilly lands in the eastern part of the Kanto plain.

The large mesh districts are classified into four types, when considered with other two indices. The first type is the mesh which is large in both of area ratio of ordinary upland fields, and the agricultural land productivity (4.3% of all the meshes in the plain forest region). They are the plain forests in the upland farming regions with the high productivity. The second type is high in the area ratio, but with low mesh in the productivity (10.1%). They are located in the upland farming regions with low productivity. The third type is low in the area ratio, and high in the productivity mesh (5.1%). The fourth type is low in both the area ratio and the productivity (28.6%). In the third and the fourth, therefore, the plain forests are situated in the districts with low area ratio.

The following is the discussion on the distribution of the four types in each district. Only the first and second types are distributed within 40km from the Tokyo civic center, where the influence of urbanization is most evident (Fig. 8). That is to say, the plain forests remain in the upland farming regions with high productivity as well as those with low productivity. The high productivity districts are in the agricultural regions of the urban fringe of Tokyo, mostly in the northern part of the Musashino upland, where vegetable growing is intensively.
Fig. 8  Agricultural land productivities and the ratio of ordinary upland field in the plain forest regions (1980)

Source: altitude mesh data from Digital national land information and the agricultural Census mesh data in 1980
CHAPTER II

In the outskirts of the Kanto plain, the third and the fourth types are seen in a wide range, while the first and the second types are distributed in limited regions (Fig. 8). The districts with low area ratio in the third and fourth types are mostly in the piedmonts in Nasunohara, and in the uplands such as the Hitachi upland in the eastern Kanto plain. These districts were the upland farming regions where the industrial crops, such as leaf tobacco, hemp, konnyaku (arum root; amorphophallus), bottle gourd, peanuts, and sweet potatoes for starch were grown remarkably, along with home consuming crops, by the 1960s (Birukawa, 1981). After the period of the rapid economic development, however, the ways of farming changed greatly, for rikuden, orchards, and meadows and pastures were brought under cultivation. In these districts the area ratio decreased, and the plain forests as farm forests lost their importance. As examined in chapter II-1, the tendency is reflected in the conversion of the plain forests into the lands for agricultural use and for urban use. The first type is seen in Sowa and Yachiyō in the western part of Ibaraki prefecture, in Yachimata, Tomisato and Choshi peninsula in Chiba, in Kashima in Ibaraki, and at the tip of Miura peninsula in Kanagawa prefecture, which are all located within 60 to 80km from Tokyo civic center. In these districts the vegetable gardening in the upland farms is
intensively done (Yamamoto, 1980). Many of the second type are distributed in the uplands in the eastern part of the Kanto plain, where the traditional types of farming such as leaf tobacco production have still been practiced.

II-4 Selection of the Study Area

Plain forests exist in various agricultural regions in the urban fringe of Tokyo and the outskirts of the Kanto plain, and their present conditions and the way of use are also manifold. It is necessary to make clear the way of use and the conditions for remaining plain forests in relation to the whole structure of the respective agricultural regions.

The northern part of the Musashino upland is chosen for study as a district where the plain forests remain in the urban fringe of the capital. The district is situated within 30 to 40km and designated as the Urbanization Control Areas. It is the suburban agricultural region with high income through agriculture, where the commercial vegetables are grown in the open-culture way by the shugyo-noka. The plain forests of red oaks and konara oaks are still kept remaining, with the residential lands and upland fields, in the landscapes divided into the rectangular lands. These forests have been managed and raised as farm
forests by individual farmers, ever since the establishment of *shinden* settlements in the Edo period. Nevertheless, in many districts, their importance lessened after the period of the rapid economic development, and the area was forced to decrease by being converted into urban land uses. In some districts, however, the plain forests are skill kept for farm forests. It is probable to elucidate the traditional ways of use and their process of change of the plain forests, examining those districts, in connection with the urbanization of Tokyo and changing farming types. Consequently, those districts are suitable for discovering the factors for the remaining of the farm forest uses. They are also useful for identifying problems to keep the forests for the future in the suburban agricultural regions under the strong influence of the urbanization.

As cases in the outskirts of the Kanto plain, the agricultural settlements in the Nasunohara and the Hitachi uplands are chosen. Both were the districts in which home consuming crops and industrial crops were grown, and which were dependent upon the plain forests to manage the upland field farming in the days before World War II. When the period of the rapid economic development came, the planted area of the industrial crops was made less, and many farmers changed the type of farming into the rice cropping in *rikuden*, the animal husbandry and fruit farming. As a
result, the traditional uses of the plain forests as farm forests were rapidly decreased. More and more farmers quit the uses of the plain forests and sold them. At the same time, many of them were converted into the urban land uses in large scales. In these states, however, the new use of the plain forests came to be seen as the forests for producing logs for *shii-take*. Accordingly, it seems that both the Nasunohara and the Hitachi uplands are appropriate districts to elucidate the uses of the present plain forests and the problems to maintain them from now on in the outskirts of the Kanto plain.
CHAPTER III

The Uses of the Plain Forests in the Urban Fringe of Tokyo

III-1 The Uses of the Plain Forests in Kamitome-niku, Miyoshi-machi, Iruma-gun in Saitama prefecture

(1) Overview of the Study Area

1) The Change in the Distribution of the Plain Forests in the Musashino Upland

The change in the distribution of the plain forests in the Musashino upland is analyzed by examining the topographical maps of the 1880s, 1940s and 1970s. Fig. 9-A shows that the plain forests were distributed throughout the uplands including the Sayama hilly land in the 1880s. Few plain forests were seen in the alluvial lowlands on the Tama and the Ara river, where paddy fields predominated in land uses. In the northern and southern parts of the Sayama hilly land, there are a series of belt-shaped plain forests; it is because they were located in the most outer ends of the premises in the rectangular divisions in the shinden settlements. In the districts between the Yanase and the Shirako rivers, there are concentrations of the plain forests. They are mostly the farm forests of the old villages which had been maintained before the shinden settlements were exploited in the Edo period (Yamaga, 1967).
Fig. 9 Distribution of the plain forests on the Musashino upland

A: 1880s, B: 1940s, C: 1970s.
Plain forests are shown by black.
Before the days of the shinden settlement, most of the Musashino upland was burnt fields and communal lands (Kimura and Ito, 1960). The farmers in the surrounding villages gathered firewood, brushwood for manure and feed, cogon grasses for roofage, and edible weeds for food, in the communal lands; but as the shinden settlement in the Kyoho period, in the early 18th century, was developed, those communal lands decreased. In the shinden settlements, every farmer became to keep a certain area of private plain forests for his farm forests (Yajima, 1955).

The distribution map of the 1940s (Fig. 9-B) indicates that the plain forests in the Sayama hilly land and in the northern part of the Musashino upland are not very different from those in the 1880s. The plain forests to the east and south of the Sayama hilly land, however, have been remarkably decreased. Almost all the plain forests distributed in the form of patches in the eastern part, have lost their existence, and the area of the forests existed in belt-shaped and concentration to the south of the Sayama hilly land have been decreased. The decrease of the plain forests can be explained by the fact that, after the Kanto Great Earthquake in 1923, the plain forests were converted into schools, factories, and military sites (Yamaga, 1971).

The distribution map of the 1970s (Fig. 9-C) showed that
CHAPTER III-1

almost all of the plain forests disappeared in the southern part of the Musashino upland. The urbanization advanced from Tokyo to the Kitatama district in the western suburbs, and converted the remaining plain forests into houses and large scale housing estates. Fig. 9-c showed that the plain forests in the Sayama hilly land and in the northern Musashino upland decreased since the 1940s. The degree of the decrease in these districts, however, is lower than in the southern part of the Musashino upland, and there still remain relatively many plain forests. In the Fukuhara district of Kawagoe-shi, the Horigane district of Sayama-shi, the Tomioka district of Tokorozawa-shi, and in the Kamitome district of Miyoshi-machi, there still remain many plain forests. These districts do not have good access to railroad transportation. Thus, they have been left behind the progress of urbanization in the Musashino upland. At present, they are the agricultural districts in the urban fringe of Tokyo, and they have the high ratio of shugyo-noka. They are also designated as "Urbanization Control Areas" by New City Planning Act in 1970.

2) The Plain Forests in Kamitome, Miyoshi-machi, and Their Changes

The district of Kamitome, Miyoshi-machi was opened as shinden settlement by Kawagoe-han (the Feudal Domain of
Kawagoe) in the Edo period, along with Nakatome and Shimotome, in 1694 (the 7th year of Genroku). According to Santome Kaitakushi by the Preservation Society of Historic Remains in Santome (1929), Santome was an uncultivated field with an area of 1,350 hectares before the development, and it was the communal field for 29 neighboring villages. In Kamitome, there ran Rokken-doro (Road of Rokken) of about 10.8 meters wide (6 ken wide), on both sides of which houses were located with rectangular land divisions, with 72 meters width, 675 meters depth and 5 hectares area. Those houses were surrounded with premises forests, with farming fields behind and the plain forests in the outer ends. At the beginning of the development, the area ratio of the farming fields and the plain forests was two to one. It seems that the area of the plain forest as farm forest, which was necessary for one farm household, was looked upon as one half of the farming field. According to Musashikoku-gunson-shi (the Saitama Prefectural library, 1954), the area of plain forests was 232 hectares, and the area of farming fields was about 501 hectares in 1876, in Kamitome-mura. Then, the plain forests were approximately one half of the farming fields. This condition did not change in 1898 when the land use map was published by Inoue (1960). But the distribution map of plain forests in 1980 shows drastic decrease (Fig. 10). Many all of them were converted into urban land uses,
Fig. 10  Distribution of the plain forests and urban facilities in Kamitome, Miyoshi-machi (1980)

1. remained plain forest, 2. upland field converted from the forests, 3. factory-sites converted from the forests, 4. other urban facilities-sites converted from the forests, 5. factory-sites converted from the upland field, 6. other urban-facilities converted from the upland field, The areas from 1 to 4 were plain forests in 1898.
and only two forests in Kamitome-ikku were reclaimed into farming fields. The most dominant urban uses are factories which moved into this districts after "The Act of Inviting Factories into Miyoshi-machi" established in 1959, and the other uses are university sports grounds, warehouses and houses for sale. In Kamitome-sanku, the decrease of the plain forests is very remarkable, especially in the eastern part of it. On the contrary, in Kamitome-niku, one part was used for Kanetsu Express Highway, and considerably large area of the plain forests still remain and they are used as farm forests even now. In 1969 the Act was abrogated, and Kamitome was designated as "Urbanization Control Area" in 1970, so that a new conversion of the forests into urban uses was prohibited after 1973.

(2) The Uses of the Plain Forests in Kamitome-niku in the Days before the Rapid Economic Development

1) The Gathered Materials in the Plain Forests

Ever since shinden settlement was opened at the end of the 17th century, the farmers in Kamitome used to make use of the plain forests positively as farm forests, for they gathered various materials for agricultural reproduction and daily-life. The forest products of Miyoshi-mura in 1912 shown in Table 7 were fallen leaves, timbers and firewoods
Table 7 Forest products in Miyosi-mura (1912)

<table>
<thead>
<tr>
<th>Forest products</th>
<th>Amount of products</th>
<th>Value of products</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fallen leaves</td>
<td>183,400 kan</td>
<td>2,934</td>
<td>48.7</td>
</tr>
<tr>
<td>Timber</td>
<td>220 sime</td>
<td>1,540</td>
<td>25.6</td>
</tr>
<tr>
<td>Firewood</td>
<td>100 tana</td>
<td>600</td>
<td>10.0</td>
</tr>
<tr>
<td>Charcoal</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Others</td>
<td>⋯</td>
<td>950</td>
<td>15.8</td>
</tr>
<tr>
<td>Total</td>
<td>⋯</td>
<td>6,024</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Iruma-gun Office (1912)
in the plain forests. The largest forest product of Miyoshi was fallen leaves, and amounted to about one half of all the products. Timbers were about one fourth, and firewoods one tenth.

The author examined the output of the main forest products in Iruma-gun, making use of *Irumagun cho-son-sei youran* (Iruma-gun Office, Saitama Prefecture, 1912). The output of timbers and charcoal was tremely high in the mountainous districts, and that of firewoods and fallen leaves was voluminously gathered in the diluvial upland districts (Fig. 11). Tsurugashima and Takahagi-mura in the Iruma upland, and such districts as Miyoshi-machi in the Musashino upland, were conspicuously abundant in fallen leaves. In the mountain districts, and in the villages and towns in the alluvial lowland on the Ara river, there were few records of fallen leaves output. Consequently, it can be said that the main products in the forests were timbers and charcoal, and in the plain forest fallen leaves and firewoods. In Kamitome-niku, other than fallen leaves, firewoods and timbers in Table 7, cogon grasses for roofage, mushrooms for food and medicinal herbs were gathered. Mushrooms gathered were Chichi-take, and Kaya-take, and herbs were mostly Japanese green gentian (*Sweria japonica Makino*) Senburi. They were gathered mostly for home-consuming use.
Fig. 11 Distribution of the production of fallen leaves, fagot and firewood (1912)

Source: Iruma-gun Office (1912)
2) The Gathering of Fallen Leaves for the Agricultural Reproduction Material

a The Use of Fallen Leaves as Manure Materials

Most fallen leaves gathered in the plain forests were used as manure (it was called Tsukute in Kamitome), which was the most important for the agricultural reproduction. The products in Kamitome-mura recorded in Musashi-koku-gunson-shi at the beginning of the Meiji period were cocoon, barley, wheat, soybeans, mulberry, Chinese indigo, sweet potatoes and tea. Examining the products in Miyoshi-mura, in 1912 (Table 8), the author found that Chinese indigo was gone, and taros, pumpkins and corn were on the increase, but the main products were barley, wheat and sweet potatoes. Sweet potatoes in Miyoshi-mura and other Iruma districts were introduced as hardy plants at the time of the shinden settlement, then cultivated as common crops, and, after the Meiji period, became the main products as well as barley and wheat. Toward the end of the Taisho period, many kinds of crops such as edible burdocks, carrots and Japanese radishes were added to them. The cropping system, however, was mainly on upland rice and sweet potatoes in summer, and barley and wheat in winter.

The soil in the Musashino upland is pale-colored Kuroboku soil whose parent material is the Kanto loam. It
### Table 8  Farm products in Miyosi-mura (1912)

<table>
<thead>
<tr>
<th>Farm products</th>
<th>Amount of products</th>
<th>Value of products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>855 koku</td>
<td>14,683 yen</td>
</tr>
<tr>
<td>Wheat and Berley</td>
<td>9,060 koku</td>
<td>71,106 yen</td>
</tr>
<tr>
<td>Miscellaneous grain crop</td>
<td>828 koku</td>
<td>6,504 yen</td>
</tr>
<tr>
<td>Pulse crops</td>
<td>1,250 koku</td>
<td>13,337 yen</td>
</tr>
<tr>
<td>Sweet potatos</td>
<td>680,000 kan</td>
<td>47,600 yen</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>202,000 kan</td>
<td>14,140 yen</td>
</tr>
<tr>
<td>Corn</td>
<td>10,000 kan</td>
<td>10,000 yen</td>
</tr>
<tr>
<td>Taro</td>
<td>1,280 kan</td>
<td>3,780 yen</td>
</tr>
<tr>
<td>Tea</td>
<td>10,500 kan</td>
<td>24,490 yen</td>
</tr>
<tr>
<td>Cocoon</td>
<td>7,670 kan</td>
<td>24,365 yen</td>
</tr>
<tr>
<td>Fruit and Nut</td>
<td>...</td>
<td>3,400 yen</td>
</tr>
<tr>
<td>Others</td>
<td>...</td>
<td>5,506 yen</td>
</tr>
<tr>
<td>Total</td>
<td>...</td>
<td>238,911 yen</td>
</tr>
</tbody>
</table>

Source: Iruma-gun Office (1912)
lacks in high productivity, for it contains active aluminum, with less phosphorus, and is acid soil of about pH 6.0-6.5 (Yamaguchi, 1967). Since the shinden settlements was opened, upland farming in Musashino rural communities, was centered around barley, wheat, upland rice and sweet potatoes. Accordingly, in contrast to the paddy fields, which could be provided with minerals from irrigation water, upland fields must be given a lot of organic fertilizers. It was indispensable to keep the fields fertile enough to yield crops by giving manure of fallen leaves from the plain forests. Most of all, the manure is highly effective to sweet potatoes, compared with other crops (Sakai, 1975), and their fertilizers were mostly manure, especially when the chemical fertilizers were not spread. As the manure contains a moderate proportion of fertile ingredients, it is easily absorbed by sweet potatoes and was effective in properly balancing for thickening of tubercles and grow-stems and leaves. Furthermore, it possesses some physical advantages in keeping the air permeability of the soil, increasing the water retentivity, improving the conditions of aridity and surplus water, and growing root systems well. It also effectively quickens the disintegration of fertilizers, the growth of tubercles, and results in the rich harvest.

In Kamitome-niku, 1,350 to 2,250kg manure was said to
be necessary for cropping of sweet potatoes in 1 hectare. Since it was possible to gather 450kg fallen leaves per 10 are plain forest, 30 to 50 are of plain forest was necessary for the crop. The gathering of the fallen leaves, which was called kuzuhaki, was the important farming work. The fallen leaves were piled up in the manure yards (tsukuteppa), and made to be fermented with pouring the bath water and waste water. On the way, the piles were pulled down and mixed together about two times so as to be ripened fully. The ripened manure was mixed with such commercial fertilizers as rice bran, wood ashes, soybean cakes and chemical fertilizers, according to the nature of the crop, and then scattered on the fields.

A part of the fallen leaves were used as the litter (shiki-wara) in cattle sheds. According to Iruma-gun choson-sei youran, 11 horses and 132 pigs were kept in Miyoshimachi in 1912. Usually the litter was wheat straw and upland rice straw, but in winter and spring the fallen leaves were used instead of them. The laid fallen leaves were raked out after a while, and made to be barnyard manure.

b The Use of Fallen Leaves as Heating Materials in the Nursery Bed of Sweet Potatoes

In the rural communities of the Musashino upland, the
fermentation hot beds were widely used as nursery beds of sweet potatoes. According to Sakai (1975), this method of seedling is comparatively active, and seedlings grow better, so that they can get quite a number of seedlings. Moreover, seedlings can be planted earlier than usual, and less area of bed is required. However, much toil is required in making the bed; much heating material, which must be trodden down, is needed; and a considerably high level of technique is called for in making up the bed. In the Musashino upland rural communities, fallen leaves were, for the most part, used as heating material in the bed. The wheat and barley straw are not suitable for sweet potato beds, for they are warmed up quickly and the duration of the heat is short.

In the lowest part of the bed, which is called shitta, the fallen leaves gathered as heating material are trodden down, and night soil and rice bran are poured into them; last of all, sieved fine manure, megoe, made in the year before, are put thinly on the surface. Around March 25, the seed tubers are put into the bed and covered with megoe, where chaff and wheat straw cut into small pieces are scattered in a thin lay so as to keep the tubers warm and humid. At the beginning of May, the use of the nursery bed is over, and the fallen leaves as heating material is brought out to the manure shed, and they are used as manure for wheat and barley in winter cropping.
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Usually about 33m² bed is necessary for 1 hectare field of sweet potatoes. Since fallen leaves for heating material is about 1,000kg, 20 are plain forest for the bed and 30 to 50 are for the farmyard manure are required. Consequently, a little more than 50 are plain forest must be kept, so that a farmer can maintain 1 hectare crop of sweet potatoes. The farmers with no sufficient plain forests, therefore, had to gather fallen leaves in other farmers' forests.

3) The Use of the Forest Products as the Farmers' Living Materials

Most fallen leaves were used as the main material for manure and nursery beds, while the leaves of Japanese red pine and others were used as the fuel in kamado (Kitchen range) and irori (a hearth made in the floor). The shrubs and herbs in the plain forests, which were cut down to make the gathering of fallen leaves easier, and the trees in the thick forests cut down for the thinning were also used as fuels. Yet fallen trees and fagot were mainly used as fuel.

When a farmer had no plain forest, he had to gather fuel wood and fagot in another farmer's forest for his family use. Naturally enough, the plain forest had a great significance in the economy of the farmer's daily life. The farmer with no plain forest gathered dead twigs for his
fuel, with a sickle with long bamboo stick, in other farmer's plain forests. Dead twigs in the other farmer's forests were allowed to be gathered by a tacit consent. It was convenient for the owners of the plain forests to prune twigs so as to maintain their forests in good condition.

The farmers, who had much more plain forests than they needed for fallen leaves, sold wood to the fuel merchants for their cash income. Red oaks and konara oaks were sold dearest of all the trees. Many farmers planted young stands (seedlings) of red oaks and konara oaks and brought up their own Kunugi-yama and Nara-yama in the plain forests.

They planted Japanese Zelkovas (Zelkova serrata Makino) as architectural materials in their forests, and brought up 10 to 15 Japanese red pine (called Tatematsu) in every 10 are area in their forests. Before World War II, a farmer, who possessed 12 hectare plain forests in Kamitome-niku, planted the seedlings of Japanese cedar, with an intention of growing a economic forest, but failed in the enterprise, for many of them were blighted. In the Musashino upland, as in the Forestry of Yotsuya (Tokyo) grown in the Edo Era, there were some case of large-scale management of economic forests, but in Kamitome-niku the main use of the forests was limited to that of farm forests.

In the Musashino upland, the roofage material was mostly cogon grasses, because of their durable length of time than
any other one. They were the most suitable for the roofs. The wheat straw endured for 5 to 6 years, and the rice straw for 2 to 3 years, whereas the cogon grass roof endured for as many as 30 years on the south side and 20 years on the north. In Kamitome-niku, the farmers cut down cogon grasses which grow in the cleared land in the plain forests, and which grow sporadically on the floor of Japanese red pine forests. They were annually cut and stored for the roofage. As it was difficult for the farmers with no plain forests to get cogon grasses, they could not help using wheat straw or others for roofage.

4) The Time of a Year When the Plain Forests Are Used

The plain forests were not used throughout the year, but mainly used in winter-time. The author examined the time of use of the plain forests in Kamitome-niku, by the years of the 1950s, contrasting the seasonal distribution of farmers' operation with the cycle of the seasons which were divided into periods of ten days (Fig. 12). With only one exception of the time of picking up mushrooms, the use of the plain forests was limited to the winter-time, that is, from December to February. This is the time of the farmers' leisure season when they scarcely needed to care for wheat, barley and sweet potatoes. *Yamashigoto* (work in the plain
Fig. 12 Climate and seasonal distribution of farmer's labor in Kamitome-niku, Miyoshi-machi (1950s)

1. raising of seedling, 2. planting, 3. seedling, 4: harvesting
The temperature is shown as a line and the precipitation is shown as a bar. Both data were normal value in Kumagaya-shi in 1941-70.

Source: The data of farm working are from the author's interviews.
: Meteorological data are from the Meteorological Agency (1973):
Nihon kiko-hyo (Climatic table of Japan)
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forests) began with *kayakari* (cutting down cogon grasses) at the beginning of December. Cogon grasses were cut down in early morning when they were wet with dew and frost, and then tied up in bundles.

After this work, *kuzuhaki*, gathering fallen leaves, was set about. First, the farmers picked up dead twigs and sprigs, weeding herbage, brushing shrubs (called *bayakari*), and thinning thickly-grown trees, so that they might gather fallen leaves easily. After these works finished, they raked fallen leaves into big bamboo baskets called *hachihon-basami* with *kumade* (rakes). Each *hachihon-basami* could contain 50 to 60kg fallen leaves. Although the quantity of fallen leaves, gathered in this way, was a little different in each forest by the forest type and the age of trees, it was possible to fill 9 to 10 "*hachihon-basami*", which was about 450kg in every 10 are area. It can be said that this was the dry season and the farmers had a great advantage in doing their works.

As the work was difficult to do when it snowed and made the fallen leaves wet, the farmers must finish *kuzuhaki* before February which was the snow-fall season. After *kuzuhaki* they cut down trees for fuel wood. The time suitable for cutting trees was from November to the end of February which was the dormant period of the trees. In felling trees for fuel and selling them to the fuel
merchants as they stood, people did it from the middle of January to the end of February, after fallen leaves gathering. When they felled trees in March, trees lessened their sprouting. According to the author's interviews, generally they felled trees in the cycle of 15 to 25 years, though the conditions of the forest lands, the configurations of the ground, soils and sunshine might change the cycle more or less.

(3) The Agricultural Management and Fallen Leaves Gathering after the Period of Rapid Economic Development

1) The Extinction of Gathering Materials for Living

Traditionally, the plain forests as farm forests were closely connected with the agricultural production and the farmers' economy, but they were made to change greatly after World War II. Especially, after around 1960, with the rapid growth of economy, the ways of living changed and gathering the forest materials for living mostly came to an end. From World War II to the latter half of the 1950s, the production of fuel wood was, temporarily, prosperous in Kamitome-niku, for there was nation-wide shortage of fuel wood and the price went higher.

In the middle of the 1960s, however, kerosene and propane gas spread even to the farm households in Kamitome-
niku, and the necessity of fuel wood for home use was decreased rapidly. The value of wood produced in the plain forests went down. Thus gathering of charcoal materials, for the purpose of urging sprout regeneration, was virtually given up.

On the other hand, among the farmers in Kamitome-niku, a boom of building new houses came because they received cash income by selling the land for the Tokyo Electric Power Co., Inc., which built iron towers of high-voltage transmission in 1960, and for Kanetsu Express Highway in 1969. The roofs of the farmers' houses were changed into tin-roofs and tiled roofs, so that the gathering cogon grasses for roofage came to an end. The materials for building houses were bought from the merchants, and the trees such as red oaks were discarded for that use. Mushrooms and medicinal herbs were not picked up any more. Consequently, the gathering materials in the plain forests for living was almost extinct in the second half of the 1960s.

In many districts, they stopped gathering fallen leaves for the material of manure due to the spread of such commercial fertilizers as soybean cakes and chemical fertilizers. As a result, in many Musashino uplands, the plain forests lost their function as farm forests. In those places the plain forests disappeared, as shown in Fig. 9,
and they were converted into the sites of urban land uses. Nevertheless, in such districts as Kamitome-niku, where the plain forests still remain, the way of use as gathering fallen leaves\(^1\) has been going on, though the gathering of the materials for living discontinued. In a word, the farmer's ways of living were earlier in giving up the dependence on the plain forests than the agricultural production.

2) The Factors that Enable the Fallen Leaves Gathering to Continue

a  The Intensive Vegetable Cultivation after the Period of the Rapid Economic Development

Miyoshi-machi is situated within 30km distance from the center of Tokyo, and has high income of agricultural production. In 1978, a farmers' income was 2,710,000 yen, which was 2.6 times as much as the average income of all the farmers in Saitama prefecture and ranked highest in the prefecture (Statistics and Information Office, Saitama Branch, Kanto Agricultural Administration Bureau, 1980). In 1980 there were 454 farm households in Miyoshi-machi, of which the percentage of shugyo-noka was 77.7% (Table 9) and it was far more than the average of Saitama prefecture, 37.2%. Average area of the agricultural fields of a farm household was about 126 are, and 1.6 times as large as the
### Table 9 Summary of farm household and farm size in Kamitome-niku, Miyoshi-machi (1980)

<table>
<thead>
<tr>
<th>Area</th>
<th>Number of farm household</th>
<th>Percentage of shugho-noka (%)</th>
<th>Operation area per farm household (a)</th>
<th>Percentage of number of farm household by farm operation area (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>less than 1ha</td>
</tr>
<tr>
<td>Miyosi-machi</td>
<td>454</td>
<td>77.7</td>
<td>125.8</td>
<td>40.5</td>
</tr>
<tr>
<td>Kamitome-niku</td>
<td>57</td>
<td>77.2</td>
<td>141.5</td>
<td>40.3</td>
</tr>
</tbody>
</table>

Source: World Census of Agriculture and Forestry in 1980
average 80 are in Saitama prefecture. As for the area cultivated, the farm households, whose cultivated area is less than 1 hectare, are 40.5%, and those with more than 1 hectare account for more than the half of all the farm households. Though the percentage of shugyo-noka in Kamitome-niku is almost equal to that of the town, the average of cultivated area of farm households in Kamitome-niku is higher than the average of the town. The farm households with more than 2 hectare account for 31.6%, and higher than the average percentage of Miyoshi-machi by 10%. Consequently, we can say that Kamitome-niku is the largest scale of cultivation in Miyoshi-machi. As for the crops in Miyoshi-machi, wheat, barley and sweet potatoes have been declined since 1960, and the commercial vegetables such as root vegetables, carrots and Japanese radishes, have come to be grown (Fig. 13). Fig. 14 of land use map shows in detail, the agricultural land use in Kamitome-niku. The upland fields are mostly cultivated for growing vegetables. Furthermore, there are a few fields of the Korean lawn grasses, and tree-growing sites of chestnuts, Japanese apricots, floral trees and tea plants.

In the open-field culture, sweet potatoes are planted in the largest part of the area. Following them, carrots and Japanese radishes are raised. The percentage of each harvested crop (Table 10) also shows that sweet potatoes and
Fig. 13 Changes of the planted area of the main crops in Miyoshi-machi (1960-70)

Source: Office of Miyoshi-machi
Fig. 14 Land use in Kamitome-niku, Miyoshi-machi (1980)


Source: the author's field survey on Sep., 17th-25th, 1980
### Table 10  Percentage of the harvested area by crops in Miyoshi-machi (1980)

<table>
<thead>
<tr>
<th>Area</th>
<th>Vegetables</th>
<th>Tubers</th>
<th>Industrial crops</th>
<th>Flower and ornamental plants and lawn grasses</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kamitome-ikkü</td>
<td>77.6</td>
<td>10.1</td>
<td>10.1</td>
<td>1.0</td>
<td>1.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Kamitome-niku</td>
<td>54.3</td>
<td>41.8</td>
<td>1.5</td>
<td>2.4</td>
<td>-</td>
<td>100.0</td>
</tr>
<tr>
<td>Kamitome-sanku</td>
<td>79.5</td>
<td>12.3</td>
<td>2.9</td>
<td>4.6</td>
<td>1.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Kitanagai</td>
<td>86.1</td>
<td>9.2</td>
<td>1.5</td>
<td>2.0</td>
<td>1.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Fujikubo</td>
<td>92.5</td>
<td>4.8</td>
<td>-</td>
<td>3.9</td>
<td>2.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Chikumazawa</td>
<td>91.9</td>
<td>4.9</td>
<td>-</td>
<td>0.5</td>
<td>2.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Miyosi-machi</td>
<td>81.2</td>
<td>13.0</td>
<td>2.6</td>
<td>1.8</td>
<td>1.4</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Source:** World Census of Agriculture and Forestry in 1980
taros, and vegetables are widely grown. By the way, during World War II and the post-war days, the sweet potatoes were widely raised in Miyoshi-machi for food and the raw material of alcohol temporarily, but as the supply of food gradually came to be stabilized the cultivation of sweet potatoes dwindled away to a smaller scale. As shown in Table 10, sweet potatoes and taros account for 13.0% of harvested crops in the whole area of Miyoshi-machi. On the contrary, only in Kamitome-niku sweet potatoes and taros account for 41.8% of all harvested crops, which is extremely high. This is because sweet potatoes are still the main crop there. The sweet potatoes produced here are called Beniaka (generally called Kintoki)\(^3\) and carried to the Tokyo market, labeled as Kawagoe Imo. Sweet potatoes are scarlet or crimson in color and the texture is less fibrous and tasty, so that it is highly evaluated in the markets of Tokyo. Sweet potatoes for food are stable in price than others in the market; they are sold in the average price of 2,000 yen per 10kg. Since about 1,770kg is harvested in 10 are field, the average earning in 10 are is about 350,000 yen \(^4\).

Sweet potatoes are planted at the beginning or the middle of May and as the runners come to spread on the fields and prevent weeds from sprouting up, there need not be any farm working till the harvest time which is from the
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middle of October to the middle of November. Sweet potatoes, therefore, are the labor saving crops with less cost of cultivation, suitable for the farmers who have large sizes of operational area, and especially so in Kamitome-niku where farmers have comparatively large operational area. It has already been shown in Table 9 that the ratio of the farm households with more than 2 hectare in operation in Kamitome-niku is high. Examining the cases of planted crops of the farm households, farm households such as farmers 1, 2 and 3 in Table 11, which have operational area more than 2 hectare, have the cropping system in which they planted sweet potatoes in the largest area, with the combination of carrots, Japanese radishes and taros in the small area. In contrast with them, the farm households 4, 5 and 6, who have less than 2 hectare operational areas, planted sweet potatoes in a smaller scale. This fact shows that small-scale farm households cultivate less sweet potatoes which require a long period of growing, and raise Japanese radishes, turnips and spinaches, etc., whose seeding time varies and whose growing period is short. These crops are grown three or four times in a year, and bring a remarkably high income in each planted area.

The farmers growing sweet potatoes have been firmly maintaining their traditional way of growing in which fallen leaves are used for heating material in a nursery bed and
Table 11  Case survey on the typical six farmers: planted crops and its planted areas by the size of operation area in Kamitome-niku, Miyoshi-machi (1980)

<table>
<thead>
<tr>
<th>Farm household</th>
<th>Operation area of upland field</th>
<th>Owned area of plain forest</th>
<th>Area of gathering fallen leaves</th>
<th>Planted crops and its planted areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>370</td>
<td>450</td>
<td>200</td>
<td>Sweet potato 240, Japanese radish(2times) 200, Carrot 50, Taro 15.</td>
</tr>
<tr>
<td>②</td>
<td>280</td>
<td>400</td>
<td>150</td>
<td>Sweet potato 120, Japanese radish(2times) 100, Carrot 35, Taro 30.</td>
</tr>
<tr>
<td>③</td>
<td>235</td>
<td>220</td>
<td>100</td>
<td>Sweet potato 160, Japanese radish(2times) 75, Edible burdock 50, Taro 40, Carrot 35.</td>
</tr>
<tr>
<td>④</td>
<td>170</td>
<td>20</td>
<td>80*</td>
<td>Sweet potato 70, Japanese radish(3times) 70, Carrot 40, Edible burdock 10, Spinach 10.</td>
</tr>
<tr>
<td>⑤</td>
<td>130</td>
<td>-</td>
<td>50*</td>
<td>Japanese radish(3times) 90, Sweet potato 40, Carrot 30, Edible burdock 20, Spinach 10.</td>
</tr>
<tr>
<td>⑥</td>
<td>90</td>
<td>10</td>
<td>30*</td>
<td>Japanese radish(4times) 70, Carrot 40, Sweet potato 25, Turnip(2times) 15.</td>
</tr>
</tbody>
</table>

* rented plain forest  
Source: the author's field survey and interviews in September, 1980
they are scattered in a large quantity on the bed. Sweet potatoes don't decrease, comparatively, the yield by a continuous cropping on the same fields. On the contrary, continuous planting of Japanese radishes, carrots and others easily make the land less productive, and so decrease the quantity of harvest (Tanaka, 1976). Consequently, in order not to make such less productive land, the manure must be scattered every year. This is why the farmers cultivating sweet potatoes are forced to acquire much fallen leaves as reproduction materials, not only for sweet potatoes, but for other crops.

The farm households with less than 2 hectare holdings are not very dependent upon sweet potatoes. Nevertheless, as they grow Japanese radishes, turnips, spinaches and so on three or four times annually, they are obliged to have a continuous-cropping injury when they rely upon the chemical fertilizers alone. Since the dependence upon them doesn't enable the farmers to maintain the reproduction on the fields, it is indispensable to use the manure of fallen leaves as an organic fertilizer. In a word, most of the farm households in Kamitome-niku manage their agriculture, depending, in a large scale, upon the plain forests which supply them with those fallen leaves.
b The Ownership and Use of the Plain Forests

In the late 17th century, when the shinden settlement was opened in Kamitome-niku, 28 farm households were given with about 5 hectare lands almost equally, and they used half of them for the plain forests. After that time, the ownership of the farmlands and the plain forests has been changed because of the decline and removal of the original farm households, and the coming of the branch farm households or the new-comers. As a result, in 1980, among the present 57 farm households, there could be seen a considerable difference in the areas of the plain forests and farmlands.

The author made a survey on the relationship between the cultivated fields and the plain forests owned, and the rent of the plain forests, selecting 48 farm households (84.2%) in Kamitome-niku. The result is shown in Fig. 15. It shows that the larger area of the plain forests the farmers own, the larger arable lands they have. Especially, those farmers who own more than 2 hectare farmlands and more than 1 hectare plain forests are the descendants of settlers who had lived here in the beginning of the settlement and who became the branches or came to live here before the Meiji Restoration. The farm households that became the branches or came to live after the Meiji Restoration, own less than 1
Fig. 15  Relation between owned area of the plain forest and operation area of the upland field by the established time of the farm households (1980)

x axis: operation area of the upland field,
y axis: owned area of the plain forest,
1. farm household lending the forest,
2. farm household borrowing the forest,
A. farm household established when the Shinden settlement was opened, B. farm household established before the Meiji Restoration, no mark. farm household established after the Meiji Restoration.

Source: the author's interviews and field survey.
hectare fields and virtually few plain forests. The farm households without plain forests are the branches or newcomers after the Meiji Restoration. During the Edo period, many of the farm households used to give their branch farm households farming lands together with plain forests. After the Meiji Restoration the number of the branch farm households increased, and farm households were unlikely to give the plain forests as auxiliary to the farmlands. Furthermore, after World War II, owing to the farmlands ownership reformation, owner farmers came to exist, but in this district the reformation was not extended into the plain forests, and the farm households with no plain forests increased in number.

The reason why the reclamation of the plain forests did not progress was that the farmers with large areas of farmlands owned many plain forests. After World War II, they could not employ laborers, and had to depend solely upon the labor of their family members. In addition, there existed the protection of the farming right for tenants such as the restriction of holding farmlands to rent by the Agrarian Act, and the regulation of tenant rents. Thus it was difficult to enlarge the scale of farming management, and the conversion of the plain forests into farmlands did not progress. After the period of the rapid economic development, however, the gathering of such materials for
living as fuel woods came to an end, and some farmers owning vast plain forests, which were wider than they needed for gathering their necessary fallen leaves, sold parts of them so as to get a large sum of money for some temporary uses. Some farmers sold out almost all of their plain forests and farmlands, in order that they might secure enough money to start their new enterprises.

Many farm households in Kamitome-niku, as mentioned above, have been cropping, depending upon the fallen leaves the plain forests supply. The farm households, who have no plain forests or quite small ones, have been forced to gather fallen leaves in the forests which they borrowed from the large-scale farm households (Table 11).

Fig. 15 shows that most farm households whose areas of the plain forests are about one third of the farming lands have no rented forest from other farm households. Out of the farm households whose plain forest areas are more than one third of the farming lands, twelve of them (35.4% of the farm households the author surveyed) lend their plain forests. Six farm households without plain forests of their own and without borrowed plain forests are engaged in non-agricultural jobs as well as farming. Many farm households who lend parts of their plain forests own more than 2 hectare farmlands and cultivate sweet potatoes. Naturally enough, they need a great quantity of fallen leaves for the
heating material of the seedling beds and the material for the manure, but they have enough areas of the plain forests to lend to other farm households.

Most farm households borrowing the plain forests are those who own less than 2 hectare farmlands. They are less dependent upon sweet potatoes and grow mostly root-crops, spinaches and others. Accordingly, they borrow the plain forests to get fallen leaves for the manure. It may be considered that the plain forest area necessary for the reproduction of agriculture in Kamitome-niku is approximately about one third of the farming areas.

Among 17 farm households which have borrowed the plain forests, two of them have borrowed about 30 are from the temple forests of Tafukuji (in Kamitome-ikku); ten from the head families or relatives; and five from the neighboring acquaintances. The land rent of Tafukuji's temple forests is as much as 1,000 yen per 10 are for a year, but instead of paying money, they have to care for the plain forests and work for the temple two or three days in the busy farming seasons. The land price of the plain forests is not different from that of the farmlands, or, in many cases, comparatively higher on account of the regulation of the Agrarian Act. The reason why the use of the plain forests is still maintained in these ways can be attributed to the fact that the farmers, in their own proper scale of
management, have been continuing to use the plain forests, according to their own scale of farming and their accounts, under the conditions such as the designation of the Urbanization Control Areas. These are looked upon as the main factors of the maintenance of agriculture to make use of the plain forests in Kamitome-niku, even in the days when the agricultural productivity has risen to a high level.
III-2 The Change in the Use of the Plain Forest in Fukuhara and Naguwashi, Kawagoe-shi, in Saitama Prefecture

(1) Overview of the Study Area

In this section, researches are made to identify changes in the traditional uses of the plain forests and the factors of the disappearance of plain forests in the Urbanization Control Areas, taking up, as cases of study, the Fukuhara district in the south-eastern part of Kawagoe-shi and the Naguwashi district in the north-western part of the same city, Saitama prefecture, within 40km from the center of Tokyo.

Fukuhara is in the area of old Fukuhara-mura which was organized, in 1889, by combining 6 villages, Imafuku-mura in the Musashino upland in the south-eastern part of Kawagoe-shi, Kamimatsubara-mura, and their neighboring villages. These villages were shinden settlement like Kamitome-mura. This area was settled in the period of Keian (1648-1651), earlier than that of Kamitome-mura, and it came into existence by clearing the upland without irrigation water, which had been the common land of surrounding older villages. In 1985, 95.9% of its farmlands is ordinary upland fields.

In the Naguwashi district, the Koaze river, a tributary of the Iruma river, flows from the south-western part to the
north-eastern part, and areas to the north-west and to the south of it are called the Iruma upland, and the eastern part is the alluvial lowland located between the Koaze and the Iruma rivers. In the fringe areas of the upland, there are old agglomerated villages with alluvial paddy fields in the front of them and the upland fields and the plain forests in the back ground of them. In the Iruma upland, just like Fukuhara, shinden settlements were established at the beginning of the Edo period, and farmers' housing sites, farmlands and plain forests in the rectangular land-division were to be observed. These villages were organized into Naguwashi-mura in 1889, and later it was combined with Kawagoe-shi to become a section of Kawagoe-shi. In 1985, there was 360 hectare farmlands in which paddy fields were 51.6%, ordinary upland fields 32.3% and tree growing sites, which were mostly mulberry fields, 15.6%.

Both districts are about the same in area and about 80% of them are designated as Urbanization Control Areas. But as there are differences in their land-uses and types of farming, there can be seen differences in the dependences upon the plain forests and the conditions of their preservation. In 1985, in the Fukuhara district, there were 212 hectare plain forests, 53.3% of all the plain-forest area in Kawagoe-shi, and in Naguwashi 41 hectare, which was 10.4% of the area. In this section, the author is going to
clarify the traditional ways of land-use in these districts, and the condition of the remaining plain forests and some problems in keeping on the use of them, comparing the land-uses and the types of farming before 1960 with those after 1960.

(2) The Differences in the Traditional Land-Uses and Dependences upon the Plain Forests between These Districts

Farmlands in both the Musashino and Iruma uplands are covered with pale-colored *kuroboku* soil whose parent material is the Kanto loam of volcanic ash soil. It is acid light soil, full of active aluminum, and low productive soil with less phosphoric acid and humus. Furthermore, since the farmlands in *shinden* settlements were all upland fields, it was necessary to use much organic fertilizers in order to maintain the fertility of the lands. Consequently, the farmers kept their plain forests consisting of red oaks, *konara* oaks and Japanese red pines to get fallen leaves for the material of the manure.

This kind of land use was widely observed in and around Fukuhara, as shown in the 1:20,000 topographical map of Kamekubo-mura published in 1881 by Military Land Survey Department, the General Staff Office in the Army. Compared
with the topographical map with a scale of 1:50,000 published in 1959 by Geographical Survey Institute shows less differences in terms of land use. Accordingly, this kind of traditional land-uses had long continued till the 1950s.

The traditional land-uses in Fukuhara and Naguwashimura, recorded in Iruma-gun cho-son-sei yoran (Iruma-gun Office, 1912) is shown in Table 12. In Fukuhara-mura, there were no paddy fields, and the ratio of the upland fields to the plain forests was 5:4. Table 13 shows that the farm products in Fukuhara were mainly upland-field rice, wheat and barley, and sweet potatoes, along with pumpkins, taros and green tea. Judging from the yield of cocoons, sericulture does not seem to have been so prosperous. In short, the cropping system in Fukuhara was based on, for the most part, upland-field rice and sweet potatoes in summer, and wheat and barely in winter. Sweet potatoes were grown as hardy plants, at the beginning of shinden development, but gradually came to be a common upland-field crop. In the Tenpo period, in the middle of the 19th century, they were highly demanded as the materials for baked sweet potatoes yakiimo in Edo city, and so a great quantity of sweet potatoes was produced here and brought to Edo with the brand of Kawagoe-imo (Yamada, 1985, p.307). The exemplary good farmer, Nihei Akazawa born in Imafuku, the Fukuhara
Table 12 Land use in Fukuhara-mura and Naguwashi-mura (1912)

<table>
<thead>
<tr>
<th>Type of land</th>
<th>Fukuhara-mura</th>
<th>Naguwashi-mura</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area</td>
<td>%</td>
</tr>
<tr>
<td>Paddy field</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Upland field</td>
<td>6,086</td>
<td>54.4</td>
</tr>
<tr>
<td>Plain forest</td>
<td>4,597</td>
<td>41.0</td>
</tr>
<tr>
<td>Housing site</td>
<td>517</td>
<td>4.6</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>11,201</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Iruma-gun Office (1912)

Note: 1 tan is about 10a.
<table>
<thead>
<tr>
<th>Farm products</th>
<th>Amount of products</th>
<th>Value of products</th>
<th>Amount of products</th>
<th>Value of products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yen</td>
<td>%</td>
<td>Yen</td>
</tr>
<tr>
<td>Rice</td>
<td>1,508 koku</td>
<td>25,602</td>
<td>12.2</td>
<td>3,776 koku</td>
</tr>
<tr>
<td>Wheat and Barely</td>
<td>7,503 koku</td>
<td>59,032</td>
<td>28.0</td>
<td>5,516 koku</td>
</tr>
<tr>
<td>Pulse crops</td>
<td>593 koku</td>
<td>6,820</td>
<td>3.1</td>
<td>1,416 koku</td>
</tr>
<tr>
<td>Miscellaneous grain crops</td>
<td>797 koku</td>
<td>8,401</td>
<td>3.0</td>
<td>360 koku</td>
</tr>
<tr>
<td>Sweet potato</td>
<td>784,400 kan</td>
<td>53,508</td>
<td>25.4</td>
<td>93,000 kan</td>
</tr>
<tr>
<td>Taro</td>
<td>2,991 kan</td>
<td>8,973</td>
<td>4.3</td>
<td>750 kan</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>84,000 kan</td>
<td>2,880</td>
<td>1.4</td>
<td>-</td>
</tr>
<tr>
<td>Fruit and Nut</td>
<td>...</td>
<td>4,348</td>
<td>2.1</td>
<td>...</td>
</tr>
<tr>
<td>Tea</td>
<td>5,585 kan</td>
<td>14,257</td>
<td>6.8</td>
<td>1,040 kan</td>
</tr>
<tr>
<td>Cocoon</td>
<td>4,676 kan</td>
<td>19,975</td>
<td>9.5</td>
<td>10,735 kan</td>
</tr>
<tr>
<td>Mulberry leaf</td>
<td>...</td>
<td>8,858</td>
<td>4.2</td>
<td>...</td>
</tr>
<tr>
<td>Others</td>
<td>...</td>
<td>210,454</td>
<td>100.0</td>
<td>...</td>
</tr>
</tbody>
</table>

Source: Iruma-gun Office (1912)
district, in the Tempo period, studied how to increase the yield of sweet potatoes and then really tried his method to get high yield. In order to diffuse his method of the yield increase, Nihei Akazawa's Experimental cultivation method of the sweet potatoes (Akazawa, 1910) was published and, then, his method was widely spread in and around Fukuharamura. Generally, the species had been Akazuru and Aozuru since the Edo period, but in the Taisho period Beniaka was introduced and Kawagoe-imo got increasingly popular in Tokyo markets.

Since the manuring was quite effective to the main agricultural products such as upland-field rice, wheat and barley, and sweet potatoes, the manure had been greatly used as fertilizer. In growing sweet potatoes, which are called nane-hansaku, it is necessary to grow seedlings in the fermentation hotbed made of voluminous fallen leaves as heating materials.

Every winter, farmers did yamashigoto in the plain forests. After kayakari they were engaged in kuzuhaki, that is, gathering fallen leaves, which was one of the most important works. They fermented the leaves fully and produced farmyard manure. A part of fallen leaves was used as the litter in the cattle sheds.

The farmers in Fukuhara, just like those of Kamitomeniku, not only gathered fallen leaves as the material for
reproduction, but collected various materials for their living until the period of the rapid economic development. According to *Fukuhara son-sei yoran* of 1912, farmers sold 402 *tana* of firewood at 3,819 yen, which tells us that the farmers got cash income by selling to the merchants raw wood for fuel. The plain forests were felled in the cycle of 15 to 25 years, and later brought up again by the sprout regeneration. In this sense, the plain forests in Fukuhara were closely connected with farming and daily lives of farms. In the Imafuku district, *Fukuhara-mura*, the farmers demanded the landlords to liberate their plain forests as well as their farmlands, and succeeded at the time of farmland ownership reformation after World War II in the enterprise (Arai, 1975, pp.375-378).

On the other hand, the traditional land-uses in Naguwash–mura show that upland fields were 34.7%, paddy fields 22.1% and plain forests 37.1% (Table 12). Upland fields account for 60% of the arable land and paddy fields account for 40% of it. The examination of the topographical maps, as in the case of Fukuhara, revealed that the traditional land-uses continued till the 1950s. As shown in Table 12, the main farm product was rice mainly grown in the paddy fields of the old villages, which amounted to 36.6% of the total sales. Sweet potatoes, which were main crops in Fukuhara, account for only 3.6% of the total sales in
Naguwashi. Nevertheless, since the amount of cocoon production went up to 20%, and mulberry leaves were recorded as 100,000 kan, sericulture was more flourishing than in Fukuhara. These lands were recorded merely in the name of upland fields in Naguwashi son-sei yoran (Iruma-gun Office, 1912, p.97) (Table 12), but quite a number of them were supposed to be mulberry fields. Especially in the uplands, many mulberry fields were seen, and so the land-use in which ordinary upland fields and mulberry fields were combined with the plain forests was common. In Naguwashi, however, farmers were less dependent upon the plain forests than in Fukuhara. In the old villages which practice paddy-field rice cropping, they could get natural supply of fertile elements in the irrigation water, and also could get organic matters by using rice straw. As a result, the balance of organic matters was kept more easily than in the settlements which practice upland-farming alone. According to the author's interviews, it was said that the farmers in Naguwashi having 30 to 40% of their farm lands in paddy fields were not dependent upon the plain forests at all, and able to get enough organic matters such as rice straw to maintain the soil fertility. In the settlements of the Iruma upland, which practice upland-field farming, they did not grow many sweet potatoes which required many fallen leaves, and sericulture was prosperous, so that silkworm
feces and silkworm bed cleanings were used as organic matters. The mulberry shoots were used for fuel. Because of the differences in the land-uses and types of farming, the farmers in Naguwashi were less dependent upon the plain forests than those in Fukuhara even in the periods of the traditional land-uses before the 1960s.

(3) The Change in the Types of Farming and in the Use of the Plain Forests after the Period of the Rapid Economic Development

In the 1960s, propane gas and kerosene spread into both the Naguwashi and Fukuhara districts, and gathering of firewood in the plain forests disappeared as in the rural communities in the Musashino upland. At the same time, such uses of plain forests as getting timber for construction and other materials for daily life came to an end. The continuance or extinction of gathering fallen leaves, which play an important part for agricultural reproduction, was influenced by the differences in the types of farming.

In the Naguwashi district, paddy-rice cropping and sericulture are still the center of the farming as in the days before the rapid economic development. The upland fields and plain forests were located in the uplands between
Kasumigaseki station and Tsurugashima station along the Tobu-Tojyo Line. Consequently, as this district is comparatively easy to access, plain forests have been converted into such uses as the school of Technology, Toyo University (1958), Toyo Rubber Company, Ltd. (1961), Fujimi Industrial Estates (1971) and so on (Fig. 16). After 1970, by the enforcement of New City Planning Act, 87% of the area of the Naguwashi district was designated as an Urbanization Control Areas. The areas that were designated as lands for agricultural use in the Agricultural Promotion Areas were limited to only paddy fields and mulberry fields. Therefore, even after 1970, ordinary upland fields were converted into the farmers' branch houses, and store houses and parking lots for self-employed side business. Furthermore, plain forests and ordinary upland fields were increasingly converted into sports grounds, hospitals, warehouses and sites for supply-materials, which were exceptionally permitted to be built as special cases in the Urbanization Control Areas. As the decrease of managing farm fields centered around ordinary upland fields, they were divided into smaller holdings. According to the 1985 Agricultural Census, the average farming land of each farm household was 24.3 are, which was rather small. As shown in Table 14, 70% of the part-time farm households were engaged in non-agricultural jobs and most vegetable farm households
Fig. 16 Land use in Naguwashi, Kawagoe-shi (1987)

1. paddy field, 2. ordinary upland field and land under perennial crops, 3. plain forest, 4. residential-site, 5. factory, warehouse and material depository, 6: others
7. boundary line between Urbanization Areas (side) and Urbanization Control Areas

Source: the author's field survey

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produced only for household consuming. Naturally, many farmers came to use chemical fertilizers increasingly, and fallen leaves manure came to be discarded in a great scale. As a result, the plain forests, which had been managed and maintained properly, decreased. Among farmers who completely quit using the plain forests, a considerably great number of them sold out the plain forests or converted them into urban land uses. So, the area of the plain forests rapidly decreased after 1960. Since plain forests were easier to be converted than farmlands, plain forests were converted into sites for supply-materials, warehouses, and sites for the disposal of industrial wastes after 1970 when designated as an Urbanization Control Areas. The decrease of plain forests continued (Fig. 17-a). As a result, the present area of the plain forests has decreased to 40% of that in 1960. On the contrary, the decreasing ratio of the paddy fields and tree growing sites (especially mulberry fields), which are still the main places of production, is rather slow, compared with that of the plain forests and ordinary upland fields. This is why there were many farmers who own paddy fields and mulberry fields in the Naguwashi district, and they could easily get out of the agricultural system depending upon the plain forests.

Fukuhara is distant from the center of Kawagoe-shi where there are railway stations, and the bus line which
Fig. 17  Decrease of area of the plain forests and farmland area (1950-80)

Agricultural Census in 1975 and 1985
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runs along the prefectural road leading from Kawagoe to Tokorozawa is the only one means of public transportation; therefore, it is not easy to access to the district. Since about 80% of the whole area of the district is the Urbanization Control Area, and most of the upland fields are designated as the land for agricultural use in the Agricultural Promotion Area, this district has the best kept arable lands in Kawagoe-shi.

In 1912, the average farm acreage of each farm household in the Fukuhara district was 250 are, but today it has been reduced to 110 are (Table 14). The group of farm households with one to two hectare in acreage is 44.2% and the group with more than 2 hectare is 13.0%， in the Fukuhara district. There still remain comparatively a large number of farm households with large size of farming in the Fukuhara district. In addition to it, the ratio of the part-time farm households engaging in non-agricultural jobs is low, and shugyou-noka are more than 70% of all the farm households, which is about two times as many as the percentages in the Naguwashi district and all the districts in Kawagoe-shi (Table 14).

The cultivated crops by the farmers in the Fukuhara district greatly changed after the 1960s. The production of sweet potatoes, which were once one of the special products and main crops, rapidly decreased, along with the decrease
Table 14  Summary of farm household and operation area in the Fukuhara and Naguwashi districts in Kawagoe-shi (1985)

<table>
<thead>
<tr>
<th>Area</th>
<th>Number of farm households</th>
<th>Ratio of Shugyou-oka (%)</th>
<th>Ratio of part-time farm household earning main income from other jobs (%)</th>
<th>Operation area per farm household (are)</th>
<th>Percentage of farm household by size of operated areas (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kawagoe-shi</td>
<td>4,586</td>
<td>35.8</td>
<td>64.2</td>
<td>90</td>
<td>63.3 30.3 6.4</td>
</tr>
<tr>
<td>Naguwashi</td>
<td>402</td>
<td>31.8</td>
<td>68.2</td>
<td>80</td>
<td>69.9 24.9 5.2</td>
</tr>
<tr>
<td>Fukuhara</td>
<td>488</td>
<td>68.5</td>
<td>30.5</td>
<td>110</td>
<td>42.2 44.2 13.0</td>
</tr>
</tbody>
</table>

Source: Census of Agriculture in 1985  

Note: Shugyo-oka means the total of full-time farm household and part-time farm household earning main income from agriculture.
of wheat, barely and upland rice (Fig. 18). Instead, such root crops as Japanese radishes and carrots came to be grown in a large scale. Recently the cultivation of carrots is on the decrease because of the low prices in the markets, but instead of them, such soft vegetables as spinaches have been grown increasingly. Taros, which have long been cultivated, are recently recognized for their good quality in the markets, and the price has gotten higher, so that they are produced more than ever. The reason why the sweet potato production has decreased is partly the decrease of the demand due to the change in the people's eating habits, the increasing damage by castaneous garden beetles and other insects, and the giving-up of the cultivation by the farmers whose farm acreage is less than 2 hectare, and who can not afford to tend sweet potatoes for long cultivation period.

The cultivation period of sweet potatoes is long, but the production cost is low and the labor required for cultivation is not much, so that large scale farmers managing more than 2 hectare still grow sweet potatoes as labor-saving crops, together with carrots, Japanese radishes and taros. On the other hand, more than 80% of the farmers with less than 2 hectare holdings have been planting crops which have wider seeding time with short growing period, and have been making multiplecroppings to get high income\(^{46}\).
Fig. 18 Changes in the harvest area of the main crops in the Fukuhara district, Kawagoe-shi (1950-85)


Note: Five important main crops in terms of harvested area are shown.
It is possible to crop Japanese radishes and carrot two or three times a year and spinaches all the year round, so they can get high returns in the limited cultivated lands.

Large-size farm households who are still cultivating sweet potatoes need a large quantity of fallen leaves for the manure and heating material for the nursery beds as ever. Small scale farm households with narrow farmlands do multiplecroppings of specific kinds by using chemical fertilizers alone, so that soils tend to be damaged by a continuous-cropping. Especially, such root crops as Japanese radishes and carrots, and soft vegetables like spinaches are liable to have an injury of continuous cropping. As the chemical fertilizers are not enough to maintain the fertility of the farmlands, it is indispensable to supply organic matters to them.

According to the 1985 Agricultural Census, only four dairy farm households breed 101 dairy cows and 5 poultry farm households keep 3,071 egg-laying hens in the Fukuhara district. Several farm households are making use of the cattle's droppings, which they bought as organic matters for the farmlands, but most of the farm households are forced to depend on the traditional organic matters of fallen-leaves manure. After 1970, Fukuhara Agricultural Co-operative Association has advocated the use of fallen-leaves manure in all the district. In former days, the farmers piled up
fallen leaves at the corner of their yard, but now many of them have the manure sheds of concrete to keep fertile elements from being washed away.

The farmers who have no plain forests of their own rent plain forests from the plain forest-owners who can afford to rent their forests in and out of the district and gather fallen leaves. In the Fukuhara district, as in Kamitomeniku, the farmers have kept gathering fallen leaves in the plain forests in proportion to their size of farming. In the Fukuhara district, therefore, agriculture is still closely related with the plain forests, which seem to be different from each other. Yet, as plain forests are not included in the category of the farmlands regulated by the present Agrarian Law, they are converted into other uses even in the Urbanization Control Areas. Consequently, plain forests, mainly in the southern part of the district, are being turned into warehouses, sites for the disposal of industrial wastes, grounds for storing soil and rock materials, sports ground (for Nihon University) and so forth (Fig. 19). Nevertheless, the plain forests in the Fukuhara district have existed as pertaining to the farmlands functionally, as mentioned in the above passage, have decreased in keeping pace approximately with the farmlands (Fig. 17-b). Moreover, compared with the plain forests in the Naguwashi district which have almost quit functioning as
Fig. 19 Land use in Fukuharra, Kawagoe-shi (1987)

1. ordinary upland field, 2. plain forest, 3. residential-site, 4. factory, warehouse and material depository, 5. others, 7. boundary line between Urbanization Areas (side) and Urbanization Control Areas

Source: the author's field survey

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farm forests the decrease of the plain forests here is rather slow.

(4) The Problems in the Preservation of the Plain Forests in the Urban Fringe of Tokyo

It has already been pointed out that the inheritance tax is one of the great factors to decrease forests because the land price in the urban fringe rural communities in the Tokyo metropolitan region has been skyrocketing (Oda, 1982). It is natural enough to examine the incidence of the inheritance tax even in the districts in the urban fringe where the plain forests still remain. This survey, however, is very difficult to do as it has something to do with the individual properties. Accordingly, the problems of the plain forest as real estates and the continuance of the uses of them are discussed in this section, making use of the Researches on the Actual Condition of the Plain Forests (Kawagoe-shi Agricultural committee, 1987).

Among the persons interviewed, about 80% in the Fukuhara district, and about 60% in the Naguwashi district are the owners of the plain forests. Examination of the kinds of trees in the farmers' plain forests reveals the characteristics of the both districts (Fig. 20). In Fukuhara, the district of upland field farming, the
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Fig. 20  Tree species of the plain forests (1987)

1. *konara* oak and red oak, 2. Japanese red pine,
Source: Agricultural Committee of Kawagoe-shi (1987)

Fig. 21  The use of the plain forests (1987)

1. gathering fallen leaves, 2. *shiitake* growing,
3. playground for children, 4. unused forest, 5. others
Source: the same as that of Fig. 20
deciduous broad-leaved trees such as red oaks and konara oaks are the most common trees, and next to them Japanese red pines are mentioned. But Japanese cedars are rarely answered. In the paddy field farming district of Naguwashi, 20% of people mentioned cedars, instead of Japanese red pines. Fig. 21 clearly shows that in the Fukuhara district more than 90% of farm households are still making use of gathering fallen leaves in the plain forests. In that case the plain forests of red oaks, konara oaks and Japanese red pines are mostly in demand.

In the Naguwashi district, about 20% of farm households are using fallen leaves, and almost 50% of owners of the plain forests leave them unused. Many plain forests are left uncared-for, with such shrubs as azumanezasa and hisakaki growing densely on the forest-floors. The reason why many Japanese cedars are planted here is that the farmers who quit gathering fallen leaves has made forests of Japanese cedars, hoping for the future income. This real situation makes us realize that it is necessary to keep the plain forests as farm forests in the agricultural management in the Fukuhara district as ever.

These districts differ in the recognition of the plain forests, reflecting their ways of using (Fig. 22). In the Fukuhara district, about 60% of the farmers replied that the forests were indispensable in their management of farmlands,
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Fig. 22 Recognition of the plain forests by the owners (1987)

1. indispensable land to farming, 2. land for conservation
3. land for property, 4. taxable useless land, 5. habitat of injurious bird, 6. others

Source: the same as that of Fig. 20

Fig. 23 Changes of the plain forest area owned by farmers for the past decade (1987)

1. unchanged, 2. decrease—sold for inheritance tax payment,
3. decrease—sold for the high municipal property tax,
4. decrease—sold for other reasons, 5. increase

Source: the same as that of Fig. 20

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and 15% of them looked upon the forest as the sources of their wealth. On the other hand, in the Naguwashi district the plain forest was recognized as indispensable in the management of agriculture by 20% of the farmers and more than 40% of the farmers regard the plain forest as the sources of their wealth and 30% of the farmers as the conservation of the environment.

Although more than 60% farmers answered that there had been no change in the areas of the plain forest in these districts in the past decade, many farmers, however, answered that the reason why the area of their plain forests decreased was partly the sale of plain forests to supplement their income, but the main reason was the payment of their inheritance taxes (Fig. 23). It is especially notable that, in the Fukuhara district where the plain forests are still in use as the farm forests, 20% of the farmers sold their plain forests to pay the inheritance tax and the municipal property tax. More than 80% of the farmers in the Fukuhara district and 70% of the farmers in the Naguwashi district think of the present inheritance tax of the plain forests as high (Fig. 24). In case of inheritance a great amount of the inheritance tax is imposed upon. Since the plain forests are not included in the category of the farmlands in the present Agrarian Law, owners of plain forests can not apply for postponing the payment of the inheritance tax.
Fig. 24 Farmer's estimation of inheritance tax on the plain forest (1987)

1. very high, 2. a little high, 3. ordinary, 4. low, 5. don't know

Source: the same as that of Fig. 20

Fig. 25 Farmer's hopes toward tax system (1987)

1. to lower inheritance tax, 2. the same as on farm land, 3. to lower municipal property tax, 4. no change, 5. others

Source: the same as that of Fig. 20

Fig. 26 Intention of farmers regarding the plain forests after inheritance (1987)

1. to maintain for the inheritors, 2. to maintain as much as possible, 3. to sell case by case, 4. to be obliged to sell

Source: the same as that of Fig. 20
When the case of inheritance takes place, the inheritor must sell his plain forests to pay the inheritance tax. That means a high inheritance tax is the serious impediment of maintaining the plain forests. In the Fukuhara district where the plain forests are virtually made use of as farm forests, 25% of the farmers have an intention to sell their plain forests in case of the inheritance, and more than 40% of the farmers are determined to sell their plain forests "in case of emergency" (Fig. 25). Such plain forests as owned by the farmers have a tendency to be reserve lands for other land-uses. Once sold out, the farm management inseparably connected with the plain forests is impossible to continue, so 90% of the farmers in the Fukuhara district wish the government to change the present tax system of the plain forests (Fig. 26). In the plain forest districts in the fringes of the Tokyo metropolitan area, the extremely high inheritance tax is the serious factor of hindrance to maintain the plain forests as ever. In the plain forests areas just like in the Fukuhara district, the administration is seriously asked to recognize the plain forests as a vital means of agricultural production.
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III-3 Consideration

The author has considered the use of the plain forests as farm forests taking, as examples, plain forest district in the rural communities situated in the northern part of the Musashino upland in the urban fringe of Tokyo. At first the traditional uses of plain-forests are analyzed, and then present day uses and factors of their remaining situations are considered in connection with the changes in types of farming and in social economy. As a result, the following six points are clarified.

1. In the Musashino upland of the 1880s, the plain forests which had been managed and maintained as farm forests by the farmers since the development of *shinden* settlements in the Edo period, were seen in a large scale. The plain forests in the southern part of the Musashino upland, however, began to decrease after the Kanto Earthquake Disaster in 1923. After the Kanto Earthquake Disaster various urban facilities and military installations began to move into the suburban districts and, the plain forests were suitable places for their construction sites. Furthermore, after World War II the residential areas in the Tokyo Metropolitan area extended into the Kitatama district, and naturally plain forests came to be converted to houses. On the other hand, in the northern part of the
Musashino upland, the urbanization was not so fast that plain forests did not decrease the period of the rapid economic development. In the first half of the 1960s, plain forests began to decrease due to the conversion into industrial sites. In the 1970s, New City Planning Act was in effect, and since most of the northern part was designated as the Urbanization Control Areas, urbanization was halted temporarily. Nowadays, quite a few plain forests still remain in the northern part of the Musashino upland, and in some districts farming with the use of the plain forest as farm forests is still predominant.

2. In the urban fringe of Tokyo, the traditional uses of the farm forests which had been kept on since the beginning of the shinden settlements had been maintained, as in the northern part of the Musashino upland, before the period of the rapid economic development. The farmers used to gather fallen leaves as the material for the manure, the heating material for seedling beds and the litter for the cattle sheds, and also gather such materials as firewood, timber, cogon grasses for roofage, mushrooms and medicinal herbs. The plain forests were closely connected with the upland fields, livestock, and farm households (Fig. 27-A). Since farmers cultivated barley and wheat, upland rice and sweet potatoes as their main crops, it was impossible for them to maintain
Fig. 27 Changes in the use of the plain forests in the urban fringe of Tokyo Metropolitan region
agricultural reproduction without scattering on the farmlands a large quantity of the manure of the fallen leaves and fertilizing the soil of low productivity. In addition to it, sweet potatoes cultivated as a home-consuming crop required a lot of fallen leaves for the heating material of their nursery beds, and so the fallen leaves were one of the most important forest products. The period of using the plain forests was centered around the wintertime except for the gathering seasons of mushrooms (summer and autumn). Farmers felled red oaks and konara oaks in the plain forests for firewoods in the cycle of 15-25 years, and resuscitated them by the later sprout regeneration.

3. In the period of the rapid economic development, firewood-gathering came to an end in the Musashino rural communities on account of the influence of the nation-wide "fuel revolution." Moreover, because of the rise of the living standard the use of the plain forests to get the materials for living such as lumber for building was doomed to become extinct. Few farmers came to keep livestock, and the relationship between the livestock and the plain forests ceased to exist. Naturally, there are, at present, two types as to the plain forest use, that is to say, A1 type of the uses in which the fallen leaves are still used for the material of reproduction, and A2 type
in which the use of plain forests as the farm forests is no longer. A1 exists in the areas where the advance of the urbanization are delayed as in the urban fringes of the capital such as Kamitome-niku, Miyoshi-machi and the Fukuhara district, Kawagoe-shi. A2 is to be found in the areas where the urbanization is comparatively in advance, such as in the Naguwashi district, Kawagoe-shi, though they are located within the Urbanization Control Areas. In these days, the urbanized areas in the Tokyo metropolitan region are daily expanding, so that A2 type of the use is seen in wider areas than A1.

4. The areas in which A1 type of the use is observed were designated as the Urbanization Control Areas, and there the farmlands, as the bases of production, were included in the Agricultural Promotion Areas, and so the conversion of the agricultural lands into other uses decreased. In such areas, the commercial vegetables are grown in intensive farming by shugyo-noka. Large-scale farmers grow sweet potatoes as a commercial crop to Tokyo markets, along with vegetables. With a view to maintain the yield and quality of sweet potatoes, farmers have been using the traditional method of cultivation to use a large quantity of fallen leaves for the manure and heating material. These farmers have the large area of the plain
forests, and so gather fallen leaves in the plain forests of their holdings. Small-size farmers grows Japanese radishes, turnips, and spinaches instead of sweet potatoes which require the long term of growing, cropping three or four times a year and maximize their utilization ratio of the cultivated lands. Consequently, farmers must use not only the chemical fertilizers, but the organic ones in the farmlands to escape from the failure of replantings. They are obliged to rent the plain forests from the large-scale farmers and use the traditional manure of the gathered fallen leaves. Even in the present days when the agricultural production has greatly been improved as one of the field production centers of vegetables in the urban fringes of Tokyo, the plain forests are still closely connected with the agricultural production through the gathering of fallen leaves. The reason why plain forests is still used in this way, is that under such external conditions as the designation of the Urbanization Control Areas, all the farmers have been trying to maintain their own individual uses of the plain forests according to their own scales of management, which includes the debit and credit.

5. A2 type is seen in the areas where the urbanization is in advance and many farmers are earning their main income from non-agricultural jobs. Their farmlands are used in
extensive ways and not designated as Agricultural Promotion Areas. They do not produce the manure through fallen-leaves gathering which requires quite much labor, and make use of chemical fertilizers and agricultural chemicals. Accordingly, the vital connection of the plain forests with these farmers and farmlands has disappeared. In the present Agrarian Law, the plain forests are not in the category of the farmlands, and so the conversion of them into other uses is scarcely regulated by the law. Even in the Urbanization Control Areas, it is recommended to sell the plain forests, converting into warehouses and sites for material depository. The remaining plain forests of the farmers' own holding are left unused for and their significance as the land holding increased. Consequently, they are the reserve lands for other urban land uses in future.

6. In A1 type areas where the gathered fallen leaves are used, the farmers' plain forests tend to be sold and converted into other uses in these days. The main reason why farmers sold their plain forests was high inheritance taxes which were imposed upon the plain forests in case of the inheritance. In the urban fringe areas where the plain forests remain, the high inheritance tax is the great impediment to the maintenance of them. It is
expected that in the days to come the sale and conversion of the plain forests will gradually increase because of the inheritance law. The designation of the Urbanization Control Areas and Agricultural Promotion Areas alone cannot conserve not only the plain forests, but the farming system organically connected with them.
IV-1 The Use of the Plain Forest at Nishihara on the Nasunohara Upland

(1) Overview of the Study Area

The Nasunohara upland consists of 40,000 hectare of confluent alluvial fans between the Hoki and Naka rivers on the piedmont of Taishaku mountains and Nasu volcano in the northeastern Tochigi Prefecture. The Zyabi and the Kuma, which flow southward in the central upland, are dried-up rivers down to the altitude of 200m, while water flows below the altitude of 200m. The central part of the fan, which occupies 68% of the district, is located at the altitudes between 200 and 400m with the gentle slope from 1/70 to 1/100.

The western Zyabi in the central fan, is called Nishihara, while the eastern Kuma is called Higashihara. As both rivers run below the ground surface as far down as the center of the fan, they are quite insufficient for the source of irrigation water. Whereas the ground water level is as low as -30 to -20m in the central fan, the level in the flood plains of the Zyabi and Kuma rivers is about -15m,
which is relatively higher than that in the other areas of the center (The Editorial Committee of the Centennial History of Nasu-sosui canal, 1985).

The ground is covered with pale-colored deluvium volcanic ash soil called kuroboku. It is light acid soil of pH 4.6 to 5.7. The surface soil is shallow, and the soil fertility is low, for it absorbs phosphoric acid so easily. The lower part consists of sand and gravel with low porosity (The Agricultural Experiment station of Tochigi Prefecture, 1986). The average temperature goes up to about 26°C in the summertime, but it goes down in winter to 0°C, which is lower than that in the Musashino Upland in the western urban fringe of Tokyo. The annual precipitation is 1,334mm, and half of the rain falls down from June to August. In winter a strong north-westerly monsoon named Nasu-oroshi, which is more than 15m/sec, blows down the upland.

On the Nasunohara Upland, before the Meiji Restoration, the villages were found below the altitude 200m at the end of fans with springs. They were also located in the central fans on the flood plains with relatively high ground water levels. Consequently, the most parts of Nishihara and Higashihara were uninhabited areas until the Meiji Restoration, and made use of as communal lands for the neighboring villages. Nishihara was 5,256 hectare of communal land for the 64 villages (The Editorial Committee
During the Edo era the villages at Nishihara had small areas of paddy field, so most of the farmers were engaged in the upland farming. In the Keicho period (1596-1615), the residents of Niwatoko and other 4 villages on the right bank of the Zyabi constructed Hikinuma-yosui canal was constructed from the upper Zyabi, as the only canal in Nishihara. As the amount of water, however, was not sufficient to exploit paddy fields, the water was used only for the daily life. In later days the canal was extended to the castle town of Otawara, and is still used for the same purpose with the name of Goyobori (canal of public use). After a great expansion and renovation in 1891 the canal came to be used for the irrigation water of the old villages, such as Niwatoko (The Editorial Committee of the Centennial History of Nasu-sosui canal, 1985).

In the Edo era, the old villagers grew such crops as millet, barnyard millet, buckwheat, barley, wheat, soybeans, azuki beans, perilla, taro, Japanese radish, upland rice, and leaf tobacco (Matsui, 1981). The light surface soil of the fields with little water retention is easily blown away by wind during the wintertime. Summer rains, moreover, wash away essential ingredients of the fertilizers and manures in the surface soil. The productivity was extremely low because of infertile acid volcanic ash soil, wind erosion,
and water erosion (Tsuji, 1980a, 1980b).

It was indispensable, therefore, to provide a much organic fertilizer, such as farmyard and barnyard manures, in order to produce these crops. The farmers gathered fallen leaves for the material for farmyard and barnyard manures, gathered the buds or young leaves for paddy fertilizer, and cut weeds to feed the livestock in their private or communal plain forests, so that they could maintain the agricultural production. They not only obtained much material for the agriculture, but also for their daily life by collecting fuel wood and cogon grasses (kaya) for thatched roofs.

Those villages lay in a part of the Nasunohara Upland well-known for horse breeding, and some people were engaged in the bringing-up of foals. In order to use wild glasses that were about to sprout up as feed for horses, farmers in Nishihara used to burn dry grasses in the early spring. Because of this custom of burning and frequent field fires, Nishihara area was the grass land of susuki (microstegium sinensis Anders), konara oaks, red oaks and Japanese red pines, until the land was reclaimed in the Meiji period (The Editorial committee of the History Of Nishinasunomachi, 1963).

Although communal land use in Nishihara was put an end to at the Meiji period when it became made Kanmin-yu-kubunn
(the district for the use of government and people), the use of the plain forests owned by individual farmers continued until the rapid economic development which began in the 1960s. In Nishihara there still remain a large area of plain forests (Fig. 28). Many of them are located in Hokine area, Shiobara-machi (the former Hokine-mura) on the Hoki and the Zyabi, and in Senbonmatsu area, Nishinasuno-machi, in the central fan. The plain forests in the valleys of the two rivers were used for agriculture of the villages which originated before the Meiji Restoration (which villages will be described as "the old villages" from now on), and were well taken care of and exploited by the individual farmers for a long time. The majority of them are, however, unused for farming now, and left to change into bushes. The plain forests in Senbonmatsu area were exploited as the farm forests in the Meiji period when the center of the fan was cleared for large plantations. At present the use of the plain forests for the farm forests are extinct; the forests are now used for growing trees for commercial profit. Thus the plain forests in both areas of Nishihara are quite in contrast with each other, in their origins of formation and present states.

Accordingly, specific objects for investigation became the plain forests in old villages in Niwatoko area, Shiobara-machi (the former Hokine-mura), and those of
Fig. 28  Distribution of the plain forests in the Nishihara, western part of Nasunohara upland

1. plain forest, 2. mountain land, 3, contour, 4: Nasu sosui canal
Source: topographical map of Shiobara at a scale of 1:50,000, surveyed in 1915, edited in 1973, revised in 1977

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Senbonmatsu area, Nishinasuno-machi, which have been used since the Meiji period and are located beside Niwatoko forests. In this section, researches are made to identify the traditional use of the plain forests, its change in accordance with the changes in the farming and economy in the rural community during the rapid economic development, and the present condition of the plain forests.

(2) The Changes of the Farming and Plain Forest Use in Old villages

1) The Traditional Use of Plain Forests

a. The Use of the Fallen Leaves as Materials for Manure and Heating materials

The plain forests of Nasunohara upland contains many red oak and konara oak trees. The gathering of fallen leaves in the forests was called konoha-sarai and was done between December and February in winter. Since this period had little farm working and rain, it was easy for the farmers to gather leaves. The gathering work was generally made until the snow-coming days in the middle February, when the wet leaves made the work difficult.

Before they began to gather fallen leaves, they collected dead twigs and branches to make the raking easy. Next they did shitagari (weeding and brushing and cut down
shrubs and low herbages). Then they gathered leaves with lakes and put them on konoha-ami, which they tied in cylindrical forms. One konoha-ami could tie up 37.5 to 45kg leaves. In every 10 are plain forest they were able to gather about 12 konoha-ami (450kg), which was the same amount, as that gathered in Musashino upland. Every farmer could gather about 12 konoha-ami a day in general, which amounted to 450 to 540kg per 10 are.

The konoha-ami tying up fallen leaves in them were brought to the houses on the hand-pulled carts (daihachi-guruma) or on the carts pulled by the horses. The leaves were put into the sheds called konohagoya and used when necessary. Most of them were used as the material for the farmyard and barnyard manures which were most important fertilizers for agriculture.

The 60 to 70% of gathered leaves were lain in the cattle sheds of horses and cows as litter along with straw, while 30 to 40% of them were used as heat material in nursery beds of tobacco. The raising of horses and foals as source of cash income made an important part in producing manure in the stables. In the horse sheds, farmers raked the leaves used for the beds of the horses, piled them in the stacks as farmyard manure, and kept there till they became ready for the fields. Those manures were mixed with rice bran, soybean cakes and chemical fertilizers, which the
farmers bought, in proportion to the kinds of the crops, and strewn over the fields. Both farmyard and barnyard manures are easy to be absorbed into the crops, for they have a trace element of fertilizers in addition to a quantity of fertilizing ingredients. Moreover, they enhance the air permeability of the soil, increase its porosity and develop its crumbled structure. Therefore, they maintained the fields from the wintertime wind erosions.

b The Use of the Forest Products as the Living Materials in the Farm Houses

Most fallen leaves were used for the farmyard or barnyard manures, or for nursery beds, while some were used for the fuel of the kitchen ranges (kamado) and the hearths made in the floor (irori). Most of the fuel, however, was wood and fagot hewn down in the plain forests. The shrubs cleared away for facilitating the gathering of fallen leaves, and the trees cut down for thinning the thick forests, were used for the firewood. As farmers without plain forests had to buy wood and fagot, it was economically significant whether they had the plain forests.

The farmers who owned larger forests sold wood to the fuel merchants called makiya. When farmer cut down trees for firewood in his own house, or when he sold his trees to a fuel merchant in the way of tachiki-uri (selling trees
as they stood), they cut down the trees by the end of February when the gathering of fallen leaves was over. After cutting trees, people left the forests to let them sprout again. The suitable cutting season was different within the forest according to topography and quality of the soil, but the cycle of 20 to 25 years was generally regarded as appropriate.

People had to buy the lumber, when a large quantity of lumber was required for the construction of a new house. To repair main house or building a small shed, however, they made use of Japanese cedars in the premises forest (called *yaura*) or of Japanese red pines in the plain forest depending upon the kind of timber needed. Besides, they picked out various kinds of mushrooms for their own tables and Japanese green gentians called *senburi* as medicinal herbs. Most of the cogon grasses for the use of roofage was not gotten from the private plain forests, but at *kayaba* (the field of cogon grasses) in the communal land.

2) The Use of the Fallen Leaves for Leaf Tobacco Farming before the Rapid Economic Development

Niwatoko area is located on the right bank of the Zyabi which flows under ground, sloping gently southwestward at the altitude of 280 to 320m (Fig. 29). Hikinuma-*yosui* canal
Fig. 29 Land use in Niwatoko, Shiobara-machi (1958)

1. farmer's house, 2. paddy field,
3. upland field (including meadows), 4. plain forest,
5. Hikinuma-Yosui canal

Source: topographical map of Shiobara at a scale of 1:50,000, surveyed in 1909, revised in 1929 and 1958
which flows southward through the central part of the area was constructed as an irrigation canal in the middle of the Meiji period. The canal, however, did not have sufficient water and became the focus of water right dispute. In Niwatoko in the central part of the fan, the underground sand and gravels made it impossible to reclaim new paddy fields with human or animal labor. Therefore, it was difficult to give the people wider arable fields.

Furthermore, the production of leaf tobacco of native species *Daruma*, which had been flourished since the Edo era, was still the main cash crop, and the villagers were not willing enough to open new paddy fields. Since they had to do the intertillage and earthing-up of tobacco and to transplant rice seedlings at the same period, they could not afford to do the two different kinds of labor at once. Consequently, in Niwatoko area leaf tobacco had been the main crop till the middle 1960s. In 1960, Niwatoko had 48 farm households, 32.0 hectare paddy fields and 38.7 hectare upland fields (The Research Society of the History of Osetsu District, Shiobara-machi, 1976). An average family planted tobacco in the fields of 20 to 40 are, but some farm households had about 70 are fields of tobacco. The fields (as shown in Fig. 29) were mostly situated in the comparatively fertile eastern part of the village, where the flood of the Zyabi had accumulated the alluvial soil. The
farmers cultivated such home consuming crops as wheat and barley, as well as some cash crops, including tubers, vegetables, and leaf tobacco. As farmers cannot produce leaf tobacco in the same field continuously, they adopted a crop-rotation system, centering upon the leaf tobacco production. The type of rotation was, for the most part, divided into two kinds: one was the rotation of barley, leaf tobacco, wheat, upland rice in two years, while the other was the rotation of barley, leaf tobacco, wheat, upland rice, wheat, soybeans, and sweet potatoes in three years.

In the days before the rapid economic development it was necessary to use 750 to 1,125 kg of farmyard and barnyard manures for cultivating upland rice, wheat or barley, in 10 are field. The farmers could possibly gather approximately 450 kg fallen leaves per 10 are plain forest and, therefore, when they plant a crop in 10 are field, they must own 16 to 25 are plain forest. The cultivation of tobacco, however, required about farmyard and barnyard manures of high quality, and necessarily they needed more than 30 are plain forest, wider than for barley and wheat.

Leaf tobacco also needed many fallen leaves for heating material in nursery beds. In Nasu District the nursery beds of tobacco were those of fermentation in general, and the fallen leaves were commonly used as the heating material. To plant 10 are of a field, they must have about nursery
bed of 9.7m² (1.8mx5.4m) called sangen-doko. They dug out a little garden mud into the form of the bed and surround it all around at the height of 45cm with rice straw and wheat straw knit together, into which the fallen leaves were put and trodden down in the early March. In order to lengthen the period of fermentation the leaves were amply watered by the day before the treading. On them the wet straw cut into small pieces was put, upon which fine mud mixed with fully ripened farmyard manure was laid in the thickness of about 6.4cm. The seeds were sowed there. Since the proper germination temperature of 26 to 27℃ was required to last for about 20 days to grow good seedlings, the bed was covered so as to keep warm and for water-proof. At the beginning of May the bed was useless, and so the leaves used for the heat material were stacked up in the shed for farmyard manure and used for the manure of winter crops for the second time. The quantity of the fallen leaves used for the heating material in sangen-doko to plant 10 are fields was about 525kg, which means that it was necessary to have more than 10 are plain forest for gathering the fallen leaves as the heat material. Accordingly, when a farmer was forced to gather the fallen leaves for planting tobacco of Daruma in his 10 are field, he must be provided with more than 10 are plain forest for the bed leaves and 30 are one for the farmyard ones, i.e. more than 40 are in total. In
other words, he needed more than four times as large plain forest as field for gathering the fallen leaves.

According to the author's interviews, by the time before the period of the rapid economic development, every farmer in Niwatoko area generally had two to three times as large forests for gathering the fallen leaves as upland fields under his management. A farmer, whose forest was small or who had no forest, must gather the leaves in the forest which he borrowed from his relatives or neighboring farmers. Thus, the plain forests, first of all, were indispensable for giving farmers fallen leaves which maintained agricultural reproduction, played an important role as farm forest to provide the people with living materials, such as fuel wood, and were utilized most greatly of all the things in Niwatoko (Fig. 29).

3) The Expansion of Rikuden, and the Decrease of the Plain Forests Owned by the Farmers Since the Period of the Rapid Economic Development

a. The Expansion of Rikuden and the Decline of Tobacco Farming

Until World War II the breeding of horses was profitable because military or farm horses were greatly needed. In the post-war days, however, the decrease in the demand caused
the decrease in horse-breeding farmers. Dairy farming was introduced in 1947 and breeding calves for Japanese cattle began in the middle 1950s as side works. These farmers began cut down trees of plain forests to open pastures and meadows. As most farmers in Niwatoko area produced leaf tobacco until the 1960s, the reclamation of paddy fields was slower there than in other areas in Nishihara. In the 1960s the electric power water-lifting machine enabled the farmers to use the underflowing water of the Zyabi, and the introduction of such machines as bulldozers made it possible to convert plain forests into paddy fields. The old upland fields and pastures and meadows were converted into rikuden by digging up them and compacting their subsoil (Table 15).

Although the tobacco farming was highly productive, it required quite much labor. And through various conditions which appeared since the rapid economic development, such as mechanization, the progress of cultivation techniques, rising productivity in the paddy rice farming because of the rice price protective policy, and the decrease of demand of Daruma tobacco, the farmers in Niwatoko also converted leaf tobacco fields into rice upland fields, called rikuden. According the Agricultural Census, the planted area of leaf tobacco was rapidly decreased: 10.5 hectare in 1960, 2.6 hectare in 1970, and 1.5 hectare in 1975. After 1986 the cultivation of tobacco in Niwatoko area disappeared.
<table>
<thead>
<tr>
<th>Year</th>
<th>Number of farm household</th>
<th>Full-time farm household</th>
<th>Part-time farm household earning main income from farming</th>
<th>Part-time farm household earning main income from other jobs</th>
<th>Amount of operation area (are)</th>
<th>Area rate of paddy field to operation area (%)</th>
<th>Operation area per a farm household (are)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>48</td>
<td>28</td>
<td>6</td>
<td>14</td>
<td>7,070</td>
<td>45.2</td>
<td>147.3</td>
</tr>
<tr>
<td>1970</td>
<td>46</td>
<td>19</td>
<td>16</td>
<td>11</td>
<td>11,600</td>
<td>85.8</td>
<td>252.2</td>
</tr>
<tr>
<td>1975</td>
<td>43</td>
<td>10</td>
<td>18</td>
<td>15</td>
<td>11,258</td>
<td>90.0</td>
<td>261.8</td>
</tr>
<tr>
<td>1980</td>
<td>44</td>
<td>11</td>
<td>15</td>
<td>18</td>
<td>11,537</td>
<td>93.8</td>
<td>262.2</td>
</tr>
</tbody>
</table>

Source: World Census of Agriculture and Forestry in 1960, 70 and 80: Agricultural Census in 1975
As many of the ordinary upland fields were turned into rikuden, pastures and permanent meadows, the significance of the plain forests to prevent wind erosions decreased.

As every class of farmer introduced paddy field rice farming in Niwatoko, the cultivated area per farm household became larger every year (Table 15). The farm household that had larger plain forest came to have larger paddy fields (Fig. 30). It was because they could expand their operation area of farm land by turning their plain forests into rikuden. In Fig. 30, we find the only one farm household 3 that manages to do a full-time farming, with paddy fields and dairy farming, i.e. a diversified farming. The other eight are engaged in part time farming. The farm households 1, 2 and 4 are those 'mainly engaged in farming' which are mainly dependent upon agricultural income, and partly upon non-agricultural income by commuting. The type of farming of the farm household 1 is mainly paddy field farming, dairy farming and 'contract cultivation' of tomatoes for process. The farm household 2 is engaged in paddy field farming, breeding of calves for beef and cultivating shiitake. The number of bed logs for growing shiitake is 9,500. Konara oak cut in the plain forest of the farmer's own possession are used for the bed logs. The farm household 4 is engaged in paddy field farming and dairy farming. The numbers 5 to 9 are mainly engaged in other
### Fig. 30. Case survey on typical 9 farmers owning plain forest and operating farm land between 1960s and 1986 at Niwatoko

1. plain forest, 2. paddy field and *Rikuden*, 3. forage crop, 4. leaf tobacco, 5. ordinary upland field

Note: The farm household number in 1960s and 1986 shows the same farm household.

Source: the author's interviews and field survey.
jobs than their own household farmings, earning livelihood by commuting. The farm household, just like 1 , is growing tomatoes for processing, by 'contract cultivation'.

b The Decrease of the Plain Forests Of Farmers

As kerosene and propane gas prevailed among farm households through the Japanese "fuel revolution," the firewood became less important for fuel in Niwatoko. The annual fuel wood cutting for sprout regeneration ceased because the firewood also became less valuable for market. Thus the traditional practices in the plain forests, obtaining materials for agricultural reproduction and materials for living in the farm houses, was extinct. Because most farmers owned less than 1 hectare plain forest (Table 16) and because imported logs increased, they could not easily change the forests into artificial coniferous forests of Japanese cedar and hinoki cypresses.

Now those farmers who make use of the plain forests in Niwatoko are only those who are growing the bed logs for shiitake and use a part of the forests for laying those bed logs.

As roof material of the farm houses were changed into tin or tile, cogon grasses for roofage also ceased. In 1963
Table 16  Changes of plain forest area owned by farm households and its rate by the size of farm household owning plain forest in Niwatoko (1960〜80)

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount of plain forest area (ha)</th>
<th>Ratio of artificial forest area (%)</th>
<th>Ratio of farm household owned plain forest by size (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>less than 0.1ha</td>
</tr>
<tr>
<td>1960</td>
<td>155</td>
<td>14.9</td>
<td>33.3</td>
</tr>
<tr>
<td>1970</td>
<td>115</td>
<td>33.4</td>
<td>39.1</td>
</tr>
<tr>
<td>1975</td>
<td>89</td>
<td>23.5</td>
<td>27.9</td>
</tr>
<tr>
<td>1980</td>
<td>88</td>
<td>28.4</td>
<td>54.5</td>
</tr>
</tbody>
</table>

Source: World Census of Agriculture and Forestry in 1960, 70 and 80: Agricultural Census in 1975
Kayaba in the communal land was sold to the Japan Society of Local Horse Races for building Jockey Training Center. In 1970 the plain forest was sold for construction of Tohoku Express Highway. In Niwatoko many farmers built or remodeled farm houses, and bought agricultural machines with the income by selling the communal land and the private plain forests.

A great decrease of the plain forests owned by the farmers was due to the purchase of the forests by real estate brokers, especially in 1970 to 72. Such land exploiters as real estate brokers had an interest in the plain forests as suitable areas for urban land use, because they foreknew the opening of Tohoku Express Highway (1972) and Tohoku Shinkansen (1984). The plain forests could easily be turned into private vacation home sites, industrial sites and recreation facilities sites. So many real estate brokers, mostly from Tokyo, rushed to buy the plain forests, for a land unit of the forest was larger than that of the field. Forest lands could be converted into other uses through easy legal procedures because they were not restricted by the Agrarian Act. Moreover, Niwatoko was not designated as Urbanization Control Areas and were not under any restriction law against exploitation.

Most small farmers sold all their plain forests, while large farmers 1, 2 and 3 in Fig. 30 with wide fields and
plain forests did not sell all their forests in order to maintain their family status; they retained some of their forests as reserve forests.

The plain forests in Niwatoko purchased by real estate brokers were divided into small lots to sell as vacation home sites. Many of the buyers were non-resident landowners (who was called Kosikoku) who lived in Tokyo or different parts of Japan. The number of these owners was 1,656 in 1986. The plain forests owned by non-residents amounted to about one fourth of all the area of Niwatoko, and those landowners also used their own forests. On the contrary, the plain forests of Niwatoko farmers were 18.8% (Table 17).

Since most non-resident landowners purchased the land for investment, only a few lots were actually used for residences; other lots were left unused and became bushes. Although plain forests remained in the rural landscape, they were actually social fallow. In the last half of the 1970s a large part of the forests was converted into Akada irrigation reservoir of the Ministry of Agriculture, Forestry and Fishery and into the places for public facilities such as a large park in the northern Tochigi prefecture (Fig. 31). Akada irrigation reservoir was constructed as a part of "National Project of Comprehensive Farm Development in Nasunohara." When the project was decided to be launched most of the places planned for
Table 17  Types of land use in Niwatoko (1986)

<table>
<thead>
<tr>
<th>Kind of land</th>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer’s dwelling-sites</td>
<td>9.8</td>
<td>(2.0)</td>
</tr>
<tr>
<td>Urban facilities-sites</td>
<td>1.5</td>
<td>(0.3)</td>
</tr>
<tr>
<td>Paddy fields</td>
<td>107.3</td>
<td>(21.9)</td>
</tr>
<tr>
<td>Upland field and pasture</td>
<td>38.8</td>
<td>(7.5)</td>
</tr>
<tr>
<td>· owned by farmers</td>
<td>92.1</td>
<td>(18.8)</td>
</tr>
<tr>
<td>Plain forest · owned by non-resident landowners</td>
<td>121.5</td>
<td>(24.8)</td>
</tr>
<tr>
<td>Northern park of Tochigi prefecture</td>
<td>29.4</td>
<td>(6.0)</td>
</tr>
<tr>
<td>Akada irrigation reservoir</td>
<td>48.8</td>
<td>(9.9)</td>
</tr>
<tr>
<td>Joky Training Center</td>
<td>26.5</td>
<td>(5.4)</td>
</tr>
<tr>
<td>Others</td>
<td>18.8</td>
<td>(3.4)</td>
</tr>
<tr>
<td>Total</td>
<td>490.0</td>
<td>(100.0)</td>
</tr>
</tbody>
</table>

Source: the author’s measuring the area of the each kind of land by digital planimeter from Fig. 10
Fig. 31  Land use in Niwato, Shiobara-machi (1986)

1. farmer's house, 2. urban facilities site, 3. paddy field,
4. upland field and meadow, 5. Hikinuma-yosui canal,
6. plain forest owned by farmer, 7. plain forest owned
by non-resident landowner, 8. Northern park of Tochigi pre.,
9. Akada Irrigation reservoir (constructed by Ministry of
Agriculture, Forestry and Fisheries ), 10. Jockey Training
Center (constructed by Japan Society of Local Horse Race)

Source: the author's interviews, field survey,
cadastral map and land ledger
construction were already purchased by real estate brokers for vacation home sites; the brokers began to sell those lots. It was very hard to buy the lots for public facilities because there were many non-resident landowners.

The present juxtaposition of the farm lands, the plain forests and the purchased lots by non-resident landowners and brokers is expected to be a great impediment to the adjustment of agricultural foundation hereafter. Furthermore there appeared a serious environmental problem caused by throwing away of garbage and rubbishes and a danger of fires among the fallen leaves in the forests. As weeding and brushing take place in the forests, the underwoods have grown into bushes. The forests, therefore, can be places of crime. The present condition is regarded as very serious and dangerous.

(3) The Change of the Plain Forests Utilization in the Reclaimed Land since the Meiji Period

1) The Rearing of Plain Forests and the Custom of Using Fallen Leaves before the Period of Rapid Economic Development

a. The Reclamation of Nishihara and Its Rearing of the Plain Forests

Nishihara, which had been the communal, uninhabited land, was brought under government ownership in the process of
deciding whether the lands belonged to the government or to the people after 1874. In 1880 by means of borrowing the governmental land, influential persons in the district, high-class bureaucrats of the Meiji government, and some societies organized by common people began to reclaim the land by following "the plantation system." The reclamation was carried out chiefly in three plantations: 

Nasu-kaikonsya founded by Josaku Innami and Takeshi Yaita (reclaimed 3,391 hectare of land), Chokosha presided by Michiyasu Mishima, and Kajiya-kaikon led by Iwao Oyama and Tsugumichi Saigo. When Nasu-sosui canal was opened in 1885, they began to reclaim the southern part of the Canal. In the beginning they reclaimed few paddy fields and was mainly engaged in upland farming, growing upland rice miscellaneous grain crops, pulses, tubers and Japanese radishes. In the plantations both the landlords and tenants did not grow leaf tobacco, but cultivated mulberry for sericulture.

The productivity of the reclaimed fields were so low that people were forced to give to the land much more farmyard and barnyard manures than to those in the old villages. The farmers naturally tried their best to maintain their plain forests to protect wind erosions and to produce organic fertilizers from fallen leaves and bottom grasses. As Senbonmatsu area was situated in the water
shortage waste land in the higher altitude than Nasu-sosui canal (Fig. 28), Nasu-kaikonsya did not reclaim this land for farming; they merely planted red oaks and konara oaks to turn the land into a plain forest. When Nasu-kaikonsya dissolved in 1894, Masayoshi Matsukata, one of the stockholders, opened Senbonmatsu (Matsukata) Farm, using his 233 hectare fields for his 36 shares at the dissolving time and 1,136 hectare plain forests at Senbonmatsu area he bought. His fields were dispersed in various areas of Nishinasunomura, but they were maintained by tenant system. Some of the plain forests were turned into fields under his direct management, but most of the forests were not divided into small parts to plant trees under his direct control.

In 10 are field under his management he began breeding sheep and horses after he had completed a meadow with large agricultural machines. As few sharecroppers in Senbonmatsu Farm and new immigrants had plain forests, they could not manage their farming when they did not gather fallen leaves by borrowing the plain forests of Senbonmatsu Farm. Since the farmers were forbidden to fell trees, they had to purchase firewood and charcoal at the farm. Until after World War II, the main source of income of Senbonmatsu Farm came from selling of fallen leaves and fuel wood.
Senbonmatsu Farm was sold from the Matsukatas to Horai Shokusan Ltd., in 1928, but the farm continued foresting and managing cattle breeding. Before the farmland ownership reformation after World War II, the Farm released the ownership of the cultivated fields to the tenant farmers, to end the management of the plantation with tenancy system. The other plantation owners in Nishihara divided and remised their cultivated lands and plain forest to the individual tenants. Senbonmatsu Farm, however, did not divide its land individually to own 843 hectare land by itself. The land chiefly consisted of the plain forests at the time when the farmland ownership reformation was completed.

b. Establishment of Ochiba Namakusa riyo-kumiai
(Union of Utilizing Fallen Leaves and Wild Grasses)

At Senbonmatsu Farm the charge for gathering fallen leaves was 5 yen per 1 hectare plain forest in 1931. It rose, however, to 7 to 8 yen in 1940. In 1947 farmers, the chief members of whom were the tenants at Senbonmatsu Farm and who made use of fallen leaves and wild grasses, organized the Union. The members were 494 farmers in two villages (old Kano-mura and old Hokine-mura) and one town (old Nishinasuno-machi). They made a contract, with Senbonmatsu Farm, to continue to use 400 hectare of plain
forest for gathering fallen leaves. Both sides agreed upon the terms that the farmers must not fell "trees whose diameters are more than 5bu (thicker than adults' little fingers), that they must gather fallen leaves from December 1 to March 31, and that they must cut wild grasses from July 10 to October 31." Furthermore, they settled that "the price of the fallen leaves in 1cho-bu (about 1 hectare) is decided by the amount of the consumer price of 1sho (about 1.81) rice multiplied by index 15.5," so that they might avoid the inconvenience of evaluating the price of the fallen leaves every year, influenced by inflation. In the indenture which had 13 articles, they agreed upon in detail the customary ways of the use, the period of the use, and the method of paying the price.

Following this contract, the members gathered fallen leaves in winter, pulling their carts and wagons from the houses, and some of them came from 6 to 8km away. In 1953, 390 farmers borrowed 439 hectare of forests for gathering fallen leaves, which meant 1.13 hectare per one farmer, and on the average two thirds of 1 farmer's cultivated fields.

Just like the old villages, every farmer kept one or two domestic animals such as a horse and a cow and produced barnyard manure. In old Nishinasuno-machi the farmers had not cultivated leaf tobacco and had comparatively larger area of paddy fields, using Nasu-sosui canal, than those in
the old villages at Niwatoko. Consequently they had lower ratio of the area for gathering fallen leaves to the area of cultivated fields than that in Niwatoko.

2) Conversion from the Agricultural Use to the Forests for Growing the Trees After the Period of the Rapid Economic Development

a. Conversion of Upland Fields and Plain Forests into Rikuden and Extinction of the Customary Use of Fallen Leaves and Wild Grasses in Nishinasuno-machi

Because of the opening Nasu-sosui canal, new paddy fields were reclaimed around the 3rd and 4th branch canals which flowed through Nishihara. The limited quality of water, the restriction of the water right, and many gravels under thin surface soil of the fan made the reclamation of paddy fields difficult with human and animals power. Of 1,180 hectare of the cultivated field in old Nishinasuno-machi in 1947, 26% (310 hectare) was paddy field, while 74% was other field (The Editorial Committee of the History of Nishinasuno-machi, 1963).

After World War II, in Nishinasuno-machi, the reclamation of rikuden was conducted rapidly because of the rise of rice price due to food shortage, the governmental encouragement of food production, the bettering of electricity supply, and the introduction of electric power water lifting machines with high efficiency. In 1959 the
area of paddy fields and *rikuden* became larger than that of the upland fields, and the paddy fields rose to 52.7% of the cultivated lands. In the 1960s the plain forests which all plantations, except Senbonmatsu Farm, had remised to individual farmers were turned into paddy fields. As a result, the upland fields and plain forests decreased rapidly, while paddy field increased greatly (Fig. 32). According to the 1985 Agricultural Census, paddy fields occupied 88.9% of 2,333 hectare of cultivated field in Nishinasuno-machi. By contrast upland fields and meadows occupied only 11.1%.

The percentage of the total of 1,298 farmers who earned the most income from rice was 84.5%, while only 5.0% of the farmers earned the most from dairy farming. Like in the old villages dairy farming was introduced after World War II, as a farmers' side work, along with the breeding foals for beef cattle (*Japanese Cattle*). Then the ordinary upland fields were gradually converted into permanent meadows.

Unlike upland farming, paddy farming does not demand much organic fertilizers because irrigation water contains trace element fertilizers and natural fertile supplies. Since upland fields were converted into *rikuden* or permanent meadows, wind erosion by Nasu-*oroshi* decreased. Through the change of farming type, a plenty of rice straw and cattle droppings became the source of organic
Fig. 32 Changes of area of the paddy field, upland field and plain forest in Nishinasuno-machi

Source: Annual Statistics of Tochigi prefecture
fertilizers, and every farmer came to necessitate less and less fallen leaves in the plain forests as a means to maintain soil fertility. In November, 1978, the farmers' Union of utilizing fallen leaves and wild grasses contracted with Senbonmatsu Farm dissolved. Thus the customary way of fallen leaves in the farm came to a close.

b The Management of Forestry in Senbonmatsu Farm

After World War II, Horai Shokusan LTD. managed Senbonmatsu Farm as a company, centering upon dairy farming and silviculture of the plain forests. In 1946 the company started dairy farming, bringing in 10 dairy cattle from Hokkaido, and began to produce raw milk. In 1949 it constructed the manufactory to make butter. In 1956 it quit using such domestic animals as horses to introduce farm tractors and cars. In 1961 the milk cows increased to 100 and they began to reclaim wider meadows to feed them. In 1965 when the number of cows reached 200, they opened much wider meadows to sell hay as forage to the Japan Society of Local Horse Races built in Niwatoko. In 1973 the number of cows became 300 and a recreational farm for tourists was opened. In 1985 the dairy cattle amounted to 350 and the area of cultivated fields and meadows reached 215 hectare.

On the contrary, the production of fuel wood in the

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plain forest, which had been one of their greatest income sources, decreased through "fuel revolution" since the 1960s, in which the demand of firewood rapidly decreased. At the same time, the plain forests of the union members gradually decreased. The farm, therefore, converted broad-leaved forests into coniferous forests. The cost for planting young trees was paid with the profit from the dairy enterprise.

Because the long custom of gathering the fallen leaves had made the forests extremely poor, they gave solid fertilizers to the forests to grow Japanese red pines. They also planted some Japanese cedars and hinoki cypresses in the proper places. The result was that the area of previously dominant broad-leaved trees such as red oaks, decreased. In place of them, Japanese red pine area occupied most parts of the forests (528.8 hectare), while the area of Japanese cedars and hinoki cypresses was 24.1 hectare (Fig. 33). After the period of the rapid economic development, Japanese red pines, which were about 40 to 50 years old, were sold to lumber dealers for high price as building materials, while the trees were still standing. Consequently, more Japanese red pines were annually and methodically planted than other tree species. Japanese cedars and hinoki cypresses were mostly planted since the 1960s, which are now young trees under the age of 20.
Fig. 33  Comparison of accumulating area of the plain forest by the tree species and age of stand in Senbonmatsu, Nishinasuno-machi (1975-80)

1. Japanese cedar and Hinoki cypress, 2. deciduous broad-leaved forest, 3: Japanese red pine

Source: The Planning report on the forest management in Senbonmatsu Farm (1975-80)
Japanese cedars and hinoki cypresses do not sell well all through Japan. Japanese cedar and hinoki cypresses of more than 61 years of age were planted as windbreak forests around farm buildings and cattle sheds. Most broad-leaved trees are planted in two-storied forest with Japanese red pines. Konara oaks are cut down in 15 to 25 years cycles for bed logs to grow shiitake. They are sold to the farmers within and outside the prefecture for the bed logs for shiitake.

It was difficult for the farmers in the old villages in Niwatoko to convert their plain forests into forestry lands, because the forests were small and the farmers had little capital. Nevertheless, in Senbonmatsu vast plain forests of 600 hectare were possessed by the single owner of Senbonmatsu Farm, and the profit of the dairy enterprise enabled them to plant seedlings. As a result Senbonmatsu Farm is one of the special cases that kept real estate brokers from purchasing the plain forests and succeeded in converting the forests into large-scale silvicultural lands, even though their forests lost the traditional function of farm forests, like the old villages at Niwatoko, after the period of the rapid economic development.
CHAPTER IV-2

IV-2 Changes in Traditional Uses of the Plain Forests in the Hitachi Upland

(1) Overview of the Study Area

The Hitachi upland is vast, at its west end the Omoi river flows and at its north end the Kuji river runs. Its breadth from east to west is about 90km and from the north to the south 60km. In the upland, there are streams which divide the upland into such smaller uplands as the Naka, Higashi-Ibaraki, Kashima, Namekata, Niihari and Inashiki. They are composed of a stratum of gravel, sand and clay of the Quarternary deluvium, on which the thick Kanto loam lies. There are extensive plain forests where pines are mainly planted, along with upland fields. There are a few red oaks and konara oaks which are conspicuous in the western districts of the Kanto plain, and in the inner districts Japanese red pines. In the littoral districts Japanese black pines are mostly seen. These plain forests had long played an important part as farm forests which provided upland farmers in the Hitachi upland with the materials necessary for farming and daily life. But, after World War II, especially after the period of the rapid economic development in the 1960s, the types of farming and the farmers' lives had to change on a great scale, and dependence upon the plain forests was considerably the
decreased. As a result, a large number of the plain forests came to be left unused with no utilization and management or to be sold for conversion into urban land uses. Among those changes new ways of land-use, though rudimentary, have come into existence. These have to do with the production of raw shiitake, in the Hitachi upland.

In this section, the uses of the plain forests as farm forests in the whole Hitachi upland area are surveyed with particular attention to comparing those before the period of rapid economic development with those after the period. Next, with Hokota-machi, Kashima-gun as an case study, the author examines trends in production of bed logs for growing shiitake, a new use of the plain forests.

(2) Traditional Uses of Plain Forests

1) Rural lives and the Gathering and Use of Materials for Agricultural production

The Hitachi upland is a diluvial upland of the Kanto loam, lacking in water retention. It has many rural communities mainly engaged in upland farming. The surface soil is the pale-colored Kuroboku soil consisting of the Kanto loam called Nopochi as the low fertility parent material, whose light soil is susceptible to wind erosion and in the wintertime to frost pillars. Furthermore, since
the soil is acid, has less humus and is full of active aluminum, the soil fertility is extremely low. Consequently, it is difficult to maintain the repeated use of the soil if the farmers do not use a lot of organic fertilizers on the farmlands just as in the case of the other diluvial upland fields in the Kanto plain. In addition to this, the crops there have been ones that yield a very high productivity when given farmyard manure and barnyard manure. They are grains such as wheat and barley, upland rice, miscellaneous grains and buckwheat; pulse crops; tubers like sweet potatoes and taros; and industrial crops leaf tobacco and peanuts.

The sweet potatoes cultivated in this district were not for food, but, for the most part, for the production of starch. Paddy rice farming was done, though on a small scale, in valley bottom, called yatsuda in the arborescent valley of the streams flowing through the uplands. The paddy fields in yatsuda were low in their productivity and limited in methods of management, and so the by-products such as rice straw were also limited in volume produced. Naturally, in the ages when chemical fertilizers were not popular, the farmers had to gather the fallen leaves and bottom grasses the plain forests yielded, and let them not so as to become usable as farmyard and barnyard manures. Sweet potatoes and leaf tobacco are called nae-hansaku or
nae-nanabusaku (half or 70% of the harvest is dependent upon seedlings), and these yields depend on the good seedlings grown in the nursery beds. The fallen leaves were the best heating material and where used in the beds in a great quantity. Since the pine leaves contain a lot of lignin and resin, their disintegration is more gradual than that of the fallen leaves of the broad-leaved trees. That was why they were widely used as heating material and manure-material in the nursery beds. The leaf tobacco cultivated there was mainly that of the flue-cured type (called Oshokushu) which requires firewood for curing and preparing of the leaves, and matsu-maki of Japanese red pines and Japanese black pines whose calorie power is higher than that of the other trees. As in the other rural communities in the diluvial uplands, the Kanto plain, so in the Hitachi upland the plain forests were important means of production attached to the upland fields. The farmers who had no plain forests were forced to use the plain forests of their relatives or acquaintances, and gather fallen leaves and bottom grasses. However, few cases of cash payment for their gathering rents were observed. But there existed a custom called shitakusa-kosaku which required the renters' labor during the busy farming seasons in exchange for gathering rights (Takatsudo, 1961).

In the Hitachi upland, in the wintertime, the farmers go
into the plain forests and engage in *yama-soji*, maintenance. First they pick up only the cogon grasses, which are the most important materials for roofage, leaving other herbs and grasses on the forest floor. Then, they collect dead twigs strewn on the floor, make weeding and brushing shrubs and herbs, and finally perform *Gashappa-sarai* (gathering fallen leaves). They brought those fallen leaves to their houses gathering fallen leaves with rakes (*kumade*), and putting them into big bamboo baskets which look very much like the *hachihon-basami* of the Musashino upland or tying them in the same nets, knit with straw ropes, like the *konoha-ami* in the Nasunohara upland. The quantity of the fallen leaves, though there are some differences according to the kinds of trees and ages of stands, is almost the same in all Kanto districts, namely, about 460kg (120 *kan*). Since leaf tobacco and sweet potatoes require fallen leaves as heating material in their nursery beds, they are more dependent upon the plain forests than other crops. Those fallen leaves which are used for the heating material are piled up in the manure sheds, and used again as farmyard manure for wheat and barley of the winter crop. Consequently, it is said that, in maintaining agricultural reproduction, in the pre-World War II days before extensive use of chemical fertilizers and electric hot-beds, the farmers were required to own as much as area of plain
forests equal to that of the planted area of field crops.

Another important task, just like the gathering of fallen leaves, was getting fuel wood in the plain forests. The self-supplied fuel of the farm households was wood obtained through the thinning of the plain forests (Nukigiri), dead twigs collected at the time of yama-soji, and shrubs and pine leaves gathered by weeding and brushing. In the Hitachi upland in particular, pruning of Japanese red pines was done as much as possible, so that the farmers might secure self-supplied fuel. There were many undergrown Japanese red pines called Sangaimatsu, whose living branches extended only from the tree crown to the third branch. Not only pruning, but thinning was done very frequently, so that the stumpage density of the plain forests was straggling (Ibaraki Prefectural Guidance Center of the Forest Management, 1960).

In addition to fuel for the home, the farm households managing leaf tobacco, as mentioned above, needed a great quantity of pine firewood for curing and preparing. Pine firewood was also in great demand, as much in demand as for the fishing boats in the littoral districts. Yama-mochi who own vast plain forests sold the trees to the merchants for fuel wood as they stood. The plain forests of pine trees, predominant in the eastern parts of the Kanto plain, seem to have been planted. In the districts where waterways were
available, the planting of Japanese red pines had been regularly carried out to provide for building wood ever since the Edo period. Especially, in modern times, the feudal government of Mito-han encouraged the farmers to plant Japanese red pines (Matsumura, 1978). Msatsu-maki and kurozumi (black charcoal) called Sakurazumi, which was produced from the raw wood of red oaks and konara oaks, were brought to Edo by the Tone waterway of from the Edo period on. Pine firewood produced in Hitachi-no-kuni (mostly the present Ibaraki prefecture) in 1887, made up 70% of the income from firewoods in the Tokyo markets, and the Sakurazumi of Ibaraki prefecture about 7% (Kimura, 1970). The production of firewood and charcoal in Ibaraki prefecture, however, precipitously decreased at the end of the Taisho period.

The Hitachi upland is diluvial and covered with the Kanto loam with low soil fertility, which is high and dry, lacking in water retention, and short of soil moisture, so that it is not always a suitable land for growing Japanese cedar and hinoki cypress. Nevertheless, in forests of Japanese red pines, which grew fully in 15 to 20 years, "two-storied" forestry method had been practiced from early times for growing Japanese cedar and hinoki cypress making use of Japanese red pines as protection trees. Using the same method, the forestry of Sanbu in Chiba prefecture.
prospered in the Edo period, but it was an exceptional case of growing Japanese cedar in the Kanto plain. Through the practice of "two-storied" forest, the farmers owning the plain forests in the Hitachi upland have grown large Japanese cedars and hinoki cypresses, though on a small scale, as reserve forests in preparation for unexpected expenses such as marriages, funerals and other ceremonial occasions. The author's interviews indicate that since those trees were sold as they stood on the plain, and did not require much labor, even the gigantic cedars and cypresses, it was easy for the farmers to cut them down and cheap to send them to the market. As a result the farmers' income was said to be very high.

2) The Use of Rearing Forests for Growing Wild Silkworms and the Use of Shifting Fields

As a special use of the plain forests, there was the growing of wild silkworms. By wild silkworms we mean silkworms which are left free and in the open in the plain forests of red oaks and konara oaks, these are different from the domesticated silkworms given mulberry leaves indoors. They are divided into two kinds, Tensan (Antheraea yamamai) and Sakusan (Antheraea pernyi).

In the middle of May the silkworm eggs are tied to the
branches of red oaks or konara oaks; this is called Yamatsuke. When hatched, the wild silkworms grow up eating the leaves of the trees, and cocooning at the end of July and the beginning of August, at which time the cocoons are harvested one after another. The textile of the wild silkworm is very difficult to dye, and so when woven with the ordinary silk yarn and dyed, the wild-silkworm part of the yarn remains white, which makes the cloth a unique one. The textile manufactures in the Yuki district in the prefecture bought wild silkworm cocoons at high prices, and wove a high-class cloth called Yuki-tsumugi, mixing in parts of wild-silkworm yarn with the woof.

The Meiji government included wild silkworm sericulture in their the increase-of-production and promotion-of-industry policies, and encouraged it to shizoku as a shizoku-jusan-jigyo^{71} (Ichikawa, 1978). Wild silkworms were mostly raised in the three gun — Higashi-Ibaraki, Nishi-Ibaraki and Makabe — where there were a comparatively large number of red oaks and konara oaks stands. According to the Annual Statistics of Ibaraki Prefecture, in 1903, 14 farm households raised wild silkworms. This was largest in record, but after 1921 neither the farm households raised wild silkworms nor the amount of production were seen in the statistics (Fig. 34). As rearing wild silkworms was done outside, it was very
Fig. 34 Changes in number of farm households rearing wild silkworms and yield in Ibaraki prefecture (1889-1921)

Source: Annual statistics of Ibaraki Prefecture in 1890-1922
liable to be influenced by climatic conditions, and there were various natural enemies such as insects, birds and snakes. Since the silkworms were easily afflicted with silkworm disease, and difficult to keep, the difference between a rich harvest and a poor one was as large as shown in Fig. 34. Furthermore, it required much labor to gather the cocoons, so that the business did not spread widely except for in the Shizoku-jusan-jigyo, though some people tried with the intention of speculation.

In addition to the immediate uses of the plain forests such as collecting forest products and rearing wild silkworms, they had a function and significance as a possible way to extend the agricultural lands of the farmers in the Hitachi upland. They used to reclaim the plain forests as shifting fields, called kirikaebata, where they cultivated upland rice and pulse crops, and then, when the fields lost their soil fertility, the farmers planted there Japanese red pines and changed them into plain forests (Table 18). The land use of the shifting fields, that is, the rotation of the plain forests and upland fields has continued till recent times. This system played a part as a "control function" to keep the scale of farming size in proportion to the labor power in the family. When a farm household had enough labor, they reclaimed the plain forests as farmlands, and, on the other hand, in case of less
### Table 18  Conversion of plain forests into farmlands (1903~72)

<table>
<thead>
<tr>
<th>Year</th>
<th>Area converted to farmland</th>
<th>Area returned into plain forest</th>
<th>Ratio of returned area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1903~1911</td>
<td>19,237</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1912~1925</td>
<td>14,143</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1926~1930</td>
<td>2,949</td>
<td>5,243</td>
<td>177.8</td>
</tr>
<tr>
<td>1931~1935</td>
<td>5,323</td>
<td>1,738</td>
<td>32.7</td>
</tr>
<tr>
<td>1936~1940</td>
<td>8,651</td>
<td>1,039</td>
<td>12.0</td>
</tr>
<tr>
<td>1941~1945</td>
<td>3,663</td>
<td>2,087</td>
<td>57.0</td>
</tr>
<tr>
<td>1946~1950</td>
<td>15,794</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1951~1954</td>
<td>1,770</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1956~1960</td>
<td>1,197</td>
<td>17</td>
<td>1.4</td>
</tr>
<tr>
<td>1961~1965</td>
<td>2,243</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1966~1970</td>
<td>4,401</td>
<td>314</td>
<td>7.1</td>
</tr>
<tr>
<td>1971~1972</td>
<td>831</td>
<td>349</td>
<td>42.0</td>
</tr>
</tbody>
</table>

*Source: Table 2-7 Conversion of plain forests and their return in Ibaraki Pre. : Forestry Agency (1984, p.89)*
available labor, the farmlands were changed to plain forests.

(3) Changes in the Use of the Plain Forests after the Period of Rapid Economic Development

In the 1960s, when the period of rapid economic development began, with the improvement in economic conditions and the standard of living, the gathering of materials for living such as cogon grasses for roofage and fuel wood was brought to an end in the plain forests. In particular, the so-called "fuel revolution" came to Japan, and fuel wood and charcoal were replaced by kerosene, propane gas and electricity, so that the ways in which forest products were consumed greatly changed. Consequently, the demand for fuel wood, not only for the daily needs of the farmers, but for the markets in Tokyo was remarkably decreased.

The type of farming changed from labor intensive farming for the self-support of families to capital intensive farming for production of commercial products. Of necessity, such self-supplied fertilizers as farmyard and barnyard manure were replaced by chemical fertilizers and agricultural chemicals; mechanization came to farming, and many farmers came to rely on income from other jobs. In the
Hitachi upland, the plain forests were converted into the chestnut orchards and others (Oyagi and Ishii, 1980), *rikuden* (Ishii and Yamamoto, 1987), and to protected horticulture and pig raising (Uchiyama and Ueno, 1980). In this way, the farmers came to choose many kinds of crops. Generally speaking, the gathering of fallen leaves are still practiced by the limited number of farmers who, in spite of the decrease in the area planted for leaf tobacco and sweet potatoes for starch, continue to cultivate traditional crops. The cultivation of leaf tobacco is less dependent upon the plain forests, for the electric heating hotbeds have been introduced into the cooperative raising way of seedlings, and heavy oil is used for the curing and preparation.

In the Sowa and Yachiyo districts in the western part of the Hitachi upland, and in the Kashima district in the eastern part, intensive horticulture has been done since the 1970s. Since Chinese cabbages, melons and water-melons are mainly planted in these districts, nursery beds are required; fallen leaves are still made use of for heating material. The fallen leaves gathered in the plain forests are mostly for heating materials in the nursery beds, and not for the farmyard manure owing to the spread of chemical fertilizers. That is to say, the fallen leaves used in the nursery beds are turned into farmyard manure, but the
gathering of the fallen leaves for the sole purpose of making manure was given up in the middle of the 1960s (Fujii, 1981). Though it is necessary to use organic fertilizer on the farmlands so as to prevent replant failure, pig feces and poultry manure came to be increasingly used instead of fallen leaves.  

When the uses of reproduction materials in the plain forests were given up and yama-soji given up, many plain forests were laid waste, along with the luxuriant growth of bottom grasses, *Phyllostachys chino* Makino called "Azumanezasa." Left waste in this condition, the plain forests of pine trees were infected by the pine wilting disease called *Matsukuimushi-higai*, caused by the pine wood nematode (*Buraphelenchus lignicolus*) in 1978 and 1979, and 1,450,000 m³ of forest were blighted in the eastern and the southern part of the prefecture, and the devastation of the pines plain forests became more serious (Ibaraki Prefecture, 1981, pp.110-121). Although these infected areas were partly converted into grounds for rearing Japanese cedars and *hinoki* cypresses, mulberry fields and chestnut fields, most of them were left un-cared for, with no appropriate management and afforestation.

Because of the local people's shortage of capital, and a lack of communication of facilities, Ibaraki prefecture has been behind the others in the capital area both in
urbanization and industrialization (Sakurai, 1960). After the middle of the 1960s, however, large scale development undertaken, such as the Kashima Coastal Industrial Region and the Tsukuba Academic Town. The plain forests left unused were exploited for these large-scale national projects. The plain forests, compared with the farmlands, are easy to convert with fewer serious legal problems and no need for substitution lands in the case of purchases. Moreover, the land area in one lot of plain forest is larger and comparatively cheaper in price than farmlands. Since a vast area can be easily converted at one time, the plain forests became the main objects of land-purchases. In 2,683 hectare, the total exploited area of Kashima Coastal Industrial Region, that of plain forests is 739 hectare, that is, 27.5%. In all the area, 1,803 hectare, of the Tsukuba Academic Town, the plain-forest area is 1,008 hectare, 55.9%. The grounds of the 1985 Tsukuba International Exposition was 232 hectare, in which 85 hectare, 36.6% was that of plain forests (Forestry Agency, 1985).

Ever since this large-scale development, urbanization and industrialization have greatly increased mostly in the southern and coastal parts of the prefecture, which are located near the capital regions, and necessarily the plain forests have been greatly encroached upon. As explained in
Chap. II-(3)-2), 84.8% of the converted forest land area is the plain forest land. 65.4% of the plain forests was converted into residential and industrial sites, recreational grounds like golf courses; the conversion to farmlands was 34.6%. Nevertheless, the conversion of plain forests to farmlands in one capital and six prefectures in the Kanto plain is 21.5% on the average, and, therefore, in Ibaraki, the percentage of the conversion to agricultural uses is comparatively high. When the author examines the situation in conversion to urban land uses in every village and town, many plain forests in every village, town and city in the Hitachi upland were converted to farmlands, more than in other uplands (as shown in Fig. 4 in Chap. II). The plain forests are, for the most part, converted to rikuden, which have prevailed intensively since about 1965, and into such things as chestnut orchards. According to Ishii and Yamamoto (1987), rikuden have rapidly appeared since about 1965, in the Hitachi upland and its neighboring uplands, and in 1978 the whole area was 14,000 hectare, which was the peak of the conversion. Since then, however, the policy restricting rice production has been enforced in the paddy fields including rikuden, and the exploitation of the new paddy fields is under strict control; naturally rikuden have come to be on the decrease.

Examining the urban land-uses, such a large-scale
construction of houses has been put into practice in the
districts along the Joban Line, and the areas neighboring
the interchanges of the Joban Express Highway and Higashi-
Kanto Express Highway, and those regions have increasingly
been changed into commuter bed-towns for Tokyo. 30% of
them are residential sites converted from plain forests;
17% is for public uses, 12% for industrial sites and 6.7%
for recreational facilities such as golf courses. Since the
number of golf courses were excessive in the latter half of
the 1960s, after 1974 Ibaraki prefecture enforced a policy
to check the increase.

As the plain forests have been cleared in response to
the demands of urban-land uses, the land price of the plain
forests has become remarkably high in recent years. This is
especially true of the land price of the plain forests in
the southern and western parts of the prefecture, which have
very good transportation links with the capital region, is
as expensive as that of home lots. As the land prices soar,
the farmers who own the plain forests have a greater
tendency to evaluate them as land capital much. The rise in
the price of plain forests land has made the inheritance
taxes extremely high. As a result, even the farmers who
gather fallen leaves in the plain forests for producing
farmyard manure, are forced to divide the plain forests into
smaller lots, and sell them in order to pay inheritance
When the farmers are obliged to sell their plain forests to real estate brokers, many of them tend to sell the forests to brokers living in outside of the prefecture. The brokers, who buy the divided small plain forests lots, partition them into much smaller lots for sale, so that, of late, non-resident landowners from outside the prefecture are on the increase. Since those non-resident landowners are mostly non-farmers who buy the plain forests for speculation, the devastation of the plain forests is proceeding more rapidly than ever. The devastated plain forests become places for throwing away garbage and waste, or dangerous place with a high sequence of crimes and fires. Furthermore, they are the causes of impediment to the administration in each executive village and town, in planning and carry out of the exploitation, collecting various obligation to be borne, and accepting the increasing procedures of registration (Hayashi, 1974).

(4) The Use of Plain Forests to Produce Bed Logs for Growing Shiitake

1) The Production of Shiitake and the Expansion of production areas in Ibaraki Prefecture

In the period of the rapid economic development after 1965, the production of shiitake rapidly expanded in Ibaraki
prefecture. Ibaraki production was ranked second to Gunma prefecture after 1969. In 1985, the production was 6.1% of national production, that is, 4,650t, and the value of production amounted to about 5,000,000,000 yen. The production of shiitake, which is different from dry shiitake, is centered upon such prefectures as Gunma, Ibaraki, Tochigi and Fukushima, which are located near the great consumer capital Tokyo, and it is in an advantageous position for transport of shiitake there (Fig. 35).

Shiitake has long been cultivated in Ibaraki prefecture, though on a small scale, in the mountainous regions such as Abukuma and Yamizo mountain lands, with have low temperatures and much rain and are suitable for the growth the hypha of shiitake. With the betterment of the family diet in the period of rapid economic development after the 1960s, producers of shiitake have appeared in all the districts of Ibaraki prefecture, for the ordinary citizens purchase more shiitake than before and its market price has been favorable (Fig. 36). In the Hitachi upland, the number of producers and production are conspicuously on the increase.

In 1968 the farmers cultivating shiitake in Ibaraki prefecture were, 10,719, the largest number. After that the number of producers gradually decreased, but production increased by 1980, and has held steady. This can be
Fig. 35  Amount of raw Shiitake production in Japan (1985)

Source: Statistics and Information Department, Ministry of Agriculture, Forestry and Fisheries (1986)
Fig. 36  Distribution of areas producing raw Shiitake in Ibaraki prefecture (1982)

1. mountain forest region, 2. boundary between the plain forest regions and the mountain forest regions,
3. boundary of districts
Source: Forestry Administration Section, Ibaraki Prefectural office (1983)
Fig. 37 Changes in numbers of farm households producing raw Shiitake by bed log number in Ibaraki pre. (1965-85)

Source: Forestry Administration Section, Ibaraki Prefectural office (1983)
explained, if we examine changes in the scale of management, where small-scale producers with less than 600 bed logs have decreased and those with more than 10,000 bed logs have increased (Fig. 37).

2) The Increase of Shiitake Products in Hokota-machi

Hokota-machi is located in the eastern central part of Ibaraki prefecture and on the north side of Lake Kitaura, and a part of the town is on the Pacific. Most of the whole area of the town, 1,337 hectare, is in the Namekata and Kashima uplands which are parts of the Hitachi upland. Since the Hokota river flows through the central part of the town, and the Tomoe river on the west side, there are ill-drained paddy fields at the valley bottoms along the two rivers. Surveying the land-uses according to a classification of the lands in Hokota-machi, in 1985 the paddy fields (lowland fields and rikuden) were 11.1% of the whole area of the town, the upland fields 36.1% and the plain forests 30.6%. As the paddy rice farming at the valley bottoms was low in productivity, the farmers had been dependent mostly upon the production of barley and wheat, upland field rice, and sweet potatoes for starch and peanuts, which are upland field crops, till the 1960s, and necessarily those districts had been the typical example of
unstable economies in upland farming regions in the Hitachi upland (Tabayashi, et al., 1984). In 1970 three farm households in the Nodomo settlement in the south-western part of the town began to cultivate *shiiitake*. In the beginning, they began with about 1,000 bed logs cut down in their own plain forests. Then the cultivation was in a small scale extensive open culture, dependent upon the natural growth in both spring and autumn, but, later, with the progress of cultivation techniques and the development of suitable varieties, it was possible to get bed logs easily, to work over wider periods, for instance, for spawning and to regulate the degree of operation. Consequently, *shiiitake* cultivation has the advantage of allowing the farmers flexibility in their work, and the wholesale price in the market has risen, so that it cultivation can be done with other crops in a type of diversified farming (Japan Kinoko Research Center, 1986). In Nodomo, and the settlements in the south-western part of the town, more and more farmers have come to undertake *shiiitake* production as one of their diversification.

With the increase in cultivation of *shiiitake*, more farmers have enlarged the scale of their operations by purchasing bed logs in a great quantity. Nevertheless, in the north-eastern part of the town the production of *shiiitake* is limited, because the development of *rikuden* has
been going on in the uplands, and many farmers are doing protected horticulture such as melons and strawberries (Yamamoto et al., 1985). The number of part-time farmers has gradually been on the increase in Hokota-machi since March, 1985, when the Kashima Line was opened, but the ratio of shugyo-noka is rather high, that is, 68.2% in 1985.

By examining the methods of shiitake-producing farmers' operations in Hokota-machi in Table 19, we can see that the income from shiitake is more than 80% of theirs, but the specialists with more than 30,000 bed logs comprise only 6% of the total number of farmers. The farmers with diversified farms are mixing the production of shiitake with the upland farming of edible burdocks, Chinese yams and mitsuba (cryptotaenia japonica Hassk), and paddy rice cultivation in at the valley bottoms. The farmers with more than 10,000 bed logs mainly produce shiitake, and those with less than 10,000 bed logs do shiitake-production secondarily. The farmers, both special producers, and diversified managers, are doing year-round cultivation and shipping. The farmers, to whom shiitake production is secondary, cultivate and ship shiitake to the markets when they don't have to work very much on the other main crops. The farmers cultivating shiitake for their own food or for speculation make up about half of all farmers, and they have fewer than bed logs.
**Table 19** Types of management of farmers engaged in raw shiitake production (1988)

<table>
<thead>
<tr>
<th>Type of management</th>
<th>Number of owned bed log</th>
<th>Number of farm household</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mono-production</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiplex production</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shiitake production as the main production</td>
<td>10,000~30,000</td>
<td>16 (16.5)</td>
</tr>
<tr>
<td>Shiitake production as a sub production</td>
<td>1,000~10,000</td>
<td>28 (28.9)</td>
</tr>
<tr>
<td>Home consumption production</td>
<td>less than 1,000</td>
<td>47 (52.5)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>97 (100.0)</td>
</tr>
</tbody>
</table>

Unit: (%)

Source: the author's field survey and interviews in July, 1988
The bed-log laying lots are mostly natural ones set in the plain forests. Less than half of the farmers use the plain forests of their own possession, and the other farmers are forced to rent the plain forests as bed-log yards. Generally the area of the bed-log yard is 10 to 30 are wide, and many farmers usually have more than two bed-log yards in case of sick soil and other problems. The lots were in the pine plain forests in Hokota-machi and other Hitachi upland districts in most cases, but, since the pine wilting disease appeared in 1974 and 1975 and blighted most of the pines, it is difficult to use those plain forests as bed-log laying lots. Accordingly, the farmers, who had planted Japanese cedars and hinoki cypresses as two-storied forests, moved their lots to those forests. Since the farmers, who had not cultivated Japanese cedars and hinoki cypresses, could not help renting such forests from the other farmers for their beds, many farmers have rented their log yards from others since the spread of the pine wilting disease. The author's interviews indicate that the plain forests of pine trees were most suitable as bed-log laying yards from the standpoint of light, ventilation and humidity, but many farmers complain that it became difficult to cultivate shiitake in the forests of Japanese cedars and hinoki cypresses, because they did not maintain enough light and satisfy the other conditions. In 1985, nine producers, in
collaboration, in Nodomo made a 990m² artificial bed-log laying lot in a plain forest of Japanese red pines with the help of a subsidy from the prefecture.

The material for the bed logs for shiitake cultivation is generally konara oaks and red oaks, and in Hokota-machi and its neighboring communities 80% of the material is konara oak and 20% red oak and other trees. According to interviewed producers, red oak produce shiitake of a high quality, but is easily infected with the germs and not so good for the beds, and konara oak, compared with red oak, is easily to cultivating shiitake.

The materials for log beds in Hokota-machi are mostly purchased, and those which were felled in privately owned plain forests were 1,000 logs and were the use of only one farmer. In the case of materials in private plain forests, it is possible to grow the trees in cycles of 15 years for felling. But because of the shortage of labor for cutting, and the problems caused by irregularity of the tree species and their thickness, many producers depend upon purchased materials. Those log materials are from Tochigi and Fukushima prefecture for the most part, and their length is 90cm, with a diameter of 10 to 15cm, and the price of one log is 164 yen in 1988. Since, the beginning of the 1970s when the production of shiitake was started, the demand for fuel wood has greatly decreased; the material logs were
easily and cheaply obtained. However, as the production, of *shiitake* was on the increase in Tokyo metropolitan regions, it became difficult to get the materials for the bed logs. Many farmers worry about expenses for the material logs, because the price has been rising by two to five yen every year. Nevertheless, few farmers want to raise the material logs in their own plain forests which are left un-cared for at present.

Fig. 38 shows the distribution of places where the material logs for *shiitake* were produced in the Kanto Plain in 1980. As shown in this Figure, most of the production areas are villages, towns and cities situated in the mountainous regions, and in the plain-forest districts except for Ibaraki and Chiba prefectures, few material logs are produced.

Even in Ibaraki prefecture, the ratio of material logs produced in the forests in the mountains and the privately owned plain forests of the farmers' own possession in the prefecture is on the decrease, and many districts such as Hokota-machi depend on material logs from outside of the prefecture. In 1985, the average degree of dependence of all the prefectures was 45.4%, but situations differ greatly from place to place (Table 20). In the north part of the prefecture where Yamizo mountain land is located, the ratio of dependence upon the material of other prefectures is
Fig. 38  Distribution of areas producing bed logs in the Kanto region (1980)

1. mountain forest region, 2. boundary between the plain forest region and the mountain forest region

Table 20  Source of bed logs by districts in Ibaraki prefecture (1985)

<table>
<thead>
<tr>
<th>District</th>
<th>From self-owned forests</th>
<th>In Ibaraki prefecture</th>
<th>From other prefectures</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern part</td>
<td>636,900 (15.5)</td>
<td>3,041,000 (74.1)</td>
<td>425,400 (10.4)</td>
<td>4,103,300 (100.0)</td>
</tr>
<tr>
<td>Eastern part</td>
<td>1,000 ( 0.1)</td>
<td>59,500 ( 7.4)</td>
<td>744,400 (92.5)</td>
<td>804,900 (100.0)</td>
</tr>
<tr>
<td>Southern part</td>
<td>81,100 ( 3.6)</td>
<td>242,500 (10.7)</td>
<td>1,952,100 (85.8)</td>
<td>2,275,700 (100.0)</td>
</tr>
<tr>
<td>Western part</td>
<td>115,000 (11.5)</td>
<td>293,700 (29.3)</td>
<td>594,000 (59.2)</td>
<td>1,003,200 (100.0)</td>
</tr>
<tr>
<td>Total</td>
<td>834,500 (10.2)</td>
<td>3,638,700 (44.4)</td>
<td>3,715,800 (45.4)</td>
<td>8,187,100 (100.0)</td>
</tr>
</tbody>
</table>

Unit: ( % )

Source: Forestry Administration Section, Ibaraki prefecture (1986)

Note: Distribution of the districts is shown in Fig. 36.
10.4%, which is very low. This is because the existing national forests offer material logs to the farmers there. On the other hand, in the plain forest districts, the eastern districts are 92.5% dependent upon material logs from outside the prefecture, and in the southern part of the prefecture 85.8%. The ratio of dependence upon other prefectures is remarkably high. In the western part of the prefecture within the Tsukuba mountain system, the ratio is less than the above districts, about 60%.

It is difficult to grasp an accurate picture of the processes through which the farmers secure their material logs, because they buy quite a few privately, except those which they obtain through the shiitake Union and Farmers Cooperative Association. In the author's interviews at the Forestry Administration Section of Ibaraki Prefecture it was estimated that the material logs from the other prefectures came to about 60% from Fukushima, 30% from Tochigi and the remaining 10% from the other prefectures, they guess.

3) The New Utilization of the Plain Forests Through the Production of Materials for Bed Logs

Although the price of the bed logs for growing shiitake in Ibaraki prefecture is 150 to 180 yen for each one, it has been rising annually. At present, bed logs amount to about 60% of all the production cost for growing shiitake.
(Hayashi, 1983). It is necessary to provide the material logs steadily and cheaply. Consequently, the dependence upon material logs from other prefectures like the producers in the plain forest districts is so high, and it is expected that operation will be difficult to continue because of the high price of the material logs caused by their scarcity. It is becoming absolutely necessary for the shiitake-producers to increase the ratio of self sustaining production of material logs.

Some plain forests of pine trees are left unused because of damage from pine wilting disease, and are not converted into farmlands and the beds for growing seedlings, these are becoming forests of red oaks and konara oaks; many are harmed by excessive growth of Azumanezasa. If those forests are appropriately managed and cared for, they can possibly be turned into the forests for growing the materials of the bed logs.

In Table 21, the production cost and earnings (per one hectare) are tentatively calculated when the material for the bed logs (konara oaks) is grown in the plain-forest districts. In the first forest 3,000 seedlings of konara oaks are planted in one hectare, with weeding and brushing, fertilizing, improvement cutting and vine-cutting being performed, and in 20 years they are cut. The cost for site preparation and growing seedlings is about 720,00 yen;
Table 21 Aforestation cost of bed logs (konara oak) for shiitake per one hectare and forecast of cost and income in the plain forest region in Ibaraki prefecture (1987)

<table>
<thead>
<tr>
<th></th>
<th>1st generation: afforestation</th>
<th>2nd generation: sprout regeneration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seedlings: 3,000</td>
<td>Number of stubs: 2,500</td>
</tr>
<tr>
<td></td>
<td>Cutting age: 20 years</td>
<td>(double bush training)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cutting age: 15 years</td>
</tr>
<tr>
<td>Forest management cost</td>
<td>Item</td>
<td>Investment</td>
</tr>
<tr>
<td></td>
<td>1st year</td>
<td>715,000</td>
</tr>
<tr>
<td></td>
<td>2nd-19th year</td>
<td>496,850</td>
</tr>
<tr>
<td></td>
<td>20th year</td>
<td>425,600</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>1,637,450</td>
</tr>
<tr>
<td></td>
<td>Gross profit</td>
<td>Selling bed logs 3,000,000</td>
</tr>
<tr>
<td></td>
<td>Net profit</td>
<td>1,362,550</td>
</tr>
</tbody>
</table>

Source: Ibaraki Prefectural Forestry Experiment Station (1988)

Note:
1) 2,500 stumpages per 1 hectare in the newly-planted forest, and 3,360 stumpages per 1 hectare in the sprout regeneration forest are obtained.
2) 8 bed logs are obtained from 1 stumpage. A bed log is 90cm in length with the diameter of 10 to 15cm. 20,000 (8 × 2,500) bed logs in the newly-planted forest, and 26,880 (8 × 3,360) bed logs in the sprout regeneration forest are obtained.
3) Estimating 1 bed log at 150 yen, gross profit from the sale is 3,000,000 (150 × 20,000) yen in the newly-planted forest, and gross profit from the sale is 4,032,000 (150 × 26,880) yen in the sprout regeneration forest.
weeding and brushing, fertilizing, improvement cutting and vine-cutting 500,000 yen; and cutting trees, pruning, bucking and log hauling 430,000 yen. 2,500 stumpages per one hectare are obtained, and 20,000 bed logs are obtained in all, for 8 bed logs can be secured from one stumpage. Estimating one log at 150 yen, the gross profit from the sale is 3,000,000 yen. Deducting the money spent in the process, the net profit is 1,360,000 yen. In the second generation forest, two stumpages are grown from 1 root by natural regeneration by shoots of the first generation forest. After silviculture such as the arrangement of the branches and sprouts, weeding and brushing, and fertilizing, they are cut in 15 years. The cost used in 15 years is 1,010,000 yen. The stumpages, possible to be cut, are 3,360 per 1 hectare, so that the profit from selling 26,880 material logs is 4,030,000 yen. When the money expended is deducted, the net profit is 3,000,000 yen. Considering the third generation forest to be the same as the second one, in the production cost and profit, the total sum of the three sales in fifty years is 11,060,000 yen, the total production cost is 3,670,000 yen. Consequently, a profit of 7,400,000 yen is expected.

On average in the north Kanto area in 1985, in the artificial forests of Japanese cedars over a cutting cycle of fifty years, the forest management cost is 1,570,000 yen,
the cost for cutting 3,600,000 yen, and the final cutting income with no thinning income 6,860,000 yen; then the final profit is 1,690,000 yen \(^{76}\). In comparison with this, considering the present price of Japanese cedars, the afforestation of bed logs for shiitake is higher in the income than that of Japanese cedars. Afforestation of bed logs for shiitake in the plain-forest districts is significant, as a new utilization of the plain forests. The shiitake producers, depending upon material logs from other prefectures, can grow their own material trees in the plain forests, and secure their own material logs. As shown in Table 22, 106 hectare were afforested for bed logs (konara oaks) for 8 years, 1981 to 88, in the forest areas in Ibaraki prefecture. They were not afforested with private expenses, but with subsidies from the prefecture and national government. Although they are at a rudimentary stage, the new utilization of the plain forests as afforestation of bed logs for shiitake will be spread, and the plain forests, which are left unused, will be preserved and have a new importance.
Table 22 Changes in aforesation area of bed logs for mushrooms in Ibaraki prefecture (1981~87)

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsidized forestation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ordinary forestation¹</td>
<td>512</td>
<td>65</td>
<td>206</td>
<td>155</td>
<td>595</td>
<td>716</td>
<td>482</td>
<td>2,736</td>
</tr>
<tr>
<td>Independent prefecture-operated forestation²</td>
<td>-</td>
<td>27</td>
<td>25</td>
<td>-</td>
<td>42</td>
<td>203</td>
<td>127</td>
<td>424</td>
</tr>
<tr>
<td>Forestry settlement projects³</td>
<td>526</td>
<td>1,581</td>
<td>1,040</td>
<td>1,584</td>
<td>808</td>
<td>558</td>
<td>432</td>
<td>6,529</td>
</tr>
<tr>
<td>Unsubsidized self forestation</td>
<td>-</td>
<td>500</td>
<td>400</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>900</td>
</tr>
<tr>
<td>Total</td>
<td>1,038</td>
<td>2,173</td>
<td>1,671</td>
<td>1,739</td>
<td>1,445</td>
<td>1,477</td>
<td>1,041</td>
<td>10,589</td>
</tr>
</tbody>
</table>

Source: Forestry Administration Section, Ibaraki prefectural Office(1988)

Note: 1) The ratio of national subsidy is 3.2/10~9.35/10.
2) The ratio of prefectural subsidy is 4/10.
3) This project gets a national subsidy; 5/10 and prefectural subsidy; 1/10.
CHAPTER IV-3

IV-3 Consideration

The author has examined the uses of the plain forests in the fringe area of the Kanto plain, taking up, as the subjects of the area study, the Nasunohara and Hitachi uplands. After making clear the traditional land-uses in each area, the author has speculated upon the current situation and the present uses of the plain forests, making the former uses the standard of consideration, in connection with the changes in social economy after the period of rapid economic development. As a result, the following items are to be explained in a clear perspective:

1. The plain forests in the outskirts districts of the Kanto plain had been used as farm forests where the farmers gathered the materials for agricultural production and use in their daily life, and closely connected with the farmers, livestock and farmlands, by the period of the rapid economic development (Fig. 39-B). In the upland farming rural communities in the upland, whose parent soil was the Kanto loam with low soil fertility, the fallen leaves, which were the main materials for the farmyard and barnyard manures given to the farmlands, were very important in the farmers efforts maintain upland farming. Accordingly, a great quantity of fallen leaves was indispensable for the heating material of the nursery beds.
Fig. 39 Changes in plain forest use in the outskirts of the Kanto Plain
of leaf tobacco and sweet potatoes, which had largely been cultivated in the rural communities of the outskirts districts as a source of cash income. Not only the fallen leaves, but other materials were obtained for daily life such as firewood for fuel, timber, cogon grasses for roofage, mushrooms for food and medicinal herbs. In the Hitachi upland in the eastern part of the Kanto plain, with so many plain forests of pines, the pine firewood was used not only for fuel at home, but quite a quantity of it was hauled to the markets in Tokyo, by the end of the Taisho period, as a source of cash income for the farmers who owned the plain forests. Furthermore, in the Hitachi upland, one saw the use of shifting fields and rearing forests of wild silkworms, which were not found in the other suburban districts of the capital. In a word, in the days before the period of rapid economic development, there had been many uses of the plain forests as farm forests. The period when the plain forests were used was centered upon the wintertime when the fallen leaves and fuel wood were collected, summer and autumn were times to gather mushrooms and the summertime also was a time for rearing forests of wild silkworms. The farmers felled the plain forests of pines in a cycle of 20 to 30 years to get firewood, and reclaimed them by reforestation.

2. After World War II, especially after the period of the
rapid economic development beginning in the 1960s, the amount of plain forest use greatly decline in the outskirts districts. In particular, the nation-wide fuel revolution and commercial economics brought a decline in the use of gathering the materials for life in the uplands as in the urban fringe of Tokyo. In the rural communities in the outskirts districts, in making use of the land resources, which were comparatively larger than those in the suburban districts, the type of farming changed from labor-intensive farming with sole intention of cultivating crops for self-consumption into capital-intensive farming to produce crops mainly for the markets. Along with this change, the degree of dependence upon materials for reproduction was necessarily changed. As a result, method of utilization of the plain forests in the outskirts districts was changed into three types of usage such as B1, B2 and B3 in Fig. 39.

3. B1 is to be seen in the intensive horticultural regions which have appeared in some limited areas since the period of rapid economic development, and in the districts where the traditional cultivation of leaf tobacco has continued. The farmers in these districts go on gathering the fallen leaves necessary for the vegetables and the heating materials in the nursery beds for leaf tobacco farming.
In B1, which is very much like A1 type in the suburban districts of Tokyo, shown in Chap. III since it became possible to obtain organic fertilizers, which had taken the place of farmyard manure, as well as chemical fertilizers, gathering of the fallen leaves mainly for producing farmyard manure decreased. The plain forests are still closely connected with the upland fields by the gathering of fallen leaves principally for use as heating material in the nursery beds. B2 is the type of use, which is widely seen in the outskirts districts, and which are observed by the farmers in the districts where such kinds of farming as livestock, orchard farming and rice farming in rikuden are being carried on. In these districts, compared with the upland field farming, the balance of the organic matters has come to be easier to keep in the management of the farmers and in the districts. At the same time, the dependence upon chemical fertilizers and agricultural chemicals has become greater, and the significance of the plain forests as land providing farmyard manure has gone down. Consequently, both farm life and agricultural production are not so dependent upon the plain forests as before. B3 is rudimentary at present and is not widely seen in the outskirts districts, but it is a new type of forest use of the plain forests in the districts where raw shiitake is
cultivated. The production of bed logs for growing shiitake has given the plain forests a new meaning for the farmers.

4. In the outskirts districts, the plain forests owned by the farmers are divided into three usage types; first, the agricultural and forest use; second, the conversion into the urban land use, and lastly, a type of non-use. In the B1 and B2 types of the rural communities, many plain forests were turned into orchards, rikuden, permanent meadows and ordinary upland fields, so that they contributed to the expansion of farm sizes. In the present depression in the Japanese forestry business, the farmers have little intention to convert their plain forests into rearing grounds for Japanese cedar and hinoki cypress. In the Senbonmatsu, the Nasunohara upland, there is a special case in which the vast plain forests owned by an enterprise were converted into the commercial forests. In the agricultural communities in the outskirts districts, which are different from the suburban districts of Tokyo, there are fewer restrictions on land-uses such as the designation of Urbanization Control Areas; in comparison with the farmlands, the plain forests are generally larger in their respective areas than the farmlands, and lands to be substituted for them are not necessary in principle, so immense area of the plain
forests can be converted at one time. Accordingly, the plain forests are converted into such urban uses as public, recreational, industrial and residential facilities. In the districts where a large-scale conversion has been going on, such as the Kashima Coastal Industrial Region and Tsukuba Academic Town, urbanization has been in progress and traditional rural ways of farming have greatly changed. Since the express highways and the Shinkansen have been constructed and the traffic networks have been widened and improved following the period of rapid economic development, the real estate brokers, with a view to speculation, have purchased the plain forests as in the Nasunohara upland for private vacation home sites. These plain forests are left unused without any appropriate conversion, and have become places for throwing away garbage and wastes, or dangerous places which may become the sites of crimes and fires. Consequently they are now problems in area of environmental conservation. The present situation in which the plain forests and farmlands exist side by side has led to impediments to administration in each executive village and town in carrying out adjustment plans for agricultural foundations, collecting various obligations to be borne, and accepting the increasing procedures of registration. Generally B2 and other plain forests of the
farmers' own holding, which are left unused at present, are those which are owned by large scale farmers who have not sold them to maintain their estates and family status.

5. The B3 type is to be seen in the districts where the cultivation of raw shiitake, a fresh food, has been carried out as one crop in diversified farming since the period of rapid economic development. The producers of shiitake in the plain forest areas can scarcely supply bed logs for shiitake for themselves, and most of them are forced to buy them from dealers. In the Kanto plain, those bed logs have so far been produced only in the rural communities situated in the mountain areas for the most part, and in the plain forest regions the bed logs have scarcely been produced. In recent years, because of the shortage of logs and with the rise in their production costs, the cost of bed logs has been soaring. In afforesting konara oaks, by making use of their sprout regeneration, in the plain forests which are left unused, a considerably high income can be expected. Furthermore, the producers of raw shiitake in the plain forest regions are to be steadily provided with the bed logs. At the same time, since the plain forests are newly connected with the farmers newly through the production of bed logs, the use of the plain forests will be enlarged, and we can
CHAPTER IV-3

expect that the plain forests, unused and devastated, which the farmers own in the outskirts districts can be effectively conserved.
CHAPTER V

Conclusion

This study intends to make clear the uses of the plain forests in the Kanto plain and their conditions of preservation. At first, the definition of the plain forests is clearly made, so that the various characteristics of the plain forests may be grasped statistically. Next, the author makes a detailed field survey of such typical plain forest regions in the Kanto plain as the northern part of the Musashino upland in the suburban district of the capital, and the agricultural regions of Nasunohara upland and Hitachi upland in the outskirts districts of the Kanto plain. A special consideration is paid to the plain forest utilization in relationship with the whole structure of the agricultural regions concerned. The traditional uses as farm forests are definitely made obvious, and making them the standard bases of consideration, the present uses and the conditions for their preservation are analyzed. As a result, the following points have come to light.

1. In the Kanto plain, even in the present days of advancing urbanization, the plain forests are distributed mostly in the diluvial uplands and alluvial fans covered with the Kanto Loam. Plain forests is a common and
customary term used indefinitely, but in this study it is defined as the forests existing on the lowlands, uplands and hilly lands, and on the gentle slopes of the piedmonts among the mountain areas. Furthermore, the villages, towns and cities in which more than 75% of the areas consist of plain forests are defined as the plain forest regions, so that the characteristics of the plain forests may be explained statistically. Then, the forests in the above mentioned districts are regarded as the plain forests, and their various characteristics in the Kanto plain are analyzed with the use of the World Census of Agriculture and Forestry as data. Calculating the area of the plain forests, in every other decade, the changes are observed, that is, 350,000 hectare in 1960, 330,000 hectare in 1970 and 300,000 hectare in 1980. In 1980, plain forests in the Kanto plain are distributed more in the outskirts districts of the Kanto plain than in the urban fringe ones, and more in the eastern parts than in the western ones. Ninety five percent of plain forests are privately owned and about 60% of the private forests are owned by farmers. As for the size of the owned area, the farmers with less than 1 hectare account for 70%, and their average owned area is about 1.2 hectare. Generally speaking, in the plain forest districts the ratio of the forest lands is less than 50%, but in the eastern
districts 10 to 50% is widely seen and in the western less than 10% for the most part with the exception of the piedmont and the northern part of the Musashino upland. The plain forests in the eastern districts are higher in the ratio of the artificial forests than in the western districts. As regards the tree species in the plain forests, red oaks and konara oaks forests in the western districts, and pines in the eastern are predominantly seen. Most of these forests are not natural vegetation, but the secondary ones planted and managed by the farmers. In Sanbu-machi and its neighborhood in the Shimosa upland, Japanese cedars of the forestry of Sanbu are seen, but they are exceptional cases which came into existence as commercial forest.

2. In the days before the period of the rapid economic development, the plain forests in the Kanto plain had not been generally managed for forestry, but used for farm forests widely, both in the urban fringe districts of the capital and outskirts of the Kanto plain. The plain forests were organically connected with upland fields, farm households and livestock (Fig. 40). In the outskirts districts, there were land use as shifting fields and rearing forests of wild silkworms, and so compared with the urban fringe districts, various uses as the farm forests were seen. In the rural areas in both districts,
Fig. 40  Traditional use of the plain forests in the Kanto plain
the farmers could not maintain the agricultural production unless they made the fields fertile with the barnyard and farmyard manures produced from the fallen leaves they gathered in the plain forests, for the parent material of the soil is the Kanto loam with low fertility. As cash crops, sweet potatoes in the urban fringe districts, and industrial crops such as leaf tobacco in the outskirts districts were cultivated; and the cultivation of these crops required necessarily a great quantity of fallen leaves for the heating material of the nursery beds. Consequently, the fallen leaves were especially important forest products in the Kanto plain. In both districts, not only the fallen leaves for the material of the agricultural reproduction, but also the materials for daily life such as fuel wood, timber, cogon grasses for roofage, mushrooms for food, and medicinal herbs were gathered and collected in the plain forests. The plain forests were, in this manner, used not only as farm forests to satisfy the farmers' direct needs of the daily life, but also functioned as windbreak forests and watershed protection forests. The period of the use was centered around the wintertime, the farmers' leisure season, when they gathered fallen leaves and fuel wood. The farmers cut the trees in the cycle of 15 to 25 years to get fuel wood, and then red oaks and konara oaks
through sprout regeneration, and pines through
forestation, were grown and managed.

3. After the Kanto Earthquake Disaster, the plain forests in
the southern part of the Musashino upland in the western
suburbs of Tokyo were converted to various urban
facilities and military installations which moved into the
urban fringes. These are the examples to show that the
plain forests were converted into urban land uses by the
external conditions like urbanization. After the period
of the rapid economic development which began in the
1960s, the ways of use of the plain forests have changed
because of the internal condition of the farm households
that the plain forests have lowered their significance as
farm forests. Both in the urban fringe districts of Tokyo
and outskirts districts of the Kanto plain, the nation-
wide "fuel revolution" progressed in the middle of the
1960s and the standard of living went up, and so the daily
life in the farm households came to be less dependent upon
the plain forests, earlier than the agricultural
production. As a result, the plain forests are divided
into three types of use; first, those which remain
maintaining the close relationship with the agricultural
production; second, those whose use as farm forests are
extinct, and are left unused; and lastly, those which are
converted into other agricultural land uses and urban land

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uses, with the decrease of the plain forests. These regional differences in the conditions of the remaining plain forests in respective districts are the very reflection of the regional differences as to the use of the plain forests as farm forests. Nowadays, the use of the plain forests in the Kanto plain are classified into A1 and A2 in the urban fringe districts, and into B1, B2 and B3 in the outskirts districts (Fig. 41).

4. A1 type is seen in the districts where the advance of urbanization is left behind even in the Urbanization Control Areas in the urban fringe districts of the capital. In the districts the ratio of shugyo-noka is high, and the farmers' upland fields are designated as the Agricultural Promotion Areas. Ever since the period of the rapid economic development, the farmers have made an intensive cultivation of the commercial vegetables for Tokyo markets, from which they have profited high income. The agricultural technique of an exemplary farming, which makes use of voluminous fallen leaves for the farmyard manure and the heating material of the nursery beds, is still practiced, whether their sizes of farming are large or not. Even in the present days when the urban fringe districts have risen to the one of the vegetable production areas, the reason why the plain forests are
Urban fringe of Tokyo

A1: Intensive vegetable farming region

Farm household

- chemical fertilizer
- agricultural chemicals
- farm product

Plain forest
- conversion
- urban land use

Outskirts of the Kanto plain

B1: Leaf tobacco cultivating and intensive horticultural region

Farm household

- chemical fertilizer
- farm product
- agricultural chemicals
- heating material

Plain forest

- conversion
- Upland field

- urban land use

A2: Urbanization area

Farm household

- chemical fertilizer
- agricultural chemicals
- farm product

Plain forest

- conversion
- Upland field

- urban land use

B2: Stock farm, rikuden, managed region

Farm household

- animal product
- formula food

Plain forest

- conversion
- Rikuden
- Meadow
- Orchard

Dairy farming

- cow dung
- litter
- barnyard manure

Pig raising

- Pig farming

Fatting of beef cattle

B3: Shiitsuke producing region

Farm household

- bed log
- chemical fertilizer
- farm product
- agricultural chemicals

Plain forest

- conversion
- Upland field

- urban land use

Fig. 41 Regional types of the plain forest use in the Kanto plain
still used and maintained properly is that the farmers continue to the use of gathered fallen leaves, according to their own size of farming. Under the external conditions of such designations as Urbanization Control Areas and agricultural Promotion Areas, which are working as checks of keeping the plain forests the farmers keep the traditional way of usage in the plain forests.

5. The type A2 is seen in the districts where the urbanizations is in progress. Since the ratio of the part-time farmers earning their main income from non-agricultural jobs is high, the upland fields are managed in an extensive way of use. On that account, the farmyard manure, whose main materials are fallen leaves gathered in the plain forests, has come to be used no more. Before the 1970s when the plain forests were designated as Urbanization Control Areas, they had been converted into other land uses in a large scale and on the decrease in their area. But still, the plain forests, which large-scale farmers did not sell in order to maintain their family status, remain unused. The farmers have a strong consciousness of possession about the plain forests in the point of retaining their estates, and look upon them as reserve lands for selling them to the urban land uses in future. The plain forests are not contained in the range of farmlands, and so the inheritance tax has risen so
high, for the land price in the urban fringe districts has risen too. In case of the inheritance, the heir is forced to sell his plain forests. As in A1 type, even the farmers using the plain forests as farm forests cannot help selling them. In the urban fringe districts high inheritance tax is a serious factor of the impediment to maintain the plain forests. The sold plain forests are being converted into warehouses and material depositories which are allowed to be converted even in the Urbanization Control Areas.

6. B1 type is seen in the intensive horticulture areas which are developed in the outskirts of the Kanto plain, and in the traditional leaf tobacco farming districts. Just like A1 type in the urban fringe districts of the capital, the farmers in these districts go on gathering the fallen leaves necessary for growing vegetables and for the heating material in the nursery beds of leaf tobacco. Nevertheless, in these districts the other organic fertilizers in place of farmyard manure have became available and the gathering of the fallen leaves with a main aim of producing farmyard manure has decreased. The plain forests, therefore, are connected with upland fields through the gathering of the fallen leaves mainly for the heating material of the nursery beds.
7. B2 type is seen in the districts where the raising of livestock was introduced into the farmers' management, and rikuden and orchards were cultivated. In the present days it is easy for the farmers to keep the balance of the organic matters than in the past-day upland field farming. Consequently, the significance of the plain forests that supply the material for farmyard manure has rapidly been falling down, and the plain forests have lost their significance in the agricultural production and in the farmers life. The plain forests have been converted into orchards, rikuden and pastures, and contributed to widening the size of the farmers' management. The plain forests owned by the farmers were rarely turned into afforested areas of Japanese cedars and hinoki cypresses. In the forestry region of Sanbu, unique and only one in the Kanto plain, they made it a rule to fell the trees in the cycle of 100 to 200 years according to the principle of selective cutting, and so it is impossible to grow Japanese cedars newly as a commercial forests, especially because the forestry in Japan now is on the decline. The remaining plain forests are owned by the farmers with a large scale of farming who maintain the plain forests as their property and family status, and so, for the most part, they are left unused.

After the period of the rapid economic development, as
Tokyo and its suburban districts became over-crowded, and the exploitation advanced into the outskirts districts, so that the demand for the urban land use was on the increase even there. The plain forests situated on the low, gentled sloped lands were liable to new urban land uses. In the outskirts districts, at present, there is no regulation about the land use such as the designation of Urbanization Control Areas. The plain forests compared with the farmlands are cheaper in the land price and larger in area as to their respective land-lots, and require no substitute lands in case of the purchase, so that they can be converted into other land use in a great scale at one time. In the districts of B2 type, the plain forests are converted into such urban land uses as public, recreational, industrial and residential facilities. As a result of the large-scale conversion into the urban land use, some districts have changed into the state of quite a different land use. Furthermore, the more plain forests are bought by the real estate brokers with intentions of speculation, the more non-resident land-owners have come to exist. The present situation, in which the farmlands, and the plain forests owned by the non-resident owners exist side by side, is an impediment to the administrations in the outskirts districts in adjusting the agricultural foundation and
conserving the environment.

8. B3 type, at present, though rudimentary, is a new use of the plain forests in the districts where raw *shiitake* is cultivated. By means of producing bed logs, the plain forests are united with farm households. In the outskirts districts of the Kanto plain, after the period of the rapid economic development, the farmers who take up the cultivation of *shiitake* as one of their diversified farmings are on the increase, and the bed logs have been demanded in a large quantity. Nowadays, the bed logs are produced in the rural communities in the mountain areas of the Kanto region. Since the price of the logs has risen in recent years because of the shortage of the material, the farmers had better grow *konara* oaks and such others for the production of the bed logs in the unused plain forests. In comparison with the cultivation of Japanese cedars, they are sure to bring the farmers higher returns in shorter terms. A new use of the plain forests as production of bed logs for *shiitake* will certainly perform the effective part of conserving the plain forests which still stand in the outskirts districts.

9. Since the preservation of the plain forests as green forests is called for at the present time, the remaining plain forests of the farmers' own possession are quite
important and valuable. On the other hand, in the region without legal regulation, and the farmers don't use them as farm forests, the plain forests are being converted into the sites and facilities of urban land uses. At the present time when the farmers are strongly conscious of owning the plain forests as their property, it is difficult to retain the plain forests as farm forests, if they don't have any definite aims to use the plain forests as farm forests. Consequently, new utilization of plain forests for producing bed logs for shiitake is recommendable as an effective method to maintain the plain forests in the outskirts districts. Moreover, as the land prices are rising now in the outskirts districts as well as in the suburban districts, it will be an effective policy to protect the plain forests that the administrations adopt proper measures to by admit the plain forest as farmland of farmers make use of the plain forests.
NOTES

1) According to Nakajima (1948), farm forests are "the general term for the forests which the farmers work for the purpose of farming and satisfying the direct or indirect needs necessary for their own daily lives."

2) A rikuden is a rice field on the upland which is made by bulldozing out of upland fields of plain forests. It is irrigated by pumping up of underground water and, therefore, has no irrigation and drainage canals. A rikuden is different from an ordinary paddy field in the flood plain or alluvial valley in the point that the rikuden has no water rights.

3) The figure used is "the Land Classification Map of Kanto (the Land Form Classification Map) III" published in the scale of 1:200,000 by the National Land Research Division, Economic Planning Agency (1968).

4) The gradient is measured in the distance of the contour with the use of the measuring instrument of the gradient.

5) In Miura hilly land, Miura peninsula, and Boso hilly land, Boso peninsula, the districts whose altitudes are less than 300m and whose gradients are more than 15° are widely identified. Therefore they are regarded as mountain forests regions.

"Nagano," "Utsunomiya," "Mito," "Tokyo," "Chiba," "Otaki," and "Yokosuka" are used, which were edited and published in the scale of 1:200,000 by The Geographical Survey Institute in 1982.

7) Takeuchi (1971) reported: It was impossible to reclaim paddy fields in the uplands in the Kanto plain by means of irrigation canal. The absence of small reservoir irrigation in Kanto uplands unlike Osaka plain can be explained by the fact that the upland surface is flat and the slope of the erosional valley is gentle. Therefore, small reservoirs would have little significance in Kanto.

8) In the present 47 metropolis and prefectures, there were no record of the plain forests in 8 prefectures. In Kanto their statistical record were kept in all the respective gun (county) in the present metropolis and 6 prefectures.

9) In the notification issued by the Ministry of Home Affairs, "The Official Form of Fuken-tokeisho (Annual Prefectural Statistics)" in 1884 which exhibited the model of the items in this Statistics (Statistics Bureau, Prime Minister's Office, 1973), there are no definitions of the plain forest or related terms.

10) The area of the plain forests and kusayama (grassy lands), except for the mountain forests, is 340,000 cho-bu.
11) The Forestry Agency (1984) also defines the general idea of "the most part" as 75% of the whole. In the villages, towns, and cities, with no such plain forests as are defined, clumps of trees are called "mountain forest regions."

12) The Forestry Agency (1984) uses as data the forest lists in 1980 drawn up by the forestry sections of the metropolis and districts. As pointed out, however, by Kanto Agricultural Administration Bureau (1976, p70), it is easier to use the Agricultural Census which as the source of basic statistics.

13) Each "ku (ward)" in Tokyo, Yokohama and Kawasaki is treated as one unit.

14) According to the condition and management of the lands, the tree species are little different from each other. There are various kinds of forests: a forest with many konara oaks, a forest with many red oaks, a forest mixed with mountain alders (Alnus tinctoria Sarg.), Japanese red pines and Japanese snowbells (Styrax Japonica Sieb. et Zucc), etc.

15) The non-national forests are the forests owned by the Forest Development Corporation, the communal forests, and private forests. The communal forests consist of the forests owned by the metropolitan and prefectural bodies, the forestry (afforestation) corporation, the municipal
bodies, and the property wards.

16) The statistical reports made by wide-range administration bodies are often different from real distribution characteristics. In order to make up this demerit, the author used the 1km² mesh as a basic unit, and tried to grasp the characteristics in the distribution by drawing maps.

17) In deciding the agricultural land productivity, the author used the method, employed by Yamamoto et al. (1983), of guessing through the total sum of the agricultural sales by the individual farmer. Although their methods, as pointed out by Yamamoto et al., has the problem of getting no determinate data, these data were used because there were many data samples and because the author intended to identify the reciprocal relationship of the distribution.

18) The decision of the standard of classification was done by calculating the mean quality of each index (M) and the standard division (s).

The plain forest area owned by a farmer: M-(1/2)S=7.0
The agricultural land productivity: M+(1/2)S=155.7
The area ratio of ordinary upland fields to total cultivated fields: M+(1/2)S=48.2

19) Shugyo-noka are full-time farm households and part-time farm households earning their main income from farming.
The ratio of shugyo-noka is that of the number of shugyo-noka in the number of all the farm households.

20) As for the reconstruction of land use map of the 1880s, the author used 16 maps of which are eight maps are a serial of "Urawa and its neighboring areas" and other maps are a series of "Hachioji and Fuda, with their neighboring areas" in Jinsoku-zu. They are topographical maps at the scale of 1:20,000, published by the Military land Survey Department, the General Staff Office in the Army. Land uses in the 1940s and 1970s were surveyed by the use of topographical maps (scale of 1:50,000) published by the Geographical Survey Institute of Japan. The author used maps of Kawagoe, Omiya, Ome, the north-western part of Tokyo, and Hachioji. From the symbols of forest land in those maps, forestlands were identified.

21) According to the 1980 World Census of Agriculture and Forestry, the rate of shugyo-noka in Saitama prefecture is 37.2%; in Fukuhara, Kawagoe-shi 67.0%; in Horigane, Sayama-shi 63.9%; and in Kamitome, Miyoshi-machi 77.2%.

22) In 1889, 4 villages, Kamitome, Kitanagai, Fujikubo and Chikumazawa, were combined into Miyoshi-mura, which was organized as Miyoshi-machi in 1970. The Kamitome district was once old Kamitome-mura and is divided into Kamitome-ikkü, Kamitome-niku and Kamitome-sanku. Kamitome-niku is once Nakahigashi and Nakanishi of the old Kamitome-mura.
23) The head of the village and the leaders of the village-sections were given two times as large lands as the villagers.

24) The ratio was calculated by making use of Inoue's figure showing the progressive changes of the land division in a part of Nakahigashi, Kamitome-mura (Inoue, 1960, p.73).

25) Though it is a personal principle statistics, according to the 1975 Agricultural Census the plain forests in Kamitome districts is 128.3 hectare.

26) In Musashi-koku gun-son-shi, vol.IV, there is a passage which describes Nakatome-mura (present Tokorozawa-shi), which is next to Kamitome-mura: The land is even high and dry, and trees are growing prosperously and firewood is plentifully provided; but there is little charcoal. According to this passage and the words of the old people it seemed that they did not make charcoal of their own in Kamitome-mura and the neighboring districts. But in the Musashino upland, for instance, in and around Oizumi-mura (present Nerima-ku, Tokyo) in the western suburbs of Tokyo, they made charcoal from plain forests.

27) According to Miura and Naito (1940), the amount of fallen leaves in the plain forests was 100 to 160 kan per 1 tan, that is to say, 120 kan in average.

28) At present they pumped up underground water in the well by cooperation, then water is poured on the fallen leaves
for the purpose of fermenting.

29) It is a work to cut down grasses by using a long-handled sickle called kigama, and it required 3 to 5 days to finish 10 are by two men. At present a mowing machine with a small gasoline engine is used, and two men can finish 10 are cutting in a half day.

30) At the time of periodic thinning they felled mostly Japanese alders (Alnus japonica Steud.), silk trees (Albizzia julibrissin Durazz.) and Japanese snowbells (Styrax Japonica Sieb. et Zucc) called "Zou," leaving konara oaks and red oaks called "katagi," which were sold to the merchants in high prices at the time of Tachiki-uri (selling trees as they stand) for fuel wood.

31) The use of fallen leaves as the litter in the cattle sheds still exists in the farm operation when farmers kept cattle. The number and varieties of the cattle, however, have decreased, and in 1980 only one dairy-cattle raiser remains, and three farmers are raising pigs in Kamitome-niku. Yet they keep the cattle in a small scale, for the main purpose of getting barnyard manure.

32) Choosing the time when the farmers grow many crops in Kamitome-niku (September 17-23, 1980), the author surveyed the land use in each farmland and made a land use map, of which scale was 1:3,000.

33) According to Sakai (1975, pp.62-63), Beniaka was
discovered by a farmer, Ichi Yamada in Harigaya (present Urawa-shi), in the Omiya upland in 1898.

34) Storing them in muro (cellar) after the harvest, the quality does not fall down, and they can be brought to the markets at any time from the middle of October, the harvest season, to April next year.

35) According to Sasaki and others (1969), before the World War II, there were two or three Sakuotoko (farm hands) in every farm household, who came to be hired from Tohoku after the graduation from the elementary schools and worked for a certain period or for a whole life.

36) According to the survey of the Tax Section in Miyoshi-machi Office, in 1980 the actual land price of 3.3m² plain forest is 50,000 to 60,000 yen.

37) Fukuhara-mura was integrated in Kawagoe-shi in 1965, and became one of the large section of it. In 1987, the whole area is 12.1 km², and the population of 17,507. It is situated in the Musashino upland which is about 50m above sea level, and is the highest in the city of Kawagoe.

38) Naguwashi-mura was combined with Kawagoe-shi in 1965 and became one of the large section of it. In 1987, the whole area is 11.7 km², and the population of 26,274. The upland is 25 to 30m above see level and the alluvial lowland is 5 to 10m in altitude.
39) Refer to p.63 and p.98 in Iruma-gun Office, Saitama Prefecture (1912).

40) According to Yamada (1985, pp.310-312), this book was sold out soon after the publication, and reprinted in 1912. Later, based upon the book, Akazawa (1914) was published in 1914.

41) According to Fukuhara-son-sei yoran (Iruma-gun Office, Saitama Prefecture, 1912, p.63), in 1912, in Fukuharamura there were 410 farm households, 3 cows, 46 horses and 140 pigs.

42) In Kanagawa Prefecture (1957, pp.29-44), also, there is a paragraph that if the areal rate of paddy fields to the cultivated land is more than 30%, enough organic matters to maintain the soil fertility are to be supplied by such agricultural by-products as rice straw.

43) According to the 1985 Agricultural Census, in 247 farm households in the Naguwashi district, out of 247 farm households, the most largest type of farm households is rice cultivation farms (159 farm households, 52.2%), followed by sericulture farms (36 farm households, 14.6%) and vegetables farms (17 farm households, 6.9%).

44) Bus service is provided by Seibu Bus Lines, connecting Honkawagoe station with Shintokorozawa, along the Seibu-Shinjuku Line. The bus runs 32 times a day on weekdays, and 20 times on holidays.
45) Along with the Fukuhara district, the Yoshino and Furuya districts in the paddy-field areas situated in the north-eastern part of the city, still keep the arable lands in good conditions.

46) In Chap. III-1, the author reported in detail the case that the farmers chose the planted crops according to their farm sizes, and had good income in Kamitome-niku, Miyoshi-mach. As the farmers with more than 2 hectare were 26.2% in Kamitome-niku, the planted area of sweet potatoes was very large one.

47) According to the 1985 Agricultural Census, leading five crops such as Japanese radishes, carrots, spinach, taro, and sweet potatoes account for 85.5% of all the harvest areas. The rate of these 5 leading crops to all the harvest areas has changed annually like this: 60.4% in 1970, 68.9% in 1975, and 78.9% in 1980. The ways of cultivation also have changed from many kinds and small production to a few kinds and large production.

48) The interviews were made to selected 108 men from the Naguwashi district, 188 men in the Fukuhara district; that is, 296 men in all (among them 215 men were plain-forest owners).

49) According to Saitama Edition Of Nihon Agricultural Newspaper (April 4, 1985), plain forests in the Urbanization Control Areas in both Fukuhara and Naguwashi
are appraised at 136,000,000 yen per 1 hectare. The appraisement of 80a ordinary upland fields in the Agriculture Promotion Areas is 37,000,000 yen. In case of the inheritance, the farmland tax is reduced to no more than one sixth, 6,600,000 yen when the farmlands are petitioned as "firm-fields of indulgence."

50) A village which came into existence after the union of the old villages on the valleys of the Hoki and the Zyabi. It was incooperated with Shiobara-machi in 1956.

51) Konoha-ami is a kind of net made of knit rope of straw. The size of a sheet is 1.2m x 1.8m, and on the either side of the longer side is fastened a bamboo stick. Holding either side of the stick, they tied the fallen leaves in the cylinder. This process of tying was called maruku which meant tying leaves together in a cylindrical form.

52) Wild grasses which were cut from spring to summer were brought into the cattle sheds for provender and litter.

53) According to the author's interviews, in the plain forest area located in the east side of a settlement called Higashiyama in Niwatoko, the trees grow five to ten years faster than forests in Nisiyama in the west, because the alluvial soil is piled up by the floods of the Zyabi.

54) In Niwatoko, 14.5 hectare of Kayaba was in Nishiyama.
Kayaba means the ground to cut cogon grasses. At the beginning of December, farmers do kayakari from the early morning, together. Kayakari means cutting cogon grasses. The cogon grasses cut down by them are brought into the house which is decided to be roofed in order, and the villagers thatch the roof together.

55) According to the author's interviews, the yield of tobacco is dependent upon seedling, so the farmers call tobacco farming as Nae Nanabu Saku which means that 70% of tobacco crop is decided whether a farmer grows good seedlings or not. Accordingly a farmer must have a highly skilled technique and intuitive knowledge about the breeding of the seedlings and the treading down of the fallen leaves.

56) According to the author's interviews, the fallen leaves of broad-leaved trees such as konara oaks and red oaks are not so good for the heat material, and those of Japanese red pines are added to them, so that the mixture becomes elastic enough for the farmers to tread down and the surface of the bed is kept flatter.

57) The contract cultivation with the Nishinasuno Branch of Kagome Ltd.

58) The effective capacity of the reservoir: 1,200,000m³. Along with Miyama Dam (the upper Naka), it was constructed as a part of "National Project of
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Comprehensive Farm Development in Nasunohara."

59) According to the Coaching Party of "National Project of Comprehensive Farm Development in Nasunohara" (1980), its aim was to reclaim the uncultivated lands, such as the plain forests, to readjust the farmlands which dispersed among the uncultivated lands, and to ameliorate the basis of the farmlands 4,515 hectare in 1 village, 2 towns and 2 cities on Nasunohara upland.

60) According to The Editorial Committee of Tochigi Prefecture (1984), a "plantation" had the lands of its own direct management. Its real state was mostly the landlord-and-tenants system which earned profits by making the tenants cultivate the fields, not a modern type of the plantation management.

61) According to the author's interviews, the tobacco farming was introduced into Nishinasuno-machi as a crop of cash income in place of sericulture after World War II. The tobacco farming, which required quite a large quantity of fallen leaves for the reproduction material, was difficult to carry on at the initial period of the reclamation when the plain forests were not fully brought up.

62) According to the author's interviews, this district was officially called "Senbonmatsu" after 1912 when the plain forests were brought up.
63) In 1886 the reclaimed fields of Nasu-kaikons ha and Kajiya-kaikons ha were incorporated into Nasuno-mura, and in 1889 changed into the name of Nishinasuno-mura. In 1932 it became old Nishinasuno-machi by the enforcement of town-system. In 1955 it was united with Kano-mura and became present Nishinasuno-machi.

64) According to Sekiguchi (1981a) it brought good species of sheep and horses from Shimoosa Imperial Pasture. In 1911 it kept 455 sheep and 29 horses.

65) According to Sekiguchi (1981b), the charcoal was carried up to Tokyo markets from Nishinasuno station of Nihon Tetsudaogaisha-sen (Japan Railroad Line) which is present JR Higashi Nihon Tohoku Honsen (JR Main Tohoku Line in East Japan).

66) According to The Editorial Committee of Tochigi Prefecture (1984), the lent farm fields 178 hectare to tenant farmers were released to them before the farmland ownership reformation and changed into their owned lands, the land area purchased by the reformation was 5 hectare. Moreover, 178 hectare waste land was bought as unreclaimed land for the emergent exploitation project in the post-war days, and Hinode reclaimed settlement came into existence. Its land register was transferred to Sekiya in old Hokine-mura (present Sekiya, Shiobara-machi).
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67) The area which Chokosha reclaimed became Mishima-mura in 1882. In 1889 it was annexed to neighboring old village, Ishibayashi-mura and other on the right bank of the Zyabi, and became Kano-mura. In 1955 it was annexed to old Nishinasuno-machi.

68) "Ochiba, Namakusa Riyo Kumiai agreement in the district of Nishinasuno-machi, Kano, Hokine and Senbonmatsu Farm" owned by Mr. Ichiro Soma, ex-chairman of the Kumiai (Union) who lives in Nishinasuno-machi now.

69) The author's interviews revealed that the curing and preparing of the flue-cured type of leaf tobacco in a harvest area of 1 tan-bu (10 are) required about 200 bundles of pine firewood.

70) In contrast with domesticated silkworms generally kept at the farm houses, the other silkworms are generally called wild silkworms. They are divided into two kinds, Tensan raised in Japan and foreign ones, mostly Chinese, called Sakusan.

71) Shizoku means descendants of Samurai. Shizoku-jusan-jigyo means work providing shizoku with their means of livelihood.

72) According to the Statistics and Information Department, Kanto Agricultural Administration Bureau (1980, p.43), 97% of the farm households in Yachiyo-machi use organic fertilizers, which are 50% pig feces, 25% poultry manure,
13% farmyard manure, 6% rice bran and 6% oil cake.

73) Taking as an example in the Fukuhara district, Kawagoe-shi, Saitama prefecture in the Chap.III-2, and in Chiba prefecture Oda (1982) pointed out the inheritance tax is a factor making forest preservation difficult.

74) This is derived from the author's interviews with Mr. Hiroyuki Kawakami the Specialist in the Agricultural and Forestal Section of the General Office in the Rokko district in the eastern part of Ibaraki prefecture.

75) This is from interviews with Mr. Konosuke Ishii, Chief Specialist of the Agriculture, Forestry and Fishery Division, Forestry Administration Section, in Ibaraki prefecture.

76) The figures for forest management cost and the final cutting income are derived from the Statistics and Information Department, the Ministry of Agriculture, Forestry and Fisheries (1986). The cutting cost is figured out by multiplying the national average 13,006 yen per 1m³ (Planning Division, Forestry Agency, 1988) by the volume 277m³ per one hectare (Statistics and Information Department, Ministry of Agriculture, Forestry and Fisheries, 1988).
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