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TOKYO, JAPAN.

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Pure forest of *Cryptomeria japonica* Don., State forest, in
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FORESTRY OF JAPAN.

CHAPTER I.

GENERAL REMARKS.

Along the western shore of the Pacific, there lies a group of numerous islands stretched in a serpent like form covered with rich verdant growths over two thirds of the area of the land. These verdant growths are none other than the forests of the Empire of Japan. The wholesome effects produced upon the land and the people by these forests are both striking and remarkable. The Japanese by nature love their forests and derive enjoyment from the prosperous and luxuriant growth of the same. The burning patriotism and the refined æsthetic ideas of the Japanese are in a large measure the outcome of the influence exerted upon the minds of the people by these forests.

The people under this influence have formed habits and manners inherent to them and naturally they have early come to recognize their duties in relation to the forests. They have not slackened their constant and minute attention to the problem of the permanent preservation of these forests by taking proper measures for their regeneration so as to make a sufficient supply against the demand for forest produces which is steadily growing from year to year.

The Empire of Japan consists of old Japan (the general name adopted for the sake of convenience throughout this work) comprising Honshu, Shikoku, Kyushu, and Okinawa islands including the adjacent islands and of Hokkaido, Taiwan (Formosa), the new territory added in 1895, and the southern half of Karafuto (Sagalien) which came into our possession in 1905. It is doubtful whether the forests in the so-called old Japan will be able to maintain their beauty permanently thus remaining transcendently superior to other changes. The Restoration of 1868 resulted in the introduction of new knowledge, and the breaking up various old customs and manners. The eastward march of the western civilization stimulated a steady progress in the method of mechanical applications which brought about the enlargement of the sphere of economic activities. These activities further led to numerous changes in forest administration affecting seriously at the same time the method of utilizing forests. Under these circumstances, the supply of the forest products is not confined simply to the supplying of timber for mining and industrial purposes as well as for articles of daily use but there arose a large demand of timber for railway sleepers, telegraph posts, various wood works, the material for paper and other branches of industry. The development of marine transportation makes it our mission to open up market abroad for our forest products, especially to supply the want of timber in China and Korea. The sudden increase of the demand for forest products produced a certain abnormal condition in our forests, giving us for the time being great cause for uneasiness.

It was apprehended on the one hand that with the reckless felling of trees not accompanied by the proper method of regeneration, the productive capacity of the land was weakened and a certain limitation had been placed upon the utilization of forests by way of their protection but on the other hand, there still exist vast tracts of the forests in the regions constituting so to speak the spinal column of the country as well as elsewhere, the primeval forests having never known any timber men's axes and given up to be the abode of bears, deer and other wild animals. Besides, Hokkaido, for instance, is rich in forests and though several decades have already passed since the exploitation of the island was commenced and much is done in the line of the forest utilization, yet large tracts of the primeval forests exist in the different parts of the island. In Formosa too, it must be observed that there exist splendid primeval forests covering no small extent of its area. Particularly in the case of Karafuto, it may be noted that the entire island is thickly covered with forests, both the utilization and regeneration of which are left for future provisions.

In short, under the general economic condition of the country, such as we find at present, these forests do not permit the old method of working and naturally there arises a necessity for ensuring the work under the strict system of control while at the same time the way must be opened for the utilization and exploitation of these forests.

CHAPTER II.

FORESTS. THEIR AREA AND OWNERSHIP.

The area of forests, including *Genya*,* in Japan occupies a greater part of the country and according to the statistics taken by the Government at the end of 1908, it covers an extent of 30,616,602 *cho*.

When these figures are compared with 29,519.46 square *ri* or 45,908,664 *cho* which constitute the total area of the country, the ratio stands at about 67%.

The forests of Japan are divided into two classes of "utilization forests" and "protection forests", according to the object of their utility. The object of the protection forests is to preserve the safety of the land and further the welfare of society by placing a limitation upon the felling of trees. The area of protection forests at the end of 1907 was over 925,641 *cho*. Apart from these forests, there are utilization forests where works may be freely undertaken with the view to the utilization of the material. The area covered by this latter class of forests amounts to over 29,690,961 *cho*. These forests owing to a difference in their ownership present differences in the management and works. The State forest and the Imperial forest are being improved under the up-to-date methods introducing new features for the renovation of the forests and the extension of the utilization but the forests owned by the people, with the exception of a small part, are given up to temporary make shifts, no special arrangements.

* P. 9.

being made concerning their utilization. Forests owned by the State, the Imperial Household and the people may be classified as follows :—

State Forests	Over 18,219,947 <i>cho</i> .
Imperial Forests	Over 2,239,881 <i>cho</i> .
Forests owned by the people	Over 10,156,774 <i>cho</i> .

The forests owned by the people covering an area of 10,156,774 *cho* include forests in the possession of temples and shrines, the public bodies, and private individuals. When these are subdivided we have the following figures :—

Forests owned by temples and shrines.. . . .	Over 124,829 <i>cho</i> .
Forests owned by public bodies	Over 3,403,493 <i>cho</i> .
Forests owned by private individuals... ..	Over 6,628,451 <i>cho</i> .

The management of these forests differs according to the difference of ownership. The State forests are managed by the Government, those owned by the Imperial Household are managed by the Department of Imperial Household while the forests owned by the people are subject to the control of the Government according to the provisions of the Forest Law.

Of the State forests covering over 18,219,947 *cho*, the area of over 7,587,335 *cho* comes under the direct control and management of the Department of Agriculture and Commerce while the forests in Hokkaido covering an area of over 4,728,648 *cho* are under the control of the Department of Home Affairs, being placed in charge of the Chief of the Hokkaido Administration. Forests in Formosa covering an area of 2,903,963 *cho* are governed by the Special Law and they are managed by the Formosan Government under the control of the Minister of Home Affairs while the forests

covering an area of 3,000,000 *cho* in Karafuto, under the similar relations, is under the charge of the Chief of the Karafuto Administration.

It is to be regretted that the figures relating to the area above mentioned have not been obtained by the results of the actual survey, these forests being still in the period of adjustment. The figures regarding the State forests and the Imperial forests have been obtained from the Public Forestry Register and those concerning forests owned by the people from the Land Register prepared by the Department of Finance for the purpose of the collection of taxes. These registers were prepared by the simplest surveying method, in the case of the former the surveying being done according to the Temporary State Forests Regulations in 1875 and in the case of the latter under the Land Tax Revision Regulations in 1872, and hence these figures are necessarily subject to variation when the adjustment of forests is completed. In particular, in reference to the area of the forests owned by the people, it may be observed that in the course of time, new forests were formed upon other class of lands or at times, by means of exploitation, forests were converted into the lands of different category so that necessarily these figures lack exactness.

The area of forests is constantly subject to variation both by the result of its actual survey and by the change of ownership. These forests are sometimes transferred partially or entirely on the one hand, and on the other are sometimes secured or appropriated to other objects of utilization by reclamation. These variations will be continued for several years

until the time when the work of Special Exploitation of the State forests and the adjustment of the Imperial forests are completed. In reference to the forests of Hokkaido, Formosa, and Karafuto, the work of adjustment and investigation is in the inception stage so that it will take somewhat longer before the area are definitely determined.

The Imperial forests are the property of the Imperial Household and at the juncture of 1889 and 1890, the State forests covering the area of over 3,557,219 *cho* found in such provinces as Kanagawa, Yamanashi, Shizuoka, Nagano, Gifu, Aichi, Miye, Aomori, Iwate, Akita, Fukushima, Miyagi, Gumma, Chiba, Tochigi, and the Hokkaido have been enrolled into the list of the property of Imperial Household. These forests were then in the same condition as the State forests, being naturally mixed up some of which subject to exploitation and others not. Thereupon in the year 1892, the Department of Imperial Household started the actual investigation of the Imperial forests and the results of the investigation led the authorities in 1898 to set about the disposal of these forests. In 1894, the Imperial forests in Hokkaido covering an area of 1,370,000 *cho* were again converted into State forests while the forests which had formerly belonged to shrines and temples were disposed of to those shrines and temples as a special measure. Owing to these facts, the area of the Imperial forests has been subjected to constant changes. Moreover, on the occasion of the revision of the land tax, forests properly to be made the possession of the people were enrolled by mistake into the list of the Government property, and then transferred to the Imperial

Household. Against these forests, applications were made later on for their transference to their original owners and this was acceded to, so that these forests changed their owners. The similar changes took place in the State forests also for the same reason. It will take a considerable length of time before the area of forests is definitely fixed. The examination of the changes in the areas of the Imperial forests during the space of 16 years from 1892 to 1907 shows that in cases of the increase of areas they were owing largely to the rectification resulting from the new survey while in cases of the decrease of areas they were due in most cases to the disposal and transference as mentioned above, and on the whole the area of the Imperial forests shows, as a result of these changes, a decrease of over 1,317,337 *cho*.

The Imperial forests may be divided into hereditary and ordinary possessions, the former is composed by those forests which bearing all perfect sylvan features and the extent of the proper area where an independent working circle is established and the forest economy may be maintained. These forests are subject to changes in conformity to the Code of the Imperial Household. The change of the area was chiefly found in the ordinary Imperial forests. The area at the end of 1907 was 1,010,362 *cho* in case of the former, and 1,249,065 *cho* in the case of the latter.

The changes in the area of the forests owned by the public body, temples, shrines, and private individuals are more frequent than in the case of the State and the Imperial forests, since works connected with the former class are not brought under the strict supervision and also to the easy

shifting of the economic relations. The decrease of the areas of forests subsequent to the Restoration must be attributed to the devastation of the forests owned by the people. While we have no statistics directly to show in reference to these changes, yet the increase of farms newly exploited and pastures is an evidence of this fact. The balance in the areas of forests owned by the people is maintained through the purchase made by the people of the State and the Imperial forests.

Besides those which bear the name of forests, there are found *genya* or wild lands everywhere covering vast areas, the use of which is unsettled. The *genya* was a newly created class of land when the revision of the land tax was made. There exists a very close affinity between the forests and *genya* (wild lands) so that they were only differentiated by the fact whether there are found trees standing or not. The work of the revision of the land tax was concluded in so short a space of time and the classification of lands had to be made according to their condition at the time, and as to their positions, topographical conditions, and external relations, no investigation seems to have been made. It is worthy of our notice that the lands covering an area of 2,229,390 *cho* under the name *genya* are destined to become forests in the near future with the exception of those portions, which owing to their geographical relations, will be turned into pasture and other smaller parts to be turned into farming lands. These lands are most extensively found in Hokkaido and the northern parts of Honshu.

These *genya* owned by the State cover an area of 452,918

cho and those owned by the Imperial Household over 136,956 *cho* and those owned by the people over 1,689,515 *cho*.

Forests in the Empire are found in all districts from Formosa on the south to Karafuto on the north. Since the country is extended from the north to the south in narrow chain, the distribution of these forests varies according to the geological relations, the topographical conditions caused by the rise and fall of steep mountains running through the various parts of the country, and the social connections depending upon the density of population. With the exception of a few forests scattered on level grounds, the main forest lands are found in various mountainous districts vertically running through the central parts of the country. It will thus be found that on the north, the great forests of Karafuto meander along their way covering the three mountain systems of the western, central, and eastern districts. Mountain ranges rivetting the Hokkaido in all directions, form beautiful forests running throughout the entire island. In Honshu, a chain of forests rising from Mt. Hakkota passing through Mt. Iwate of Riku-chu and Mt. Azuma of Usen, running along the boundaries of Shinano and Echigo, forms the forest of Kiso. A branch facing toward the south forms a large tract of forest lands comprising Imperial forests of Mts. Fuji and Amagi. On the south, a chain of forests takes its rise in the Kumano mountain range in the province of Kii forming those found in the districts of Yamato and Yoshino. In Shikoku, a chain of forests starting from the boundaries of Sanuki and Awa it covers the high ridges of Mt. Ishizuchi on the west, and extends over to the province of Tosa. In Kyushu, Mt. Aso in

the province of Higo forming the centre, a chain of forests runs southward to Mt. Kirishima. In Formosa, there are found the handsome forests of Mts. Ari and Rantai around the high peak of Mt. Niitaka (Mt. Morrison) while the thick forest growth covers the hills of the entire island. It will thus be observed that the area of forests is the largest in the central mountainous districts forming the very back-bone of the country but smaller in levels along the shore. In general, these forests grow clustered together in the rigorous climate of the north but are scarce on the south where the temperature is warm. The distribution of these forests is given in the following table:—

Descriptions.		Honshu. <i>cho.</i>	Shikoku. <i>cho.</i>	Kyushu. <i>cho.</i>	Total and (Average) <i>cho.</i>
State forests and <i>Genya</i> (wild lands).		6,471,266.2	200,676.2	915,392.9	7,587,335.3
Imperial forests and <i>Genya</i> (wild lands).		1,563,839.9	—	—	1,563,839.9
Forests & <i>Genya</i> (wild land) owned by people	Public forests and <i>Genya</i> (wild lands)	2,710,942.1	154,745.4	203,883.7	3,069,571.2
	Forests and <i>Genya</i> owned by temples and shrines.	118,088.6	4,179.4	2,382.7	124,650.7
	Forests and <i>Genya</i> owned by private individuals.	5,334,534.1	595,853.1	463,612.6	6,394,008.8
	Total	8,163,564.8	754,777.9	669,888.0	9,588,230.7
Grand total		16,198,670.9	955,454.1	1,585,280.9	18,739,405.9
		Sq. ri.	Sq. ri.	Sq. ri.	Sq. ri.
Entire area		14,690.53	1,180.67	2,827.80	18,699.00
		<i>cho.</i>	<i>cho.</i>	<i>cho.</i>	<i>cho.</i>
		22,846,712.2	1,836,178.0	4,397,794.6	29,080,684.8
Entire population		37,161,100	3,078,700	7,628,300	47,868,100
The area of forests per Sq. ri.		<i>cho.</i>	<i>cho.</i>	<i>cho.</i>	<i>cho.</i>
		1,102.7	809.2	560.6	1,002.2
The area of forests per capita		<i>cho.</i>	<i>cho.</i>	<i>cho.</i>	<i>cho.</i>
		0.4318	0.3109	0.2023	0.3904
The percentage of the forest area against entire area		0.71	0.52	0.36	(0.64)

Descriptions,		Hokkaido.	Formosa.	Karafuto.	Grand Total
		<i>cho.</i>	<i>cho.</i>	<i>cho.</i>	and (Average). <i>cho.</i>
State forests and <i>Genya</i>	(wild lands).	4,728,648.8	2,903,963.0	3,000,000.0	18,219,947.1
Imperial forests and <i>Genya</i>	(wild lands).	676,041.5	—	—	2,239,881.4
Forests & <i>Genya</i> (wild land) owned by people	{ Public forests and <i>Genya</i> (wild lands) }	333,921.9	—	—	3,403,493.1
	{ Forests and <i>Genya</i> owned by temples and shrines. }	179.2	—	—	124,829.9
	{ Forests and <i>Genya</i> owned by private individuals. }	234,442.3	—	—	6,628,451.1
	Total	568,545.4	—	—	10,156,774.1
Grand total		5,973,233.7	2,903,963.0	3,000,000.0	30,616,602.6
		Sq. ri.	Sq. ri.	Sq. ri.	Sq. ri.
Entire area	{	6,095.36	2,232.10	2,390.00	29,519.46
	{	<i>cho.</i>	<i>cho.</i>	<i>cho.</i>	<i>cho.</i>
		9,479,503.9	3,626,881.9	3,721,593.6	45,908,664.2
Entire population		1,223,900	3,183,417	47,831	52,323,248
The area of forests per		<i>cho.</i>	<i>cho.</i>	<i>cho.</i>	<i>cho.</i>
Sq. ri.		980.0	1,245.2	1,253.6	1,037.1
The area of forests per		<i>cho.</i>	<i>cho.</i>	<i>cho.</i>	<i>cho.</i>
capita		4.8801	0.9107	62,7203	(0.5815)
The percentage of the forest area against entire area		0.63	0.80	0.81	(0.67)

Remarks:—1. This table shows the entire area of Japan (exclusive of Karafuto) by the 24th statistics of the Department of Agriculture and Commerce (published in March, 1909.) while the number of population in Honshu, Shikoku and Kyushu is taken from the 28th statistics of the Empire of Japan (published in December, 1909.)

2. Islands of Sado, Awaji, Oki, and the Izu islands are included in Honshu, and Iki and Tsushima in Kyushu.

3. The area of the forests worked by percentage system is included in the area of State forests.

4. The area of forests and the total population in Formosa; the entire area, the forests area, and the total population in Karafuto are inferred from the special investigation made by the Bureau of Forestry in 1908.

The above table shows that the ratio of forests against the total area of land in Karafuto is 81%, that in Formosa 80%, that in Honshu 71%, that in Hokkaido 63% while Kyushu

has only 36%. The ratio in Shikoku being 52% occupies the medium position. The average ratio throughout the country is 67%. In making a mention of the topographical condition of Japan, it will be noted that only a few days have elapsed since Karafuto, Formosa, and Hokkaido have begun to be exploited so that there is a vast tract of land that may be regarded as the forest districts being rich in forests and that in the northern part of Honshu, a greater part of the land is occupied by steep hills and precipitous mountains which constitute the so-called absolute forest districts, reaching the climax in the neighbourhood of Mt. Fuji. As we approach southwestern provinces, large plains are opened with ranges of hills containing a few high peaks scattered here and there. These geographical conditions are one of the primary causes which brought about the disparity in the distribution of forests and it will also be observed that the history of the local economic development has the closest connections with the existence of forests. The districts of Shikoku, Kyushu, and the western part of Honshu were early opened to civilization, the means of communications were comparatively developed; products were freely conveyed to the markets both by land and sea; the demand of timber accompanying the increase of population had early become very keen. All these circumstances must have caused the reckless felling of forest trees causing thereby the gradual decrease of their area while the breaking up of forests stimulated by the necessity of the increase of agricultural farms must have also contributed to such a distribution of forests as we have at present. When apportioned to the number of inhabitants, it will be observed that in Kyushu, the area os.

forests per capita is 0.210 *cho*, in Shikoku it is 0.310 *cho*, and in Honshu it is 0.436 *cho*, the latter figures being double what they are in Kyushu. The rate per capita in Formosa is 0.910 *cho* while in Hokkaido where the number of the population is smaller, the proportion stands at 4.880 *cho* per capita. In Karafuto that has the smallest number of population and a large area of forests, the forest apportioned per capita stands at 62.720 *cho*. On the whole, it will be noted that in the district which is densely populated, the area of forests owned by the people is comparatively larger than that of the State forests, and it appears that where the population is small, the proportion of the State forests seems to be increased. In Honshu, the area of forests owned by the people amounts to over 2 times that of the State forests, in Shikoku the proportion is about 350%, while in Kyushu the area of the State forests is larger than that of forests owned by the people. In Hokkaido, the forests owned by the people are 1/8 of those owned by the State while in Taiwan and Karafuto, all the forests belong to the State. In districts where there are a large number of forests owned by the people, the State forests are found scattered about in the remote and mountainous interiors. In regions to which communication facilities for the conveyance of timber are available, the forests are mostly owned by people. In these forests, with a few exception, no strict system of working is in operation. The works are in such a position as to be shifted by the changes in the demand for the products in the market and this has often led to such deplorable results as the devastation of the forests. Under such circumstances, the forests found in a

condition injurious to the preservation of the land and which have been converted in accordance with the Forest Law to the protection forests, are mostly owned by the people thus subjected to the limitation in their work. These forests cover a disproportionately large area in various districts but as a result of the random felling of trees which continued for many years, the stock of forests has been greatly reduced and the products being insufficient to meet the general demand, the supplies were looked for elsewhere. In the southern part of Honshu and in Kyushu these phenomena are being observed. The progress of the technical and mining industries has recently increased the demand of timber to such a degree that imports of timber in a large quantity had to be made yearly from other districts, with the exception of daily fuel. The northern part of Honshu and Hokkaido possess vast areas and rich growth of forests, some of which have not been as yet utilized and many of these forests are found in the immediate neighbourhood of villages so that the products from these forests not only satisfy the daily demand of local districts but it is appropriated for technical and mining industries as well as for other purpose of consumption, besides their being exported in large quantities. Thus surplus timber in Hokkaido is exported as building materials or railway sleepers to Honshu, China, and Korea. With the exception of making the supply for a few local demands, the entire portion of forests in Karafuto has not been utilized while in Formosa it is only within the last few years that the measures for the utilization of forests have been adopted.

In short, with regard to the condition of the distribution

and ownership of forests, it may be observed that owing to future adjustments some changes may be expected but, on the whole, the order is restored and provisions completed so that in the course of time the supply of the products will be strikingly increased affording facilities to obtain the timber everywhere throughout the country.

CHAPTER III.

THE FOREST ZONES AND THE CONDITION OF FORESTS IN JAPAN.

The geographical position, the topographical condition, climate, and geology of forest lands affect considerably the species of forest trees and the condition of their growth.

Owing to the difference in the degree of the Latitude and that of the altitude above sea level, there is a considerable climatic difference in various districts. With the exception of the Kuriles group and a few high mountainous districts, the growth of the forest trees has been so favourable that there are found various lines of forests from the Torrid zone to the Frigid zone having rich and abundant varieties of forest trees, which have no equal in the world. Owing to the distribution of land, topographical condition, continental and oceanic relations, and to the tidal relations both cold and warm, the climate of Japan is extremely complicated showing great varieties. The temperature ranges from a yearly average of 20° C. in Formosa, the land of high temperature, to the yearly average

Young forest of *Thujopsis dorabrata* S. et Z., State forest,
in Aomori Major Forest Reserve.

of $2^{\circ} 5'$ C. in Otomari, Karafuto, the coldest district. In observing the temperature for the seven months from April to October which have important relations to the growth of forest trees, thus it will be seen that in Kyushu, the average temperature is $21^{\circ} 2'$ C., in Shikoku $20^{\circ} 9'$ C., in the southern part of Honshu $20^{\circ} 4'$ C., in the northern part of Honshu $18^{\circ} 4'$ C., in Hokkaido $12^{\circ} 7'$ C. and even in the high mountainous districts, it falls seldom below 10° C.. In Karafuto, during this period, the average temperature is 10° C. while the maximum temperature runs up to over 17° C. When these figures are compared with Dove's standard temperatures, it is about a degree higher in summer and about seven degrees lower in winter.

The geology of the forest districts in Japan possesses all the strata from the archæan formation to the cainozoic formation and are very complicated in their composition. The forest lands in Karafuto consists of rocky strata subsequent to chalk, and of rocks of archæan formation. The forest lands in Hokkaido consist of rocks of neovolcanic strata, of aqueous rocks and sandstone, tuff and conglomerate of the Tertiary period, and a small section consists of the land belonging to the palæozoic strata. Forest lands in the northern part of Honshu such as Aomori and Akita are chiefly of the igneous rocks in the Tertiary period. In the central part of Japan, mountain veins facing the Pacific consist of the strata belonging to an archæan formation while the forest lands of Kiso are composed of granite, other igneous rocks, and the soil of archæan formation. The geology of the land in Muro in the province of Kii, is of porphyry belonging to the

Mesozoic period. The forest lands of Yoshino in Yamato province belong to the archæan formation. In western part of Honshu, particularly in Chu-goku, the land is mostly composed of granite while the forests in such provinces as Tanba and Tajima stand upon the archæan formation. The central mountain chain of Shikoku belong, as is the case with Yoshino in Yamato province, to the archæan formation. A portion of southern Kyushu also belongs to the archæan formation but the rest is largely composed of igneous rocks. The basic strata of Japan consists of rocks of archæan formation, upon which other strata have been deposited. The volcanic eruptions in each geologic period have extended over the surface of large areas of igneous rocks, in fact one third of these forest lands consisting of these igneous rocks. The rock belonging to the archæan formation is granite, and those eruptions of archæan and mesozoic formations have granite strata, porphyry, diabase, and porphyrite. There are large varieties of rocks belonging to the Tertiary and Quarternary but the largest area is occupied by andesite and basalt.

The difference in the strata naturally causes variations in the soil both in kind and nature affecting to no small degree the growth of forest trees and the formation of forests.

Coniferous forests covering an extensive area and retaining the beautiful sylvan features grown by the natural regeneration are mostly found upon the strata of igneous rocks while a greater part of forests grown up by means of planting are to be found on the aqueous rocks.

Japan's topographical and climatic relations affect the species of forest trees, condition of their growth, and the

formation of forests. There are as many as 600 species of forest trees, of which those occupy important position in forest economy number some scores.

The forests in Japan may be classified to four zones such as Torrid Forest Zone, Tropical Forest Zone, Temperate Forest Zone, and Frigid Forest Zone.

1. The forests in the Torrid Forest Zone cover the entire of Formosa, the southern half of the Luchu islands, the Yaeyama islands, and the Bohnine islands. In reference to the altitude, these forests are found in the places below 500 metres above sea level in Niitaka-yama, Formosa, where average annual temperature is over 21° C. In forests belonging to this zone, Ako (*Ficus Wightiana* Wall. var. *japonica* Miq.), Tako-no-ki (*Pandanus odratissimus* L.), Ryugan (*Nephelium Longana* Camb.), Binroji (*Arca Catechu* L.), Tsugu (*Arenga saccharifera* Labill.), Basho (*Musa Basjoo* Sieb.), and bamboo make perfect developments. Bamboos are grown everywhere in these districts and their growth being vigorous, produce bamboos of large size. These bamboos being strong in their quality, are much utilized as materials for various kinds of wares and buildings.

2. The Tropical Forest Zone comprises Shikoku, and Kyushu as well as the northern part of the Luchu islands covering the southern part of Honshu, south of 36° North Latitude. In regard to the altitude, the forests of this zone are found in districts below 1,900 metres above sea level in Formosa, 850 metres in Kyushu, and 500 metres in Tsukubasan, Hitachi, the average yearly temperature ranging from 13° C. to 21° C. in this zone.

Varieties of trees being numerous in forests of this zone, there are large numbers of them which possess an important value in the forest economy. The climate of this zone being mild and genial, and the population being dense, gave rise to various productive undertakings so that the supply of forest products falls short of meeting the demand. As a result of the reckless felling of trees for years in the past, there are very few forests which retain their primitive features. In Honshu, such primitive forests are found only in the premises of shrines and temples in various districts. The trees in these forests as they stand at present may be divided into ever-green broad-leaved trees, deciduous broad-leaved trees, and pinus species.

Of ever-green broad-leaved trees, the following are the important varieties:—

Kusu-no-Ki (*Cinnamomum Camphora* Nees.). This species finds its native soil in Shikoku, Kyushu, and Kii (of Honshu), forming an extensive natural forests, but this species grows in any place of this zone where there is found rich, fertile, and clayish soils, but it especially thrives in southern districts free from the cold wind. In Formosa, it grows even in places which are 1,000 metres above sea level forming pure or mixed forests with other species. In Kyushu, Shikoku, and the southern part of Honshu, it has been customary with the people to add to the natural scenery of temples and shrines by the preservation of this tree species, and therefore in various places there are seen not a few of old trees of this species in a large size. The wood being hard and lustrous retaining a peculiar fragrance, it is prized as the material for costly apparatus and furnitures. Since the timber possesses durability against

moisture, it is used to be highly valued as the material for building ships. With recent years, the demand of it as the material for camphor, has been rapidly increased which fact stimulated the people to form the forests of this species and there is every possibility that in future the area of these forests will be considerably increased.

Tsuge (*Buxus semipervirens* L. var. *Japonica* Muell. Arg.). This is ever-green species, of which the largest measures 50 centimetres in diameter and 15 metres in height. It is not particularly large in size but being hard in its nature and uniform in tissues, the annual rings are hardly distinguishable. Heart wood being pretty and lustrous is prized as the material for fine sculpture. As the material for valuable utensils and rulers, this wood is highly prized. It is grown in the provinces of Kyushu, Kii, and Izu, being particularly thrives in such State forests as Kabaru, and Kosho-san of Kyushu, and in the private forests as those are found in islands of Mikura and Miake in Izu. This tree finds its congenial soil for growth in a limestone soil, the forests being formed either by seedlings or cuttings.

Ichii-gashi (*Quercus gilva* Bl.), Shira-gashi (*Quercus Vibrayeana* Fr. et Sav.), and Aka-gashi (*Quercus acuta* Thunb.). Of all the broad-leaved trees, these three varieties are most extensively utilized, and as the handles of agricultural implements, rolling stocks, and rudders of boats they are to be most valuable. The largest of Ichii-gashi (*Quercus gilva* Bl.) is 55 centimetres in diameter and 30 metres in height, bole measuring 15 metres. It has been specially valued from ancient times as supplying the best material for the handle of a spear and its felling was prohibited under the rigorous command of

the clan government. This species grows in Kyushu and the southern part of Honshu. It really forms pure forest but rather is found mixed with other species of *Quercus* occupying vast areas. It being shade bearing in nature, well grows under the shelter-wood and the forests may be renewed either through natural regeneration or by means of planting.

Principal varieties of deciduous broad-leaved trees are Kunugi (*Quercus serrata* Thunb.), Konara (*Quercus glandulifera* Bl.), and Shide (*Carpinus laxiflora* Bl.).

Kunugi (*Quercus serrata* Thunb.). This is used as fuel of a superior quality and the material for making charcoal. It ranks next to the other varieties of *Quercus* in the quality. Partly owing to the easiness of forming the forests and partly to the fitness for intensive working under the short rotation, this species is largely planted in the private forests. In these days, with an exception of the northern half of Honshu and Hokkaido, these forests are extensively grown in Shikoku, Kyushu, and the southern part of Honshu. The bark of this species contains tannin and is used for dyeing and in the tannery industry while there is a large demand of this tree as the wood upon which "Shiitake" (a kind of mushrooms) is cultivated.

Konara (*Quercus glandulifera* Bl.). As the firewood and charcoal, the demand of this species is quite extensive. This is the principal tree in the forests of natural growth comprising various species of trees around mounds and on hills in Honshu. The area covered by these forests is quite extensive, reaching Hokkaido passing through the northern part of Honshu. Like the *Quercus serrata* Thunb., this species having light demand-

ing nature grows everywhere in this zone where the soil retains the proper amount of humidity. The forests are treated by coppice system, and within quite recent times it grows in many instances, mixed with *Quercus serrata* Thunb. and *Carpinus laxiflora* Bl.

There are two kinds of pine forests such as of *pinus densiflora* S. et Z., and *pinus thunbergii* Parlat.; the former grows most extensively occupying as it does the first position among conifers in this country. It grows thickly everywhere from the southern extremity of Kyushu to the southern part of Hokkaido with the exception of marshy places. This tree thrives in clay or claysh soil on the dry and elevated land. When the forests either on levels, hills, or mountainous districts are deforested by the reckless felling or fires, this species precedes other trees. In the southern part of Honshu, this tree grows most prosperously in places 2,000 metres above sea level. The nature of this species being light demanding it does not thrive in shadowy places. It may be formed into forests with favourable results either naturally or by means of artificial planting. In most cases, it retains sylvan features of pure forest but in some rare instances, it is artificially grown mixed with bamboos and *Quercus glandulifera* Bl. Owing to the robust nature and the rapidity with which it grows, this species is planted in the forests owned by the public bodies, temples and shrines, and the private individuals. In the southern as well as the central parts of Honshu, where as the result of the abusive felling of trees, the land is impoverished, there is every indication that this species will come to occupy a large tract of land in future. The wood bears yellow

and light reddish colour. It is hard and elastic. Being rich in resin, it is durable against moisture and as such it is highly appreciated as timber used for public engineering and pillars in mines. Next to Sugi (*Cryptomeria japonica* Don.) it has an abundant demand as building materials, and is indispensable as fuel for daily use. In fact, "Matsutake" a variety of the best edible mushrooms is grown among forests of *pinus densiflora* in the southern part of Honshu.

Kuro-matsu (*Pinus thunbergii* Parlat.). In a similar way with the *Pinus densiflora* S. et Z., this is utilized in various ways. The wood being of a light reddish colour, is hard and full of resin, and therefore can be preserved for a lengthy period. It is well adapted to the building of the foundations of bridges and to various engineering works. As a fuel, it has a strong power of combustion. Torches used by fishermen are made of the root of this tree which have a rich amount of resin. It thrives in a sandy shore blown by briny winds. In fact, it grows everywhere in Shikoku, Kyushu, and the shores of Honshu covering quite an extensive area of land.

Besides these trees, there are the bamboos which are one of the most useful forest growth in Japan, among which we may mention Madake (*Phyllostachys Quiloi* Riv.), Hachiku (*Phyllostachys puberula* Munro.), and Moso-chiku (*phyllostachys mitis* Riv.). There is always exist a large demand for these bamboos as the materials for tools and furnitures and after being worked under various crafts, these are at present exported in an increasing quantity to Europe and America. Bamboos are cultivated in the private forests everywhere in Japan chiefly in the southern part of Honshu, Shikoku, and Kyushu. Above all,

Pure forest of *Fagus sylvatica* L. var. *Sieboldi* Maxim , State forest, in Miyagi Major Forest Reserve.

in such districts as Kyoto and Nara, favourable sylvan features are retained, in fact, some of *Phyllostachys Quiloi Riv.* found in the private forest in Yamashina, Kyoto, measures 20 centimetres in diameter and 22 metres in length. Bamboos mostly grow either between the agricultural farms or on the slopes of mounds and do not form the forest covering an extended areas. These bamboo forests are treated by annual selection system and are well fitted to be undertaken by men of small means.

Of all the bamboos, *Phyllostachys mitis Riv.* makes the most rapid growth, it sometimes reaching 30 centimetres in diameter and 25 metres in heights. This is extensively cultivated in such districts as Kyushu and Kii, and is highly prized as the material for various implements.

3. The forests in the Temperate Forest Zone are found in districts from the northern half of Honshu to the southern half of Hokkaido, that is, in those regions from 36° to $43^{\circ} 5'$ North Latitude and the yearly average temperature ranges from 6° C. to 13° C. The distributions in respect of altitude are found in the height 3,000 metres in Formosa, 1,800 metres in Shikoku, and 1,500 metres in the central part of Honshu, and 500 metres in the southern part of Hokkaido.

Forests in this zone being quite extensive, many of them have not been explored. Trees of an excellent quality form a natural forest and this zone is considered to be most valuable in the forestry of Japan. It may be said that the beauty of the Japanese forests reaches its climax in this zone, but owing to the rigorous climate in some parts and the damages from the snow drifts, a sufficient attention must be paid to the

tending and protection of these forests. There are over 60 varieties of forest trees belonging to this zone, but the principal species are as follows:—

Among conifers, Hinoki (*Chamaecyparis obtusa* S. et Z.), Sugi (*Cryptomeria japonica* Don.), Hiba (*Thujopsis dolabrata* S. et Z.), Koyamaki (*Sciadopitys verticillata* S. et Z.), Sawara (*Chamaecyparis pisifera* S. et Z.), Nezuko (*Thuja japonica* Maxim.), Momi (*Abies firma* S. et Z.), Tsuga (*Tsuga Sieboldi* Carr.), Iramomi (*Picea bicolor* Mayr.), Baramomi (*Picea polita* Carr.), Himeko-matsu (*Pinus parviflora* S. et Z.) Chosen-matsu (*Picea Koraiensis* S. et Z.), Goyo-matsu (*Pinus pentaphylla* Mayr.), Kara-matsu (*Larix leptolepis* Gord.) and etc.

Among deciduous broad-leaved trees, Keyaki (*Zelkova acuminata* Pl.), Yachidamo (*Fraxinus mandshurica* Rupr.), Katsura (*Cercidiphyllum japonicum* S. et Z.), Onara (*Quercus crispula* Bl.), Sawagurumi (*Pterocarya rhoifolia* S. et Z.), Tochi-no-ki (*Aesculus turbinata* Bl.), Kurumi (*Juglans Sieboldiana* Maxim.), Nire (*Ulmus campestris* Sm. var. *lanceus* Planch.), Kuri (*Castanea vulgaris* Lam. var. *japonica* De.), Kiwada (*Phellodendron amurense* Rupr.), Harigiri (*Alcanthopanax ricinifolium* S. et Z.), Enju (*Sophora japonica* L.), Hako-yanagi (*Populus Tremula* L. var. *villosa* Wesm.), Doro-no-Ki (*Populus balsamifera* L. var. *suaveolens* Loud.), Ho-no-Ki (*Magnolia hypoleuca* S. et Z.), Kashiwa (*Quercus dentata* Thunb.), Sakura (*Prunus Pseudo-Cerasus* Lindl. var. *spontanea* Maxim.), Buna (*Fagus sylvatica* Z. var. *Sieboldi* Maxim.), Kaede (*Acer palmatum* Thunb.) and etc.

Hinoki (*Chamaecyparis obtusa* S. et Z.). The wood being dense and compact, possess a peculiar flavour, and therefore is

adapted as the material for buildings, ornament's woods, earth works, and the building of ships and bridges. In point of variety of utilization and the high respect in which it is held, this tree occupies the most important position among the conifers in Japan. It grows in all the districts such as, the central and the southern part of Honshu, Shikoku, and Kyushu while in those provinces of Kii, Yamato, Musashi, Totomi, and Tajima, artificial forests of this species occupy a greater part. The natural growth of this tree of the Imperial forests in Kiso are celebrated as one of the three beautiful forests in Japan, and natural forests of Koya-san in Kii province are known for the production of large timber of this species. The native soil of this tree is found in the central part of Honshu at the height from 550 metres to 1,500 metres above sea level but it grows in either above or below the said altitude provided that the air does not lack a proper amount of moisture, either alone or mixed with other species, retaining the perfect sylvan features.

Hiba (*Thujopsis dolabrata* S. et Z.). Together with *Chamaecyparis obtusa* S. et Z., *Chamaecyparis pisifera* S. et Z., *Thuja japonica* Maxim., *Sciadopitys verticillata* S. et Z., this tree constituted the five important species, so-called "five trees" of Kiso during the feudal times and enjoyed careful protection as "Tome-ki" (Lit. the preserved tree). This is principally grown by means of natural regeneration but seldom by artificial planting. Such districts as Aomori, the northern end of Honshu, are celebrated for the existence of the pure growth of this species while in the State forests covering an area about 100,000 *cho* in peninsulas as Tsugaru, and Nanbu,

it grows mixed with a small amount of Buna (*Fagus sylvatica* Z. var. *Sieboldi* Maxim.). In the mountains on the northern borders of Rikuchu, the Goyo-zan in Rikuchu and mountain ranges of the Tone county, Kozuke, this species grows mixed with other conifers such as Himeko-matsu (*Pinus parviflora* S. et Z.) and Sawara (*Chamaecyparis pisifera* S. et Z.) covering a large area of forests. This tree grows very slowly, annual rings being narrow and owing to the compactness of the quality it has a strong power of resistance. The wood, therefore, supplies important materials for building and public engineering. Of late, this tree has come to be used as railway sleepers, for which purpose it excels others as it is preserved to a lengthy period.

Sugi (*Cryptomeria japonica* Don.). Of all the varieties of conifers, next to Aka-matsu (*Pinus densiflora* S. et Z.), this tree covers an extensive tract of land and it thrives in sunny grounds. Being active in its growth, it attains a considerable size, the largest being 2 metres in diameter and 40 metres in height. If the soil and the air are adaptable, it may be cultivated in all parts of Shikoku, Kyushu, Honshu, and even as far as the southern part of Hokkaido. The beautiful sight of the natural pure forests of this species is presented in the State forest of Nagakizawa in the Akita Major Forest Reserve while beautiful forests formed by artificial planting are found in the private forests in Yoshino districts of Yamato province. The natural growth of this species in the State forests of Yakushima in the Kagoshima Major Forest Reserve, Kyushu, is well known for the production of timber of a fine quality. The gains are so brightly discernible and possess what is

known as "Uzura-moku" or "Quail-grain." The wood is light yellowish and raddish in colour. As the material for buildings, implements, and decorations, it is known for its wide applications.

Sawara (*Chamaecyparis pisifera* S. et Z.), Nezuko (*Thuja japonica* Maxim.), Koya-maki (*Sciadopytis verticillata* S. et Z.). In natural forests, these trees grow mixed with other species, very few of them being found as pure forests. In the State forests of Koya-san in Kii province and in the Imperial forests of Kiso these trees grow mixed with *Chamaecyparis obtusa* S. et Z. and other conifers. Of the natural forests of these species, the largest is found in groups at the points ranging between 900 metres and 1,800 metres above sea level in such provinces as Yamato, Bungo, Satsuma, Omi, Iwashiro, Shimotsuke, and Uzen. *Chamaecyparis pisifera* S. et Z. and *Thuja japonica maxim* are fine in their quality but being soft and light, they are liable to split and break. These trees are made into boards, sliding doors, boxes and bended-wooden articles. The growth of the *Sciadopytis verticillata* S. et Z. being extremely slow, the grains narrow, and possessing a kind of resin, it is prized for the durability in water and is used as the materials for buckets and earth works.

Momi (*Abies firma* S. et Z.). This species thrives most extensively in the primitive forests in the southern part of Honshu, Kyushu and Shikoku. It grows in shady places. In the latter portion of its life, the growth is very rapid and it forms a fully developed trunk in the congenial soil. The wood is light and soft, easily warping and pliable. As the timber for general use, it may be inferior to other conifers but as the

material for pulp it is found to be excellent.

Tsuga (*Tsuga Sieboldi Carr.*). This tree in the same locality with *Abies firma* S. et Z. and in most instances, it thrives mixed with it. Its growth is slow but being hard in quality, it is principally adapted for the material of buildings. The timber with vertical grains is highly appreciated for decorative purposes. It is used together with *Abies firma* S. et Z. as the material for making pulp or boxes.

Himeko-matsu (*Pinus parviflora* S. et Z.). The forests of this tree spread over the mountain ranges of Iwashiro starting from the land 1,600 metres in height along the borders of Kozuke and Echigo, and in Tsushima and Shiribeshi, Hokkaido, they present perfect sylvan features unmixed with other trees.

Goyo-matsu (*Pinus pentaphylla* Mayr.) and Chosen-matsu (*Pinus koraiensis* S. et Z.). These trees grow from this zone to next zone, and may be found in a small quantity in the mountains in the central and northern parts of Honshu.

Bara-momi (*Picea polita* Carr.) and Iramomi (*Picea bicolor* Mayr.). The distribution of these trees are very limited and they grow mostly clustered together on the slope of Mt. Fuji at the height over 2,000 metres above sea level and also they are found scattered over high mountainous districts. These trees being slow and dull in their growth, the wood is soft and does not begin to be compared with other varieties of conifers as far as their utilization is concerned but they may be satisfactorily used as the ceiling boards of the house or as the furniture not subject to moisture.

Kara-matsu (*Larix leptolupis* Gord.). The natural forests of this species chiefly found at the slope of Mt. Euji, Mt.

Asama and in the Azumi county of Shinano province. Some grow on the slope of Mt. Nikko spontaneously but elsewhere there exist very few of its natural forests. This tree grows on dry soil of volcanic strata making a healthy growth in the sun shine. The wood being hard and durable, is highly prized as the materials for houses, ships, telegraph posts, earth works, and others. As it grows very rapidly, there are risks connected with the building up of forests by cultivation. In fact, since it grows with favourable results in poor and desolate soil, the districts for the planting of this tree has recently been extended through the entire part of Honshu and Hokkaido.

In this zone, great varieties of deciduous broad-leaved trees are grown occupying a greater part of the forest area but they seldom grow unmixed with other trees. Konara (*Quercus glandulifera* Bl.), Kashiwa (*Quercus dentata* Thunb.), Onara (*Quercus crispula* Bl.), Kaba (*Betula species*), Doro-no-ki (*Populus balsamifera* L. var. *suavcolens* Loud.), Katsura (*Cercidiphyllum japonicum* S. et Z.), Han-no-ki (*Alnus japonica* S. et Z.), and Buna (*Fagus sylvatica* L. var. *Sieboldi* Maxim.) constitute pure single-aged forests respectively and extend over Honshu and the southern half of Hokkaido while other varieties of deciduous broad-leaved trees grow irregularly mixed with numerous kinds of other broad-leaved trees and conifers. The following species are the principal forest trees in reference to the forest economy.

Keyaki (*Zelkova acuminata* Pl.). Of the broad-leaved trees growing in Japan, no other tree enjoys a wider utilization and a greater respect than this species. This species grows to

a large size everywhere in Shikoku, Kyushu, and Honshu mixed with other shade bearing species of broad-leaved trees but very few form forests by itself. It makes a perfect growth in the congenial soil in the south-eastern slope of mountain. It makes a spontaneous growth at points below 1,600 metres in Shikoku and Kyushu, and 750 metres in the northern part of Honshu. The wood of large dimensions is produced from the districts of Kiso, Izu, Totomi, Hyuga, Yamato, Ise, and Mutsu. In order to obtain the large timber of this species, it requires a long rotation so that the undertaking is not adapted to men of small capital. In the State forests, efforts are being made to regenerate the forests of this species both naturally and artificially whenever the land is adapted to afforestation so that the districts of this species are constantly extending. The wood being hard and lustrous, it is highly valued as the material for buildings, decorations, and ship-buildings. The wood bearing such beautiful grains as "Jorin-moku," "Tama-moku," and "Botan-moku" is best adapted to the manufacture of household furnitures and implements. This wood with all its hardness is very easy to work up, and therefore valued for articles of fine arts and carving.

Buna (*Fagus sylvatica* L. var. *Siboldi* Maxim.). Next to Aka-matsu (*Pinus desiflora* S. et Z.), this is a variety of trees which covers the widest extent of the area and is found everywhere in mountainous districts of the north and the south of Honshu, Shikoku, and Kyushu and is distributed in the southern part of Hokkaido. It grows together with Onara (*Quercus crispula* Bl.), Katsura (*Cercidiphyllum japonicum* S. et Z.), Shioji (*Fraxinus Siboldiana* Bl.), Kaede (*Acer*

pictum Thunb.) but it forms a grand and extensive pure forest at points 300 metres above sea level in the mountain ranges of such provinces as Aomori, Iwate, Echigo, and Yamagata. The wood is but little used as the material for buildings and other similar purposes but as fuel, it forms one of the important supplies. These forests supply the fuel in the smelting places of Kosaka, Ani, Ashio and other mines. This species grows in shady places and grows incessantly until it reaches the mature age and become very large. It is said that the Ainu (Natives of Hokkaido) used to make a canoes out of this wood.

Yachidamo (*Fraxinus mandshurica* Rupr.), Katsura (*Cercidiphyllum japonicum* S. et Z.). Of the broad-leaved trees in Hokkaido, these are the only varieties used as the material for buildings. They are also used as the decorative material and grow very extensively so that they are seen all over Hokkaido. They also thrive among the rocky valleys in mountains in the northern part of Honshu, finding a congenial soil in plains and wet places. The wood being soft and tenacious, has the qualities of durability and elasticity. Of late, it is being exported to North China as railway sleepers.

Inu-enju (*Cladrastis amurensis* B. et H. var. *floribunda* Maxim.). This species grows with other broad-leaved trees in the central as well as in the northern part of Honshu and the southern part of Hokkaido. The wood is of a peculiar nature possessing a beautiful lustre. It is used as the material for the best class of utensils and implements and valued also as the material for buildings and decorative purposes.

Kurumi (*Juglans Sieboldiana* Maxim.). It grows most

abundantly in fertile soil of the lower land among the mountains in the central as well as in the northern part of Honshu while on the dry soil upon the summit of mountains they are scarcely found. In the plains of Ishikari and Tokachi, Hokkaido, beautiful forests of this species are seen mixed with yachidamo (*Fraxinus mandshurica* Rupr.), Katsura (*Cercidiphyllum japonicum* S. et Z.), and Nire (*Ulmus campestris* Sm. var. *laevis* Planch.). The wood being pliable and strong, is free from the fear of being warped or crooked so that it is most extensively used for passenger cars or the first class material for decoration in general. It is peculiarly adapted for the rifle stocks.

Hari-giri (*Acanthopanax ricinifolium* S. et Z.). This grows in the humid soil in the mountainous districts of the northern part of Honshu and in all parts of Hokkaido. In deep forests or fertile grounds it grows to the huge size, the wood being hard and lustrous shows bright grains and is white in colour so that it is prized for the articles of decoration and implements.

Kashiwa (*Quercus dentata* Thunb.). Together with Onara (*Quercus crispula* Bl.), this species grows in wet mountainous places in the north-eastern districts of Honshu. It also thrives in the plains of Hokkaido. It seldom forms pure forests by itself but always grows mixed with other deciduous broad-leaved trees with the exception of those in the plains of Tokachi and Ishikari in Hokkaido where it forms extensive pure forests. At present, *Quercus crispula* Bl. are mostly used as railway sleepers and prized as fuel while the *Quercus dentata* Thunb. that contains tannin in the bark is chiefly used for tannery, the rest being used as fuel.

Pure forest of *Chamaecyparis obtusa* S. et Z., Imperial forest, in Kiso.

Hako-yanagi (*Populus tremula* L. var. *villosa* Wesm.) and Doro-no-Ki (*Populus balsamifera* L. var. *suaveolens* Loud.) These species are the unique material for making match sticks. *Populus tremula* L. var. *villosa* Wesm. is found in Shikoku, Kyushu, and Hokkaido while the *Populus balsamifera* L. var. *suaveolens* Loud. thrives in the northern part of Honshu as well as in Hokkaido. In Karafuto, it is also found in a limited quantity. They never fail to grow in light and wet soil. In Monbetsu and Shari counties of Kitami province, Kamikawa county of Ishikari province, and the Tokachi county of Tokachi province in Hokkaido, they form perfectly developed pure forests by themselves. They are fond of growing in sunny places. Being rapid in growth, in 25 years, they attain the height of 20 metres. These trees may be regenerated either by cuttings, seeds, or suckers.

Kuri (*Castanea vulgaris* Lam. var. *japonica* Dc.). This tree grows extensively in Kyushu, Shikoku and the western part of Honshu presenting beautiful sylvan features along the slopes of high mountains or hills while in the central as well as the northern part of Honshu, fine timber of this species is produced in plains. It does not form large forests by itself growing mixed with Buna (*Fagus sylvatica* L. var. *Sieboldi* Maxim.), Hiba (*Thujopsis dolabrata* S. et Z.), Kiwada (*Phellodendron amurense* Rupr.), Katsura (*Cercidiphyllum japonicum* S. et Z.), Kaede (*Acer palmatum* Thunb.), and Sawa-gurumi (*Pterocarya rhoifolia* S. et Z.) but it forms forests unmixed with other trees as seen in the Kohinata State forests, Tone county, Kozuke province, and in Hiraka county, Ugo province. The wood being hard, it stands moisture for

extended period so that it is valued as railway sleepers.

Sakura (*Prunus pseudo-cerasus* Lindl. var. *spontanea* Maxim.), Kaede (*Acer palmatum* Thunb.), Ho-no-ki (*Magnolia hypoleuca* S. et Z.). These trees are important species from the standpoint of forests undertakings but there is no district where these trees form pure forests; they grow mixed with other conifers and broad-leaved trees being scattered in all districts. These trees are valuable according to the nature of the crafts into which they are put. The timber of this species being comparatively high in price and limited in their production, the supply does not always meet the demand. In future, it is expected that in the forests owned by the State and the people these trees will be planted mixed with other trees.

Such deciduous broad-leaved trees as Tochi-no-ki (*Aesculus turbinata* Bl.), Nire (*Ulmus Campestris* Sm. var. *lacris* Planch.), Han-no-ki (*Alnus japonica* S. et Z.), Toneriko (*Fraxinus Bungeana* Dc. var. *pubinervis* Wg.), Saikachi (*Gleditschia japonica* Miq.), Enoki (*Celtis sinensis* Pers.), and Yanagi (*Salix babylonica* L.) are not worthy of being cultivated and built up into forests regarded from the standpoint of forest economy but in this forest zone, these trees are planted for the purpose of the protection of the principal species in the forests and of the maintenance of the forest lands.

4. Forests in the Frigid Forest Zone cover the northern half of Hokkaido, the group of Kurile islands and the entire part of Karafuto, occupying the lands whose average annual temperature is below 6° C. and the distributions in respects of altitude they are found in regions above 3,500 metres above sea level in Formosa and 1,800 metres in the central part of Honshu.

Forests in this zone, with the exception of Hokkaido and Karafuto, find their existence on the summit of high mountains. The soil in such places being bad, and suffering damages from the fierce wind, their growth are impeded, not producing valuable timber. But in Karafuto and Hokkaido, the thickly wooded conifers cover the mountains and hills. There are deep forests to which no human footsteps have as yet penetrated and the principal species of trees are Todo-matsu (*Abies sachalinensis* Mast.) and Ezo-matsu (*Picea ajanensis* Fisch.). In Hokkaido, these trees begin to grow in regions 450 metres above sea level in the mountainous districts of the southern part of the island and extending over the boundaries of Teshio, Tokachi, Nemuro, and Kitami, inclusive of the mountain ranges of Ishikari, reach to Kunajiri island. In particular, these forests present perfect sylvan features without being mixed with other trees covering a large tract of land such as the Imperial forests of Tarumae and Amaryo, the State forests of Teshio, the Imperial forests of Kushiro, the State forests of Oneto, Shari, and Kokugo-to. The greater part of the forests covering 80% of the entire land in Karafuto practically consists of these trees. Parts below 400 metres above sea level on Mt. Niitō are covered with coniferous forests composed of these trees while up to 500 metres, there grow mixed forests of conifers and broad-leaved trees. In those parts above 500 metres and below 20 metres there exist broad-leaved trees, Hai-mats (*Pinus pumila* Pall.) and lawns. The greater parts of Karafuto are below the 500 metres above sea level so that they are thickly wooded with these trees. The distant view of these forest ranges is altogether continental and such

an imposing spectacle is nowhere found throughout Japan. The wood is rough and light, and subject to warping by the degree of its dryness, yet its demand as the material for buildings and earth works is quite large, being equalled by no other timber supplied by Hokkaido and Karafuto.

Akaezo-matsu (*Picea Glehni* Mast.). This is an important tree growing together with Todo-matsu (*Abies sachalinensis* Mast.) and Ezo-matsu (*Picea ajanensis* Fisch.) in Karafuto but the output is not very large. Compared with these two varieties, it enjoys a greater and a higher quotation. The wood being hard, it is highly appreciated for building purposes. In Karafuto, Etrop and Shikotan of the Kurile group, there are found a species of *Larix leptolepis* Gord, called Shikotan-matsu (*Larix dahurica* Turcz. var. *japonica* Maxim.) which even in the rigorous climate and against cold winds form forests by themselves. The wood is reddish in colour and hard in its composition and stands moisture for a lengthy period so that as the material for shipbuildings, public engineering and household furnitures, its demand is very large. To this list, we may add such deciduous broad-leaved trees as Shira-kaba (*Betula alba* L. var. *vulgaris* Dc.), Yamahan-no-Ki (*Alnus incana* Willd. var. *glauca* Ait.), Nanakamado (*Pirus aucuparia* Gaertn var. *japonica* Maxim.). Throughout this zone, there are found pure forests of these species or mixed with other trees in various places. The land in Karafuto and Hokkaido covered by these forests is by no means limited in its extent, but these trees have no special value in the forestry. The supply from these forests is made in the way of fuel and timber for the purposes of mining and fishery.

The varieties of forest trees in each of these zones are almost innumerable, but those mentioned above are the principal species in Japan. These trees naturally form forests by themselves or mixed with other trees in their respective zones. Conifers, in general, occupy elevated places such as hills and mountains in the southern part of Honshu while the forests in the low and level grounds are generally of broad-leaved trees. On the contrary, in the northern part of Honshu, conifers mostly grow along the mountain slope but both on the summit and foot of mountains broad-leaved trees are found.

CHAPTER IV.

THE FOREST EXPLOITATION.

SECTION I. OUTLINES.

The record shows that attempts for the exploitation of forests were made as early as in the period of Konin (the beginning of the 9th century) and the Emperors of successive generations put a limitation upon the felling of trees by the Imperial Decree with a view to the protection of forests. For the space of several hundred years the courtiers vied with one another for the supremacy in the administration causing a series of internecine wars. To be sure, there was an occasional respite but having no energy remaining to attend to the forest exploitation, it was neglected together with other branches of industries. Since the Tokugawa family started the Govern-

ment in Edo (in the middle of the 17th century) for the space of three hundred years, a great deal of attention was paid with considerable results to the adjustment of the forest administration and to the protection of forests. In respect to the method of exploitation, it may be observed that owing to differences of conditions and usages in various clans it showed corresponding variations, and on account of military considerations, the exploitation of forests was conducted by the conservative policy under the most rigorous legal provisions. In these days, therefore, there was a distinction between the forests to be exploited and those in which the felling of the trees had been prohibited. At any rate, there was none that was not subjected to more or less limitations. The felling of important trees was prohibited even in such exploitable forests which went under the names of "Mochi-yama," "Shitate-yama," "Miyama" and "Gyorin" not to speak of forests preserved for the protection of paddy fields, irrigation, and those against the collapse of sand, against snow, winds, waves, and those for attracting fish. In reference to other trees, the freedom of felling was given. For instance, those trees which were known as the "Five-trees" in Kiso, *Thujaopsis dolabrata* S. et Z. in Aomori, *Cryptomeria japonica* Don. in Akita, the "Six-trees" in Kii, the "Seven-trees" in Awa, and the "Three-trees" in Kumamoto belonged to the category of trees not to be cut down. These facts account for the preservation of handsome forests in these districts.

As results of the utmost efforts made towards the preservation of these forests, beautiful sylvan features were presented which lasted, however, but temporarily. On the occasion of

the Restoration of the Meiji period, the evil of the reckless felling of trees took place for a time which almost ruined the forests in many cases. At this juncture, the Government made a careful investigation of the means of forming forests in the economic way which led the authorities to promulgate the law relating to the land tax. Lands were categorized showing the distinction of ownership between the Government and the people, but as a matter of fact not only boundary lines were despairingly mixed up but there arose various evils as the encroachments of forest lands and the despoiling of their products whether intentionally or by mistake creating a great deal of trouble in exploitation. The first exploitation of the State forests in Honshu (exclusive of Hokkaido, Formosa, and Karafuto) that was commenced in the year 1890, was aimed to adjust these abnormal condition of forests. This undertaking was to be continued for 15 years from 1890 to 1904, the expenses needed for which being paid out of the ordinary annual expenditure together with the extraordinary expenses amounting to 855,951 yen and the work is conducted every year covering the following points:—

1. To investigate the actual condition of the State forests covering an area of 6,6000,000 *cho*, scattered all over the country, differentiating those forests which should be preserved as the State forests and those which may be advantageously transferred to the ownership of the private individuals, and to determine the districts under the State control by means of considering the facilities of the control and observing the question whether it is economically profitable or not.

2. To investigate and determine the boundary lines

between the forests owned by the State and that owned by the people so as to protect the State forests against the transgression of boundary lines, and also to rectify the despoliation of forest products either intentionally or by mistake.

3. To survey the State forests covering an area of 1,380,000 *cho* that is easily to be utilized and also economically under a keen demand, and to ascertain the exact areas of these forests so as to prepare the perfect forest maps.

It need scarcely be stated that to attain the three objects mentioned above will take a considerable length of time. Not only that, since the nature of the work bears serious relations to various other matters it is next to impossible to pass fair judgement upon the question of the preservation and abandoning of these forests by taking a general observation of the forests covering such a large area, unless the work is carried on continuously. In order to smoothly accomplish the undertaking, both the demarcation and the actual survey of boundaries must go hand in hand and as at the same time the present forest system necessitates the speedy completion of the work, it was projected to continue it for a period over extending some years. It is highly commendable that these measures were adopted so as not to be swayed by temporary considerations and arguments. Notwithstanding the fact that the first exploitation of State forests have been attained by the work of a few experts, it is gratifying that comparatively satisfactory results have been obtained. Such programmes as the disposal of the State forests either by means of sale or lease, conversion of the State forests to the cultivate land and pasture as well as the preparation of the working plans for the

long period (which may be taken as the future standard of the exploitation) have been made on the basis of these results. Thus a new epoch was opened in the works of the State forest in Japan.

The 2nd exploitation of the State forests was realized by the publication of the Special Account Law of the Forest Funds in 1899, whereby the abnormal condition of the State forests was regulated, the sphere of utilization was determined and the radical measures of adjustment were to be adopted to give facilities to the work and to economize the management of the State forests. The total funds to be put into the work were figured at 23,022,053 yen. The works proposed, consist of the investigation concerning the disposal of the State forests not needing preservation, the actual survey of the State forests which are necessary to be preserved, the preparation of the working plans, the formation of new forests in barren lands, the provisions of forest engineering and various items concerning the Government purchase of the private forests and in these ways, it is proposed to determine the work of the State forests.

After the conclusion of the investigation relating to the question as to the preservation and disposal of the State forests and *genya* (wild lands) in 1894, the authorities took great pains and paid the keenest attention in the execution of the work. But since the adjustment of forests and *genya* involves a large amount of expense, the work proved abortive owing to the financial difficulties. In 1898, however, the Government proposed to meet the expenditures for these adjustments not by the general annual expenditures but by the

proceeds to be realized from the disposal of unnecessary State forests and the law to that effect was finally promulgated with the consent of the Imperial Diet.

The completion of this work has to be attained chiefly by the disposal of the State forests not needing preservation, so that it is obvious that the Government should pay attention to the method of the disposal in order to complete the work as soon as was predetermined. According to the plan proposed, the advantages for the State accruing from the adjustment of the State forests are various. To mention some, it may be stated that by the disposal of State forests and *genya* not necessary to be preserved, the district under the Government management will be narrowed affording great facilities to the protection of State Forests and economizing the expenses for control. The receipt of the land tax to be collected from forests disposed of, will amount to 50,983 yen yearly, which will add to the yearly increase of the Exchequer revenues. The compilation of the working plans accompanied by the actual survey will do away with the complications in the work and will show what is the stock of the State forests. As to the increase of the volume of timber to be felled, it was figured that subsequent to the year 1910, the forest receipts would be quadrupled. The afforestation of the land where there are no trees, will lead to the decrease of the wilderness, securing the advantages arising in connection with the protection of land. Even on the supposition that 100 years hence the timber produced will show the same quotation as at present, there will be forest receipts amounting to some 66,000,000 yen which actually corresponds to about 13 percent of

the Exchequer revenue at present. The hopefulness of this undertaking in future is most plainly shown in the experience of the past 11 years.

SECTION II. THE ACTUAL INVESTIGATION OF STATE FORESTS.

The actual investigation of State forests comprises the items, as to investigate the position, the topography, the area and the condition of those State forests under the supervision of the Department of Agriculture and Commerce and to adjust and draw the line between those forests to be preserved in the permanent possession of the State and those which might be transferred with advantage to private ownership. The standard of the determination may be given as follows:—

1. The forest lands covering the area of 50 *cho*, or the forest lands that scattered within 2 *ri* from a town or village, and might be worked independently for a series of years.

2. Forest covering an area not exceeding 50 *cho* which may be placed under the Government control together with the other forests covering several thousands of *cho* either in same or the neighbouring county.

3. Forest covering the area less than 10 *cho* and which produces a small amount of forest products but which in consideration of the forest undertakings, is necessary for the purpose of the conveyance of timber, the preservation of timber, and the building of official residences, may be regarded as adaptable from the economic standpoint of view, to the Government undertakings connected with the forest exploitation.

Those forests which stand outside the three conditions above named and which are found within the sphere of the regular farming lands or those necessary for the collection of agricultural manures and for the keeping of live stock will be, it is proposed, transferred to the private ownership.

Comparatively speaking, the State forests of Japan possess large areas while their position being distributed in various directions, a great deal of inconvenience is felt both in the management and supervision of the work, and some of the forests are regarded as being probably more profitable if utilized as agricultural land. The investigation of the actual condition was started in the year 1890 at the beginning of the first exploitation of the State forests, and was completed in 1894 after the elapse of 5 years. According to the results of the investigation of the State forests covering an area of 8,095,016 *cho*, the forests which need to be preserved are 7,354,343 *cho*, and those which do not require preservation are 741,573 *cho*. Proceeds obtained from the disposal of the forests covering an area of 741,573 *cho*, form the funds for the work of the second exploitation of State forests.

The work of adjustment of State forests in the first exploitation was necessarily imperfect. Beside this, the progress of the times since then, led to changes of the conditions requiring more or less consideration in regard to the work. It was in the year 1899 that the Regulations for the disposal of the State Forests were drawn up which enabled the authorities to start the reinvestigation of the work, so as to avoid as much as possible any shortcomings.

The disposal of these forests was to be completed in ten

Mixed forest of conifers and broad-leaved trees in Shikoku.

years. After the investigation extending over the years from 1899 to 1907, it was found out that there were 8,654 places which were decided to be preserved covering an area of 4,643,445 *cho*, and that those which were not to be preserved numbered 531,772 covering an area of 705,177 *cho*, of which those disposed of were 178,397 with an area of 366,057 *cho*. The proceeds realized from these forests amounted to 21,094,767 *yen*, involving expenses amounting to 12,485,292 *yen*.

SECTION III. THE SURVEY OF STATE FORESTS.

It has been the opinion of the authorities that the rational exploitation must be conducted by means of the perfect forest maps drawn up by the results of actual survey of the forests. In October, 1884, the Regulations were published concerning the demarkation of the boundaries of State forests, by which the local government was instructed to make the survey of the boundaries and areas of the State forests. The method of the survey being extremely simple, it was next to impossible to attain the desired ends. Since then, the Regulations were frequently revised and in 1900, the Regulations and By-laws relating to the survey of the State forests were passed which are being carried into practice at present. The revised Regulations have paid a special attention as to the settlement of the boundary lines, the estimation of the area, and the survey of the position. These investigations were divided into the three items, namely, the settlement of the boundary lines, the triangular survey, and the boundary survey. The results of these surveys were reduced to a map with the scale of 1/5,000,

which furnished the basis for the preparation of the working plans and the drawing up of the detailed maps of the State forests.

The actual survey of the State forests based upon the above mentioned Regulations attained the following results. For the space of 11 years from 1890 to 1900 the boundary lines surveyed extended for 237,921 *cho* covering an area of 761,349 *cho*, and the boundary lines surveyed from 1901 to 1908 extended for 959,539 *cho* covering an area of 3,071,345 *cho*, making a total of 1,197,460 *cho* in boundary lines covering an area of 3,832,694 *cho*.

SECTION IV. THE PREPARATION OF THE WORKING PLANS OF STATE FORESTS.

In order to confirm the basis of the exploitation of State forests, it is first of all necessary to ascertain the conditions of the lands and forests so as to adopt the standard for their utilization. In 1890, the temporary working plans were compiled. Owing to the lower degree of the utilization of forests and to the smallness of numbers of the staff thoroughly posted up in the forestry, the compilation of the perfect working plans was regarded as an impossibility.

The opportunity for the compilation of the working plans having arrived with the progress of the work of the first exploitation of the State forests, the Regulations for the preparation of working plans of State forests were published, under which the work was started in the State forests in the control of Major Forest Offices of Ehime, Fukuoka, Kagoshima as well as in those State forests under the control of Major

Forest Offices of Osaka, Ishikawa, and Akita. The working plans prepared by these Regulations have their objects for the protection and the permanent utilizations of the State forests:—

1. To cause forests bear perfect sylvan features at all times so as to produce a large amount of timber in future.
2. To adopt the proper method of planting and felling of trees and protect against damages from winds, fire, and insects.
3. To make provisions in consideration of the decrease of the output owing to the above named damages and other causes.

In consonance with the principles above indicated and on the expectation that the evils of the reckless felling of trees will lead to the scarcity of timber, it was considered a matter of great importance to the State to recoup the stocks in forests and enrich the supply.

In preparing the working plan, the Minor Forest Division based upon the local administrative division was regarded as a unit, and the plan of the working was to be compiled accordingly; the annual yield was estimated by both methods of periods by area and periods by volume.

The results of the progress of the actual investigation brought us to be better acquainted with the conditions of forests while the development of communication; at large affected the State forests from the economic point of view. Under the circumstances, there arose a necessity for the revision of the working plans of the State forests. In 1899, the Regulations for the preparation of working plans of State

forests were amended, and in 1902 they were entirely revised in order to adopt the working plans fitted to local conditions and to improve the sylvan features. In other words, the working plans consist of the utilization of forests and the method of their regeneration. The principle was adopted, in the consideration of the condition both interior and surrounding, to maintain the capacity of forests and to introduce the measures of adjustment and the improvement of forests so as to increase the receipts to the maximum degree and to make supplies of products to meet various demands. The results of the compilation of the working plans of State forests for the space of 9 years up to 1907 since the commencement of the special exploitation of the State forests which was started in 1899, show that its progress was slow at first but owing to the improvement of the Regulations and the *modus operandi* for the compilation, the work made a steady progress. The working plans were thus completed during this period as follows:—

The number of working circles.....236....area....1,277,389 *cho*.

It may be noted that the working plans were systematically started with forests which economically occupied important positions. Of the State forests covering a large area, there were not few in which the working plans could not be completed as soon as they were expected, so that in 1904 Regulations were made for the management of forests whose working plans have not yet been compiled. Of these forests, according to the general observation, the temporary working plans were adopted so as to keep the balance in planting and felling of trees.

The above description relates to the State forests of Honshu and we will publish here the general condition of the

exploitation of the State forests in Hokkaido, Taiwan and Karafuto.

(I) The Exploitation of the State forests in Hokkaido. The work of the colonization of Hokkaido has been brought to anything like order only within the last 20 or 30 years so that the attention of the Government has but recently been drawn to the forest exploitation.

Among the State forests in Hokkaido, there is a considerable extent of land adapted to agriculture, so that the line of demarkation has been drawn between the land to be preserved as forests and that to be left for agriculture and pasture, of which the latter was to be colonized and opened in the season. Forests and *genya* to be preserved as forests were subjected to utilization and improvements with a view to the preservation of the land and the furtherance of the benefits desirable from forests. Since the promotion of the permanent interests of the State is a matter of supreme importance, the total area of the State forests in Hokkaido figuring 4,780,000 *cho*, with the exception of those in the Kurile islands covering an area of about 570,000 *cho*, has been brought under the adjustment programme which was carried into force with the consent of the Imperial Diet on April, 1908. The programme stands as follows:—

(a) The Distinction of Forest Lands:—A distinction has been made between the forest lands to be utilized for the purpose of agriculture and pasturage, and those to be preserved as forests. In reference to the forests to be preserved, a distinction has been drawn between those which should remain permanently as the State forests and those which should be

transferred to the ownership of public bodies or private individuals. The work consists of the demarkation of the boundaries, which is to be concluded in 10 years subsequent to 1908. The estimated area of the forests according to the above named distinctions stands as follows :—

1. State forests.....	2,280,000 <i>cho.</i>
2. Public forests	450,000 „
3. Private forests.....	300,000 „
4. The land for colonization purposes	670,000 „
5. Objects yet undecided.....	510,000 „

After the determination of the distinction of these forest lands, the work as stated below will be started in connection with the forests to be preserved as the State forests while other forests will be transferred to the private as well as to the public ownership.

(b) The Triangular Survey :—The triangular survey has already been started by the Military Head-quarters but since its progress does not necessarily accompany the object of the adjustment of the forests, it is to be repeated to lay the foundation for the forest survey. The work is to be started beginning with the year 1913, and to be completed in 13 years.

(c) The Compilation of the Working plans and the Preparing of the Forest Register :—In the district determined as the State, and the public forests after the investigation of these forest lands, the working plans regarding the utilization and regeneration of forests are to be drafted, by which the planting and felling of trees will be regulated with a view to the adjustment and revisions of sylvan features, and also the forest register is to be prepared in order to determine the location, area of

forests as well as the condition of lands and forests. It is proposed to complete the work within 15 years subsequent to 1908, and after the second investigation, there will be drawn up an elaborate working plans.

(II) The Exploitation of the State forests in Karafuto. Since the land was ceded to Japan, only a short time has passed so that all the affairs including the forest work as yet belong to the period of investigation. The island has beautiful forests of wide expanse consisting of conifers. Not only are these forests rich in lumber but their regeneration being extremely easy, they are highly adapted to the working of forests on a large scale. The principles of the future exploitation of the forests may be briefly stated as follows:—

1. With a view to determine the area of the forests which shall form the basis of the sylvan undertakings by drawing a line of demarkation between the forests to be preserved and those to be reclaimed, the investigation of the State forests and *genya* will be made between 1909 and 1911.

2. In order to exploit and utilize the State forests and *genya*, the condition of forests will be investigated, the amount of forest stocks will be estimated, and in order to determine the method of working of the State forests covering an area about 640,000 *cho* which affords the best facilities for utilization, an investigation will be started for their utilization, which being continued for the space of 10 years from 1909 to 1918.

3. At the same time with the investigation relating to the utilization above mentioned, forest roads and canals will be opened.

4. In those sections where the investigation concerning

the utilization is completed, the work will be at once started in accordance with the programme.

5. Fishery being the most prosperous undertaking of the island, forests along the coast which have connection with the coaxing of the finny tribes shall be preserved as the fish inviting forests and shall be left outside the utilization programme mentioned in item II.

6. Coal fields are found everywhere in the island, the amount of the coal being estimated at several hundred million tons, and therefore forests situated on the convenient positions for supplying timber needed for mining purposes accompanying the development of the coal mining in future will be kept as reserve forests and shall be left outside the utilization programme of item II.

(III) The Exploitation of the State forests in Formosa. The district where the greater part of the State forests in Formosa lies, is inhabited by the barbarians who have not been brought under the civilizing influence and frequently they inflict damages upon the people crossing the boundary lines. Until these barbarians are tamed and made good citizens of the Empire, the utilization of these forests and *genya* is next to impossible, so that there are large numbers of forests still left untouched, only a small portion of which being utilized but from year to year the crude savages are being brought under the Imperial influence and converted into what is called "tamed savages" so that no small portion of the forests is being exploited. There is a number of places where the timber industry has been carried by the people where Hi-no-Fi (*Chamaecyparis obtusa* S. et Z.) and Beni-Hi (*Chamaecyparis*

formosensis matsumura) form beautiful forests. The work connected with the felling of trees is to be started on an extensive scale so that the time for the exploitation of these forests will not be very far off.

Camphor being one of the staple products of the island, the Monopoly Bureau of the Department of the Civil Administration has the control over it. Since the creation of the Camphor Bureau (the present Monopoly Bureau) in 1899, with the cutting down of camphor trees of the State forests, a necessity for the building of camphor forests was deeply felt. The Industrial Bureau taking the matter in hand has made yearly appropriations to different prefectures for cultivating camphor trees on a large scale but the growth of camphor trees takes many years before they are available for camphor crops. Since 1905, forests of camphor trees have been planted for extracting camphor from leaves, and in some prefectures, nurse bed has been established with a view to the culture of camphor trees. The area of camphor forests which treated by the system of high forests is about 1,658 *cho* while the area covered by coppice of the same is about 780 *cho*, the growth of the camphor trees being quite successful.

With the recent years, not only the Government is engaged the camphor culture, but the necessity of encouraging the undertaking on the part of the people has also been recognized so that seedlings raised by the Government were distributed among the people free of charge so as to contribute towards the camphor culture. Within recent times, seedlings of camphor tree thus conferred yearly to the people numbered as many as 3,000,000 which being planted

covering an area of 873 *cho*, but with all these attainments, the work was far from being satisfactory so that in February 1907, under the Formosan Government law, the Regulations for the encouragement of camphor plantations were issued whereby those among the people desirous of forming camphor forests can receive the grant of seedlings, the lease of Government forest lands being free of charge. And when forests are successfully grown, these lands will be given to cultivators free of any compensation. There is, of late, an increasing tendency towards forming camphor forests, so that it may be expected that in future there will be a striking increase in the number of these forests.

SECTION V. THE EXPLOITATION OF IMPERIAL FORESTS.

The Imperial forests had ordinary formed a part of the State forests so that in respect of the land feature, condition of forests, and of their distribution, they are similar to those of the State forests. Since there is a necessity for the adjustment of these forests, an item of appropriation for the investigation of forest lands was created in 1892, and in the same year the Regulations for the investigations of the actual conditions of the Imperial forests were issued while in 1893, by-laws relating to the Survey of the Imperial forests and the Regulations for the demarcation of the boundary lines of the Imperial forests were promulgated, according to which the actual conditions have been investigated in a regular order. Boundaries were surveyed and their lines were drawn. By means of triangular and polygonometrical surveys, both the

Giant trees of *Cinnamomum Camphora* Nees. in the State forest,
Kumamoto Major Forest Reserve.

position and the areas of the forests were defined and since then, the works have been steadily continued so as to lay the foundation of the exploitation. By 1898, the work of the adjustment had made a systematic progress, so that in the greater part of the hereditary Imperial forests, the work was completed and in the ordinary Imperial forests, the actual survey was also finished. In order to determine upon the policy of the exploitation of the Imperial forests and to plan for their rational utilization in 1899, the Regulation for the preparation of the working plans of the Imperial forests were issued by which the working plans were laid beginning with the forests which needed immediate attention. According to this Regulation the policy of the exploitation of the Imperial forests differs from that of the State forests. The principle of the largest returns has to be always kept in view. In consonance with the principle of the continuation of the productive capacity, the increase of receipts has chiefly been aimed at. From the nature of the Imperial property, with a view to make supplies of special timber needed for the building and repairing the Ise shrine and palaces, not a few of the forests are provided with the treatments of long rotation. The area of the forests, actual survey completed by 1907, covered 747,910 *cho*, of which the working plans were completed, reached 404,115 *cho*. In reference to the Imperial forests in Honshu the working plans are all completed excepting those connected with sand protection and other arrangements. Since then, according to the plans adopted, both the felling and planting of trees are conducted, while for the forests and *genya* of which no working plans have been compiled in Honshu

and for the Imperial forests in Hokkaido, the working plans will be compiled for the space of 20 years beginning with 1908 so as to complete all the arrangements connected with the Imperial forests.

SECTION VI. THE EXPLOITATION OF THE PUBLIC, AND THE PRIVATE FORESTS.

Among the forests owned by private individuals, there are some forests where the intensive work has prevailed so that in the progress of the silvicultural knowledge and management, satisfactory arrangements were made so as to afford a considerable sum of profits but the majority of the forests under the public, and the private ownership, are conducted on no rational basis. Subsequent to the Restoration, the forests were so recklessly despoiled of their trees that they seemed to be abandoned to nature, the result of which was that the land was gradually ruined and impoverished. Owing to the retention of the old custom of supplying green manure to agriculture, there is preserved a vast area of land without trees growing on it. The exploitation of the private forests has direct interests with the owners themselves so that but few of these forests are left to run wild, and with the gradual development of the ideas concerning forestry among the people there is a tendency for the rational forest undertakings, but the forests owned by the public bodies which are worked by joint efforts under old usages, are neglected both in respect of the work and protection, so that efforts are being made in various local provinces to effect the adjustment of these ruined

forests. The Regulations to control those who set fire in forests or kindle fire in the dangerous neighbourhood of the forests were published. For the reclaiming of the forests regarded to be necessary from the standpoint of the protection of the land, the Regulations for the reclaiming of forests were enacted. In order to determine the method of felling and planting of trees, it was found to be necessary to issue the Regulations concerning the control of public forests and wild land, and since it was feared that the control of the forests would remain nominal if these Regulations were not acted upon and the adjustment of the public forests and *genya* which widely wasted, is not made, the Regulations for the adjustment of public forests and wild lands were also issued, and in order to avoid the future disputes about boundary lines, the Regulations for the survey of boundaries of forests owned by prefectures were published. Going a step further, in order to complete the method of the control of forests owned by the public bodies, temples and shrines, the Regulations for the works which are of the lower degree compared with the Regulation for the exploitation of the State forests were issued. Under these Regulations efforts have been made to stimulate the adjustment, protection and management of these forests. However, it is to be greatly regretted that the progress of the work is extremely slow, partly owing to the defect in the organ of the control of forests owned by the people, and partly owing to the non-diffusion of forest education.

The knowledge concerning forestry and the technical ideas being still crude among the people, there is an ample room for development and improvement of the forests owned

by the people. In order to develop the knowledge concerning the sylvan industry and to guide and foster them, the local prefectures appointed forest experts at the municipal and prefectural expenses by way of setting an example by forming model forests based upon scientific principles. The sylvan industry conducted by the people was encouraged at the municipal and prefectural expenses. The methods of work carried by defraying local expenses for the encouragement of private forests vary according to special circumstances in various localities but they may be briefly stated as follows:—

1. To subsidise those who raise the seedlings for building forests by the establishment of nursery beds by themselves or to give either seeds or seedlings to them free of charge.

2. When forests are built under the management of a public body or school, or upon the lands requiring the building of forests for the preservation of the peace of land or when orders are given to build forests under the Forest Law, seedlings or subsidies are allowed to builders.

3. To set an example of forest undertakings and conduct experiments regarding forestry by the establishment of model forests and nursery beds where the cultivation of seedlings and the building of forests are shown.

4. With a view to the dissimination of the knowledge regarding forestry, the Forestry Training Institutes were established in important places where lectures are given on the primary principles of forestry, forest survey, forest protection, forest utilization, and forest management. The circuit lectures were also made to foster the ideas regarding forestry.

The Department of Agriculture and Commerce is also

directly concerned about the cultivation of special trees. As a consequence of the gradual dissimination of ideas regarding forestry, the work of building up forests in various districts is coming into fashion, and the demand is increasing rapidly for Kusu-no-ki (*Cinnamomum Camphora* Nees.) in order to raise promising camphor, Keyaki (*Zelkova acuminata* Pl.) necessary to the manufacturing of military implements, ships, and rolling stocks, Urushi-no-ki (*Rhus vernicifera* Dc.) as the materials for artistic lacquer wares, Haze-no-ki (*Rhus succedanea* L.) for making the raw wax, Doro-no-ki (*Populus balsamifera* L. var. *Suaveolens* Loud.) for match-sticks and chip braids, Kurumi (*Juglans Sieboldiana* Maxim.) for rifle stocks and other implements, Kashi (*Quercus species*), Ho-no-ki (*Magnolia hypoleuca* S. et Z.), and Kuri (*Castanea vulgaris* Lam. var. *japonica* Dc.) for various industries. The supply is, however, inadequate to meet the demand, and since here was a fear of want in future, necessity was recognized for studying the best method of growing these trees. An investigation was made as to the lands adapted to the cultivation of these trees. Seeds and seedlings were conferred *gratis*, the expense being paid out annually. Since 1907, the officials have been despatched charged with the duties of encouraging and controlling work. According to the plan based upon the figures connected with the supply and demand of timber of these species in future, the following amount of the seedlings of these species is to be planted in forests owned by the people:—

Kusu-no-ki (<i>Cinnamomum Camphora</i> Nees.).....	197,400,000
Doro-no-ki (<i>Populus balsamifera</i> L. var. <i>Suaveolens</i> Loud.).....	50,000,000
Keyaki (<i>Zelkova acuminata</i> Pl.)	10,000,000
Kurumi (<i>Juglans Sieboldiana</i> Maxim.).....	24,000,000

Urushi-no-ki (<i>Rhus vernicifera</i> Dc.)	8,000,000
Haze-no-ki (<i>Rhus succedanea</i> L.).....	8,000,000
Ito-no-ki (<i>Magnolia hypoleuca</i> S. et Z.).....	13,200,000
Kuri (<i>Castanea vulgaris</i> Lam. var. <i>japonica</i> Dc.).....	10,000,000
Kashi (<i>Quercus species</i>).....	90,000,000

To mention some of the results obtained in 1907, there were planted 2,110,842 of Kusu-no-ki (*Cinnamomum Camphora* Nees.), 491,460 of Keyaki (*Zelkova acuminata* Pl.) and 6,000,000 of Urushi-no-ki (*Rhus vernicifera* Dc.), while the seeds of these species sown amounted to 9.920 koku.

CHAPTER V.

THE FOREST WORKING.

SECTION I. THE PRESENT CONDITION OF THE FOREST WORKING.

The working methods of forests is not uniform but differs according to the ownership of the forests. The forests belonging to the State, and the Imperial Household are of extensive dimensions and some of them are in deep mountains and dark valleys where the sound of an axe has never been heard, and in those places there are comparatively a large number of forests which have not utilized. The general principle of the working is to put these forests in normal state, and to make a long use of the forests and in consequence the proceeds of the forests in many cases may be comparatively small in proportion to their area. For the private forests, the aim being to secure much

Terrace planting to prevent the collapse of the soil in
Hiroshima Prefecture.

profit in as short a period as possible, not a few of them are most carefully attended to and are in most beautiful feature. In the neighbourhood of Ome and Takaido near Tokyo and in Muro in the province of Kii, and in the Yoshino districts of Yamato, there are many forests of Sugi (*Cryptomeria japonica* Don.) and Hi-no-ki (*Chamaecyparis obtusa* S. et Z.) which are the most famous privately owned ones and their profits are large. The general tendency of late has been to plant such trees, as are most demanded in the market and from financial considerations the owners are gradually shortening the age of rotation so that it has become impossible to look to private forests for the supply of huge timber. In order to fill up this defect in the national economy, the plan taken by the Government with regard to the working of the State forests or those owned by the Imperial Household is to produce such timber as private forests can not supply, by planting such trees to meet the demand in the market and tastes of the people. The period of rotation of these species in the State forests are generally as follows:—

Sugi (<i>Cryptomeria japonica</i> Don.)...	... ..	80—100 years.
Hiba (<i>Thujopsis dolabrata</i> S. et Z.).	... ..	130—150 „
Kara-matsu (<i>Larix leptolepis</i> Gord.)	... ..	60—80 „
Keyaki (<i>Zelkova acuminata</i> Pl.)	... ..	100—200 „
Kurumi and Kuri (<i>Juglans Sieboldiana</i> Maxim. and <i>Cas-</i> <i>tanea vulgaris</i> Lam. var. <i>japonica</i> Dc.)	... ..	80 years or more.
Hinoki (<i>Chamaecyparis obtusa</i> S. et Z.).	... ..	80—120 years.
Aka-matsu (<i>Pinus densiflora</i> S. et Z.)	... ..	40—80 „
Kuro-matsu (<i>Pinus thunbergii</i> Parlat.).	... ..	40—80 „
Kusu-no-ki (<i>Cinnamomum Camphora</i> Nees.).	... ..	40—120 „
Kashi (<i>Quercus</i> species.)	... ..	80—120 „

In cases when such high rotation is admitted it is of course necessary to maintain the land capacity by the under-

wood adopting the coppice-with-standard system or two-stored height forest system and thereby keep the forests in a good economical condition.

In the Imperial forests the period of rotation of the principal species is as follows:—

Sugi (<i>Cryptomeria japonica</i> Don.)	... ..	60—120 years.
Hiba (<i>Thujopsis dorabrata</i> S. et Z.)	... ..	80—160 „
Kara-matsu (<i>Larix leptolepis</i> Gord.)	... ..	50—100 „
Keyaki (<i>Zelkova acuminata</i> Pl.)	... ..	100 years or more.
Hinoki (<i>Chamaecyparis obtusa</i> S. et Z.)	... ..	80—160 years.
Matsu (<i>Pinus species.</i>)	... ..	50—100 „
Kusu-no-ki (<i>Cinnamomum Camphora</i> Nees.)	... ..	100 years or more.

The selection of working system in the State and the Imperial forests differs according to the condition of the forests. For instance, when the forest is in a steep mountain and danger is feared, unless precautions are taken by insuring the preservation of the land, the system of selection felling is adopted, but in the forests where no such apprehension exists the clear cutting is admitted. In the case of forests grown in the mixed state of those that may be used as building materials and of others which are only fitted for fuel, the gradual improvement of the species of the over-wood and increase of the profit are effected by the coppice-with-standard system. The coppice system is chiefly adopted in private forests, the aim of which being the product of firewood and charcoal. In the districts, where the demand can not be supplied from such private forests, this working system is adopted in the State forests. The forests that are worked by this system are mostly those of natural growth, there are, however, not a few forests in the neighbourhood of cities, consisting of Kunugi (*Quercus serrata* Thunb.), Konara (*Quercus glandulifera* Bl.).

and other trees artificially planted, and worked intensively by this system.

The bamboo culture forms a special feature in the forestry of Japan. It is worked only by the selection system. There is almost no place in Japan where lands are not suited to bamboo culture, and consequently the profit is very large but the area of these forests is comparatively smaller than that of other tree species.

We regret very much that we are unable to give statistics and a table of the exact area of the forests classified according to the system of working, but the State forests in Honshu may be roughly classified as follows:—

System.	Against forest area.
High forest system... ..	80%
Coppice system.	4%
Coppice-with-standard system	6%
Barren land	10%
Total..	100%

From the above table it will be seen that the high forest system occupies the majority of the whole area of the State forests. The principal trees of those forests are equally divided between conifers and broad-leaved trees; the principal trees of the former kind are Sugi (*Cryptomeria japonica* Don.), Hinoki (*Chamaecyparis obtusa* S. et Z.), Matsu (*Pinus species*), Kara-matsu (*Larix leptolepis* Gord.), Hiba (*Thujopsis dolabrata* S. et Z.), Momi (*Abies firma* S. et Z.), Tsuga (*Tsuga Sieboldi* Carr.), Todo-matsu (*Abies Sachalinensis* Mast.), Tohi (*Picea hondocensis* Mayr.) and those of the latter are Kashi (*Ever-green Quercus species*), Nara (*Quercus glandulifera* Bl.), Buna (*Fagus sylvatica* L. var. *Sieboldi* Maxim.), Kusu-no-ki (*Cinnamomum*

Camphora Nees.), Keyaki (*Zelkova acuminata Pl.*), Kuri (*Castanea vulgaris Lam. var. japonica Dc.*), Shioji (*Fraxinus Sieboldiana Bl.*), Kaede (*Acer palmatum Thunb.*), Kaba (*Betula species.*). The species in coppice woods are Kunugi (*Quercus serrata Thunb.*), Ko-nara (*Quercus glandulifera Bl.*), Kashi (Ever-green *Quercus species.*), Shide (*Carpinus laxiflora Bl.*), Soro (*Carpinus yedoensis Maxim.*), and others, and the over woods of the forests of coppice-with-standard are Matsu (*Pinus species*), Momi (*Abies firma S. et Z.*), Tsuga (*Tsuga Sieboldi Carr.*), Kusu-no-ki (*Cinnamomum Camphora Nees.*), Kashi (Ever-green *Quercus species*), Keyaki (*Zelkova acuminata Pl.*), and Kuri (*Castanea vulgaris Lam. var. japonica Dc.*).

The forests belonging to the Imperial Household may be classified according to the working systems as follows :—

Systems.	Against forest area.
High forest system...	80%
Coppice system ..	7%
Barren lands ...	10%
Forest lands not worked .	3%
Total...	100%

From this table it will seen that 80 percent of the entire forests are high forests, 7 percent coppice woods, and 10 percent barren lands and 3 percent forest lands not worked. The species of trees of these forests are about the same as those of the State forests above mentioned. With the development of saw milles, there has naturally arisen a tendency toward general unity in the size of timber which has hitherto shown the places of product, being different according to various districts and the market price and credit had come to be decided by the size of the timber.

The season of felling of trees has a close connection with the situation of the forest and with the existence or non-existence of the advanced means of transportation but generally, the season of felling of trees in Japan are seven months beginning with the autumnal equinox to March of the next year. In Hokkaido and the northern part of Honshu, where grounds are covered with snow for nearly one half of the year, they set about felling of trees with the beginning of the snow season, and slide down the logs to the banks of the rivers on the snow, and thence in spring, when the snow begins to melt and the rivers swell, the logs are floated down the stream. There are of course not a few forests which are worked throughout the year, for instance, the forest which produces charcoals or materials for some industries, are usually worked throughout the year.

The timber felled in forests are brought to the final market through various procedures according to the condition and customs of the place. The transport of the timber is divided into two stages. The first is the transport of timber from the felling place to the timber depot, and the second is the transport from that timber depot to the final market by the organs of communication. In the first stage of transport, the means employed from the old times has chiefly been, from the geographical condition, floating on the river. This is due to the geographical situation of the Japanese forests, most of which are, as explained before, on the side of the steep mountain slopes. In such places, the construction of cart roads can not in most cases be hoped for. The forest roads are made in the upper course of the river, and the timber is brought to

the place, from where it can be floated by the stream in rafts or by ships to the depot, and the first stage of transports is the work between the forest and the timber depot. In truth, there are rivers in Japan that are not fitted for the purpose. The second is the transport from the depot to the markets which are generally situated in the place where rivers empty themselves into the sea. This situation of the market gives great convenience to the floating of timber. There is, however, an inconvenience that every market does not necessarily exist at the mouth of a river, but in some cases it is far from the river. Even in such case, the timber can be transported by sea. Japan is surrounded by sea and a harbour is found in almost all parts of the coast, and the inconvenience of the distance is sufficiently mitigated.

Thus, water affords great convenience and facility to the transport of forest products, and has an important relation to the supply of timber. It is, however, difficult to make use of the river throughout the year, on the one side the water being required for the purpose of the irrigation of the paddy fields, and on the other, in the summer and the early autumn the river often inundates making the floating of timber impossible. The season most suited for the purpose is the seven months from the end of September till the middle of March of the next year. The development of wood technology and the increase of demand of timber in the market, not allowing the supply to be limited to a certain season, but requiring continual supply, the general tendency now is to rely upon the transportation by land instead of by water, and thus to save the inconvenience of limiting the supply to a certain season and damage done to the

quality and the loss of timber caused by floating. The improvement of public roads in these thirty years, has greatly stimulated this tendency. In consideration of this tendency the forest roads have been constructed in the State forests and the Imperial forests and in some places forest railways have been constructed for the transportation of the timber. The great extension of railways of late, and the completion of equipments for the transport of timber have greatly facilitated the transport of timber and ultimately have increased the price of timber at the places of origin, and also greatly extended the sphere of the demand. Of the transportation will be treated under a different chapter.

SECTION II. THE UTILIZATION OF THE MINOR-PRODUCTS OF THE FOREST.

The use of minor-products of forest is making great improvement with the development of the forests exploitation, becoming of an important item of forest incomes. We shall state the condition of the use of the principal minor-products of the forests.

1. Dead twigs, dead leaves, and branches and twigs left after the felling of trees are important fuel for the inhabitants in the neighbourhood of the forests. The Government has, therefore, fixed liberal regulation in the treatment of these minor-products of the State forests as well as the Imperial forests and the inhabitants of the neighbourhood or the people working in the forests are allowed to collect them at a very low price or free of charge under certain conditions. In some

occasions they are also allowed to take the shrubs growing on regenerated land. The Regulations concerning the State forests left in care of temples and shrines, or forests entrusted to villages or towns have been issued for the purpose of preserving the State forests, but also with a full consideration of their economical relations to the villagers, and according to these Regulations these minor-products are left to be collected, under supervision, by the villagers free of charge throughout the year.

2. The growth of weeds is remarkable in all parts of the country, the ground being moist. The weeds are allowed to be collected by the people for the purpose of tending the forest and for their special uses, within the limit not affecting the capacity of the ground. The custom of making the weeds in forest and field into fertilizers or to feed cattle with, is still prevalent. There are, therefore, many forest lands throughout Japan left open for the special purpose of growing weeds. In the southern part of Honshu there is an objectionable custom of burning those grass fields in winter. This custom is specially prevalent where agriculture is advanced. This burning of dead grass gives very bad effects to the growth of forests. The practice has now greatly abated but is still not entirely abolished.

3. Mushrooms are a very important minor-product of the forests and almost every forest in Honshu produces them, and there are numerous kinds of mushrooms that are edible. The most important kinds are as follows:—

Shiitake;—The dried *Shiitake* is one of the important staples exported to China, Hawaii, Hongkong, British India,

and the United States of America. The total amount of the product during 1907 reached over 1,855,700 *kin*, valued at over 1,033,500 *yen* of which over 1,626,700 *kin*, valued at over 1,067,000 *yen*, was exported. This mushroom grows on kunugi (*Quercus serrata* Thunb.), Ko-nara (*Quercus glandulifera* Bl.), Soro (*Carpinus yedoensis* Maxim.), and these trees grow mostly in the districts of Hyuga and Bungo in Kyushu, and the districts of Kii, Ise, and Suruga in Honshu. In these districts, for the purpose of cultivating this mushroom, the age of rotation of these trees is fixed at 18-25 years, and it is worked by the coppice system. The profit is very large. The *Shiitake* grows twice a year, in the spring and the autumn. This mushroom like others grows naturally but in recent years people have begun to plant the spore, and artificial growing of the mushroom is now being carried on a large scale. The mushroom is grown and prepared in different manners. Some for export purpose and others for demand at home. The special kind call "donko" is highly prized in the Chinese market. Indeed *Shiitake* is prized in all places.

Matsutake:—This mushroom springs up in the forest of *Pinus densiflora* grown in the granite soil of the tertiary formation. The place best suited for the purpose is the shallow soil where weeds do not grow much. In such places it naturally grows in abundance. The output of the mushroom during the year 1907 was over 3,079,700 *kin*, valued at 503,600 *yen*. This mushroom has the highest flavour of all kinds, and people of all classes have it at dinner. The quality, however, is very fragile and is impossible to keep it dried for a long time, without losing its flavour as *Shiitake*. There-

fore, we can taste its nice flavour for only one month in the Autumn which is the season of its growth. In recent years, however, people have begun to preserve it in tin cans, and export it to foreign countries. The most famous *Matsutake* producing places are the forests belonging to Osaka Major Forest Office and Hiroshima Major Forest Office, and in certain Minor Forest Offices a greater income is obtained from the proceeds of this mushroom. The gathering of this mushroom is very simple and done by women and children, and increasing demand of labour for gathering of mushrooms naturally causes the raising of the wages of poorer classes in those districts, conferring on them no small benefits.

Besides these, the mushrooms such as *Kotake*, *Kikunage*, *Shimejitake*, *Hatsutake*, etc. are very nice food.

4. Fruits of *Rhus succedanea* L. As material for vegetable wax it constitutes an important item in the minor-product of the forest. This fruits are produced mostly in Kyushu, Shikoku, and southern part of Honshu and the product is yearly increased. Vegetable wax has hitherto been used solely as the material for candles, but lately it is being used for giving luster to clothes, and also as a rust preventive. In Europe and America, vegetable wax is used as a substitute for beeswax. During the year 1907 the total amount exported to Hongkong, Germany, England, and the United States of America amounted to over 3,621,600 *kin*, valued at over 1,070,500 *yen*. If the amount consumed at home is added to this the total will amount to a very large sum. This species is cultivated in the forests belonging to temples and shrines, public forests, and private forests. It

bears nice fruit when grown on a slope facing to the south.

5. Seeds.—The planting of trees on waste lands and the forest lands after the trees felled, is now greatly in vogue and artificial forests are expanding. In consequence, there arose a great demand for seedlings and seeds, so that seeds have now become one of the minor products of the forest. The gathering of seeds is chiefly done by private individuals. The seeds which mostly demanded are that of sugi (*Cryptomeria japonica* Don.), and the next are those of Aka-matsu (*Pinus densiflora* S. et Z.), Hinoki (*Chamaecyparis obtusa* S. et Z.), Kunugi (*Quercus serrata* Thunb.) and Kara-matsu (*Larix leptolepis* Gord.). The seeds of *Cryptomeria japonica* Don. and *Chamaecyparis obtusa* S. et Z. are mostly produced in Yoshino districts of Yamato, and the Muro districts of Kii.

Quercus serrata Thunb. has deep roots and the seedlings are very strong, for this reason this species has now come to be largely planted in dry hill sides. In consequence, the demand for seeds had greatly increased. The seeds are now chiefly produced in the Ikeda districts of Settsu, and the Nasu districts of Shimotsuke.

The seeds of *Larix leptolepis* Gord. are being supplied from the Saku districts of Shinano. The planting of this species is now largely practiced in private forests and to meet the demand of the seeds of this species, gathering of seeds is carried out in the southern part of Honshu and in various parts of Shikoku and Kyushu. The output of seeds during the year 1907 exceeded 2,200 *koku*, is valued at over 41,100 *yen*.

6. Nuts.—The nuts of Buna (*Fagus sylvatica* L. var.

Sieboldi Maxim.), Shikimi (*Illicium Anisatum L.*), Tsubaki (*Thea japonica Nois.*), Abura-giri (*Alcurites cordata Muell. Arg.*), Inugaya (*Cephalotaxus drupacea S. et Z.*), Kurumi (*Juglans Sieboldiana Maxim.*), etc. are gathered as the material for vegetable oil. High wages are being paid for these nuts gathering and in the nut gathering season farmers often get three times as high wages as their ordinary pay. With the development of the mechanical industries the demand of vegetable oil has greatly increased, and consequently the gathering of these nuts is making a gradual increase. The output of nuts during 1907 was over 159,700 *koku* and was valued at over 555,200 *yen*.

7. Bark—The bark of Kashiwa (*Quercus dentata Thunb.*), has hitherto been used as a dyeing material or for the tanning of skins but lately the demand for it has greatly increased. This bark is at present being supplied by the forests in Hokkaido and the northern part of Japan. There are, however, no forests made artificially for the purpose of producing the bark, but this material is obtained from the forests of a natural growth. The bark of Han-no-ki (*Alnus japonica S. et Z.*), Tsuga (*Tsuga Sieboldi Carr.*), Kuri (*Castanea vulgaris Lam. var. japonica Dc.*), Nobu-no-ki (*Platycarya strobilacea S. et Z.*), Nara (*Quercus species.*), and Shii (*Pasania cuspidata Oerst.*) are also used in the same way as the *Quercus dentata Thunb.* The output of bark during 1907 was over 4,480,600 *kin*, valued at over 71,800 *yen*.

Besides these, there are many minor-products of forests such as bark of Sugi (*Cryptomeria japonica Don.*), Hinoki (*Chamaccyparis obtusa S. et Z.*) and the Sheath of bamboo,

The forest preserved for natural scenery of temple Kiyomizu
in the suburb of Kyoto.

animal skins, vegetables of natural growth etc.

SECTION III. WOOD TECHNOLOGY.

The industries connected with forestry are various in Japan and the products are not trifling, but there are few companies which worked on a large scale with abundant funds and the industry is left to individual enterprise of those who are working on a small scale with small capital.

Charcoal Manufacture:—This is industry undertaken in almost every part of the country and there is almost no forest of broad-leaved trees where charcoal manufacture is not being carried on. Japan has indeed made a special development in this industry. The “Bincho” of Kumano districts of Kii, “Sakura charcoal” of Shimo-zusa province, and “Ikeda charcoal” of Settsu province are charcoals well known from olden times. During recent years coal has come to be greatly used as a substitute thereof, but nevertheless there are extensive demands for charcoal and for certain industrial purpose the demand for charcoal is still increasing. The product in 1907 was 237,229,300 *kwan* and valued at 15,869,400 *yen*. The manufacture of acetate of lime is now making a great development but they are mostly by-products of the charcoal industry.

With the development of various industries, the demand of sawn timber has greatly increased and saw mills have been established in various places. The establishment of many saw mills has helped on the business transaction in timber, at least it has worked to bring about the unity in the size of timber, and consequently there is a great saving of freight and

the raising of prices of rough timber which has ultimately enhanced the profit of forests. There were 14 Government saw mills and about 700 private ones in 1909, and the motor power employed in the former was 1,935 H. P. the material consumed in that year being over 570,000 *shakushime* (When night work was done the amount would reach about 970,000 *shakujime*). The motive power of private saw mills exceeded 11,500 H. P. (Steam, water power, electricity, petroleum, etc.) and the material consumed was about 8,500,000 *shakujime*.

Camphor and Camphor Oil:—These are one of the most important staples of foreign trade. They are made from the camphor trees growing in the southern part of Honshu and in Formosa. The superiority of the quality is well known to the world. The output is exported to America, Germany, France, and England. The amount of these articles exported in 1907 was as follows:—

Camphor:—over 3,057,600 *kin*, valued at over 5,026,800 *yen*.

Camphor oil:—over 1,870,500 *kin*, valued at over 367,700 *yen*.

Match-sticks:—Besides meeting the domestic demand, the amount of match-sticks exported to China, Korea, and British India is very large. The match-sticks factories are established in the districts where there are large quantity of Doro-no-ki (*Populus balsamifera suaveolens* Loud.) and Hako-yanagi (*Populus tremula* L. var. *villosa* Wesm.) which are the material for match-sticks. The amount of match-sticks exported in the year 1907 reached 6,436,650 *kin*, and the value exceeded 169,200 *yen*.

The Manufacture of Wood Pulp:—This industry has also made a rapid development in recent years. In former years

we had to look to European countries for the supply of this material. A great demand for paper of all kinds and the advancement of the paper industry in Japan have caused the rise of this industry. According to the returns of 1907, there are more than 10 factories manufacturing the wood pulp with steam as a motive power. The wood most employed as material for this purpose is Shirabe (*Abies veitchii* Lindl.), Momi (*Abies firm S. et Z.*), Tochi (*Picea hondensis* Mast.) and Tsuga (*Tsuga Sieboldi* Carr.); Todo-matsu (*Abies sachalinensis* Mast.) and Ezo-matsu (*Picea ajanensis* Fisch.) growing in large quantities in Hokkaido and Saghalien Island are also much employed.

Bamboo baskets, Blinds, and Sticks:—These and other bamboo articles are manufactured in large quantities and the amount exported has greatly increased of late. The export in 1907 exceeded 1,084,400 *yen*.

Chip-braid:—This is also increasing its output and the amount yearly exported is not at all trifling. The amount of this article in the year 1907 reached 3,414,000 bundles, valued at 884,200 *yen*. For the material of this merchandise, Doro-no-ki (*Populus balsamifera* L. var. *suaveolens* Loud.), Hinoki (*Chamaecyparis obtusa* S. et Z.), Ho-no-ki (*Magnolia hypoleuca* S. et Z.), Hako-yanagi (*Populus tremula* L. var. *villosa* Wesm.) are mostly employed, but there are many other woods that can be used for the purpose. In the manufacture of these chip-brands, the most famous place is Tokyo and Kobe.

Besides these above mentioned, the chief wood workings are the manufactures of boxes, wheels, kegs, barrels, joinery, turnery, and the manufacture of other articles. The industries

which have a close connection with the forestry have thus a very good prospect and it may be expected that they will make a remarkable development.

CHAPTER VI.

FOREST YIELD.

SECTION I. THE YIELD OF STATE FORESTS.

In reference to the income out of the forests, no exact statistics are obtainable upon the forests owned by private individuals so that we shall confine our statements herewith to the State forests of 7,484,770 *cho* and the Imperial forests covering an area of 2,236,882 *cho*.

The yield from the forests differs according to the location of the forests and the geographical shape of the land upon which the forest stands, and the amount of timber produced depends upon the species of the trees and the condition of their growth. The monetary yield of forest must be fixed by the situation of the forest, whether equipments are made or not for the conveyance of products, specially by the demand and supply of the products in the market.

The annual yield of the State forests has an increasing tendency as the method of management in these forests advances, and in fact, it has increased by about $2\frac{1}{2}$ times in these ten years, the particulars of which can be seen in the following table :

Years.	1898.	1901.	1904.	1907.
	<i>Shakujime.</i>	<i>Shakujime.</i>	<i>Shakujime.</i>	<i>Shakujime.</i>
Timber	...1,007,681	1,700,895	3,189,036	3,186,637
Fuel... ..	...3,599,802	4,140,582	6,229,854	7,508,298
Total.. ...	...4,607,483	5,841,477	9,418,890	10,694,935
	<i>cho.</i>	<i>cho.</i>	<i>cho.</i>	<i>cho.</i>
Entire forest area. ...	8,361,944	8,214,503	7,820,597	7,484,770
Yield per <i>cho</i>	0.55	0.71	1.20	1.43

(In the table, there is not included the annual output of boughs, faggots, and stumps; all figures bellow one *shakujime* are cut off, and the same shall be done in all the tables inserted after this).

Such a great increase of the annual yield in these ten years is due on the one hand to the fact that with the progress of the method of management in these forests, the exact state of these forests became clearly known so that the felling of trees, rightly carried out, was increased, and on the other hand it is the result of the increase of the demand for the products with the improvement of the means of traffic. The utilized area of State forests was only about 20% of the whole area in 1898 while in 1907 it increased to about 44%, and the utilized area was increased by 22 times while the amount of timber produced 2.3 times.

As is seen in the foregoing table, the output against the whole area of the forests in these ten years has increased from 0.55 *shakujime* to 1.43 *shakujime* per *cho* in average, while the increase was from 2.7 *shakujime* to 3.3 *shakujime* per *cho* against the utilized area.

This output of products is rather small in amount against the total stocks in these forests, and we can see that the amount of the output is less than half the amount of trees

that might be rightly felled in a year. This is owing to the reason that in most of the State forests there are a large number of inferior trees and they harm the growth of the trees of a superior species and this irregular sylvan feature makes it impossible to fully utilize the capacity of the land, and that the growth of trees can not be effected as regularly as is expected in consequence. Moreover, the Government's policy is to make the output of timber products as small as possible in amount until its adjustment works of the forests are completed, and further more the means of traffic being still in an undeveloped state, there is left a considerable area of forests not utilized.

In reference to the monetary yield, State forests are in a most unfavourable condition on account of their bad location. The following is the list of the income every third year during the ten years from 1898-1907.

Years.	1898	1901	1904	1907
	<i>yen</i>	<i>yen</i>	<i>yen</i>	<i>yen</i>
Sales of Timber and Bamboo	1,168,846	1,862,368	2,580,988	7,242,792
Sales of Minor-pro- ducts & etc. . . .	142,904	158,655	147,260	175,534
The rent of Leased Land	46,323	68,312	82,679	91,287
Others	93,593	87,187	73,842	135,043
Total	1,451,666	2,176,522	2,884,769	7,644,656
	<i>cho</i>	<i>cho</i>	<i>cho</i>	<i>cho</i>
Entire forest Area... ..	8,361,944	8,214,503	7,820,597	7,484,770
	<i>yen</i>	<i>yen</i>	<i>yen</i>	<i>yen</i>
Yield per <i>cho</i>	0.174	0.265	0.369	1.021

As it will be seen from the above table, in 1898 the income was *yen* 0.174 per *cho* while it increased to *yen* 1.021 in 1907, and it will further increase year after year with the

progress of the adjustment of the State forests and the development of industry of the country. The above table shows that compared with 1898, the amount of income increased by 1.5 times in 1901, by 2 times in 1904, and by 5.8 times in 1907. Of the utilized area, the amount of income has increased in these ten years from *yen* 0.869 to *yen* 2,300 per *cho* on the average.

The increase of the gross incomes not only depends upon the increase of the output of timber but the appreciation of the price of timber and the depreciation of transportation charges as a results of the development of the means of transportation in these years. These have a more important connection with timber than with fuel.

With the increase of income, the expense of the State forests has naturally increased. In 1898 the total amount of the expense was 856,706 *yen* while it increased in 1907 after ten years by about 3 times or to 2,950,594 *yen*.

This increase of the expense is, of course, caused mostly by the appreciation of the price of materials used for forest works and that of the wage of labourer employed owing to the rise of the cost of living in general, but it is also a result of the increase of expenditure connected with the expansion of the forest works.

A list of the expenses of the State forests for every third year during the ten years from 1898-1907 is given below :—

Years.	1898	1901	1904	1907
	<i>yen</i>	<i>yen</i>	<i>yen</i>	<i>yen</i>
Expenditures	856,706	1,019,257	1,142,871	2,950,594
Expenditures per <i>cho</i>	0.103	0.124	0.146	0.394

In the above figures, salary, allowance, and travelling expense of officials, the expense for the planting of trees and

for the conveyance of the trees felled, and all other expenses needed for both management and works are included. And these expenses put together were *yen* 0.103 per *cho* in average in 1898 while it increased to *yen* 0.394 in 1907 after ten years, and the ratio of increase went up regularly during the seven years from 1898-1904, but thence it has rapidly gone up till 1907 on account of the establishment of saw mills etc., owing mainly to the increase of the expense for works. Thus compared with 1898, the expense increased by 1.3 times in 1904 and by 3.4 times in 1907.

The following is the state of the accounts of the State forests:—

Years.		Entire Forest Area, <i>cho</i>	Gross Income, <i>yen</i>	Gross Expenditure, <i>yen</i>	Net Receipt, <i>yen</i>	Income per <i>cho</i> , <i>yen</i>
1898	... ..	...3,861,944	1,451,666	856,706	594,960	0.071
1901	... ..	...8,214,503	2,176,522	1,019,257	1,157,265	0.141
1904	... ..	...7,820,597	2,884,769	1,142,871	1,741,898	0.223
1907	... ..	...7,484,770	7,644,656	2,950,594	4,694,062	0.627

As it is seen from the above table, the net receipt in these ten years has increased on the average from *yen* 0.071 to *yen* 0.627 per *cho* against the whole area of the forests. In proportion with the utilized area, the net receipt has increased from *yen* 0.356 per *cho* for 1898 to *yen* 1.425 for 1907.

SECTION II. THE YIELD OF IMPERIAL FORESTS.

Those forests in possession of the Imperial Household are in a better condition than the State forests for two reason. One is that when they were started, these forests were grouped together as much as possible for the sake of convenience in

controlling them, and the other is that they were all comparatively better systematized forests and they are rich in those kinds of trees which form the most important timber in Japan. The table below shows the amount of the timber products of these Imperial forests during those ten years from 1898 to 1907:—

	1898	1901	1904	1907
	<i>shakujime</i>	<i>shakujime</i>	<i>shakujime</i>	<i>shakujime</i>
Timber	643,571	1,033,586	1,407,143	2,493,575
Fuel... ..	563,220	851,130	959,999	1,120,836
Total.. ...	1,206,791	1,884,716	2,367,142	3,614,411
	<i>cho</i>	<i>cho</i>	<i>cho</i>	<i>cho</i>
Entire Forest Area ..	2,245,902	2,217,248	1,563,130	2,239,882
Yield per <i>cho</i>	0.54	0.85	1.51	1.61

Namely, the average amount of the products against the whole area of the forests was 0.54 *shakujime* per *cho* in 1898 while it went up to 1.61 *shakujime* in 1907, or it increased by about 3 times in those ten years. The amount of the monetary yield from these forests in the same decade is as follows:—

	1898	1901	1904	1907
	<i>yen</i>	<i>yen</i>	<i>yen</i>	<i>yen</i>
Sales of Timber and Bamboos.	818,083	948,813	799,146	1,906,548
Sales of Minor-products & etc	26,972	26,623	32,204	33,757
The Rent of Leased Land	64,314	85,898	115,727	156,138
Others	196,035	52,890	36,415	53,154
Total... ..	1,105,404	1,114,224	1,083,492	2,149,597
	<i>cho</i>	<i>cho</i>	<i>cho</i>	<i>cho</i>
Entire Forest Area... ..	2,245,902	2,217,248	1,563,130	2,239,882
	<i>yen</i>	<i>yen</i>	<i>yen</i>	<i>yen</i>
Income per <i>cho</i>	0.492	0.502	0.693	0.959

It can be seen from the above table that in the Imperial forests as in the State forests the output of products as well as the amount of monetary yield have gradually increased as the

method of management progressed, and they are still in progress from the economical point of view. Thus, these Imperial forests being comparatively well administered, have brought about a good income so far, namely it was on an average *yen* 0.492 per *cho* in 1898 and increased to *yen* 0.959 in 1907, showing an increase of *yen* 0.467 in those ten years.

The amount of the expense of the Imperial forests has increased too as can be seen in the following table :—

	1898	1901	1904	1907
	<i>yen</i>	<i>yen</i>	<i>yen</i>	<i>yen</i>
Expenditures	418,802	545,286	715,776	832,789
Expenses per <i>cho</i>	0.186	0.246	0.458	0.372

Thus the expense of the Imperial forests increased in almost the same ratio as in the case of the State forests, namely it increased in the decade on an average from *yen* 0.186 to *yen* 0.372 per *cho* showing an increase of about two times. The figures given below explain the state of the accounts of the Imperial forests :—

Year.	Entire Forest Area.	Gross Income.	Gross Expenditure.	Net Receipt.	Receipts per <i>cho</i> .
	<i>cho</i>	<i>yen</i>	<i>yen</i>	<i>yen</i>	<i>yen</i>
1898... ..	2,245,902	1,105,404	418,802	686,602	0.305
1901... ..	2,217,248	1,114,224	545,286	568,938	0.257
1904... ..	1,563,130	1,083,492	715,776	367,716	0.235
1907... ..	2,239,882	2,149,597	832,789	1,316,808	0.588

The net receipts against the whole area of the forests was on an average *yen* 0.305 per *cho* in 1898 and it increased to *yen* 0.588 in 1907, that is the net receipts from the Imperial forests showed an increase of *yen* 0.283 per *cho* on an average in this decade.

The forest preserved for attracting fish in Ehime Prefecture.

CHAPTER. VII.

SYLVICULTURE AND TRANSPORTATION OF FOREST PRODUCTS.

SECTION I. SYLVICULTURE.

The political revolution in the beginning of the Meiji Era (1868) produced a disastrous effect upon the preservation of the forests. The forests throughout the country were mercilessly cut down so that there appeared in all quarters of Japan hills and mountains deprived of trees. The consequence was that not only was the forests economy jeopardized but the economic order of the people at large was deranged, dealing heavy blows upon the productive industry of the people by giving rise to annual inundations which devastated many parts of the country. This state of affairs was noticeable in the forest districts with granite strata, particularly in the province of Omi, Mino and those portions of the Chu-goku facing the inland sea. The adjustment and improvement of these unwooded lands called forth the immediate attention of the Government, so that in 1875 the Regulations for the Provisionary Investigation of the State forests were published. The extent of the nude land was thus investigated. In the year 1877, at Nishiga-hara, Tokyo, the Forest Experiment Station was established for the purpose of making experiments regarding the cultivation of trees and the kindred subjects. In 1878, the Regulations for the percentage system of forests were issued by which the authorities encouraged the people

to plant trees in the nude lands owned by the State. In these various ways, efforts were made towards the restoration of the forests, but the result not having reached the expected degree was limited to the plantation of trees in the land, covering about 80,000 *cho*. Of the forests owned by the people, there had already been started an intensive work of forestry in districts such as Yoshino (Yamato), Muro (Kii) Tama and Iruma (Musashi) and Katsuno (Yamashiro), while there was made a progress in the sylviculture worthy of notice, but in the rest of the forests, the work was crude and the forest was left to the natural process of regeneration. In forests owned by the public bodies, the vast area were mostly given up to the collection of the grass. In 1890, when the system of municipal government was carried into effect, these forests were one after another selected as the basic funds of these self-governing public bodies or as the common property of public corporation. In these ways, a greater attention came to be paid to the reforestation of the nude lands owned by the people. Since the Forest Law was brought into operation in 1897, the local prefectural government by granting subsidies from local funds proposed the reforestation of the nude lands and encouraged aforesaid of deserted and ruined forest lands. Under supervision of the Government, the planting of trees has become prosperous. The area of forests planted by the people for the last three years from 1905 to 1907 is 249,563 *cho*. The number of seedlings distributed, reached 1,125,369,851. The area of forests reproduced by means of the natural regeneration is 138,095 *cho*.

The method adopted by way of encouragement for planting

of trees in the nude forest lands varies according to local circumstances, but generally the prefectural government establishes the nursery beds and the seedlings, raised there, are distributed among the people either free of charge or at a low price. The planting of trees is encouraged by means of allowing subsidies, and the experts are appointed as officials in charge of these functions.

In reference to the State forests, it may be noted that since the opening of the exploitation work, the building of forest has been effected from year to year, but in most cases, the work consisted of the regeneration of the forests after the trees felled, but nothing was done by way of improving the nude forest lands. It was not until 1895 when an investigation concerning the nude forest lands was completed that the plan covering an extended period for the building up of forests in these lands was drawn up. Since then, a fixed annual budget was compiled whereby forests were formed upon the lands covering no small extent. The work of the silviculturists in the State forests made a fair progress subsequent to the opening of the adjustment work of the second period in 1899, and the whole attention was directed towards the improvements of unwooded lands. The area of the state forests formed during the space of 30 years from 1878 to 1897 is 43,149,90 *cho*, and the area of the forests that was built for the space of ten years from 1898 to 1907 is 176,370 *cho*, of which the area of natural growth was about 18,000 *cho* and that of trees planted for sand protection was 2,897 *cho*. The 80 percent of the former was the regeneration in the cleared lands, and only 20 percent was the plantations of unwooded lands, and the 65

percent of the area of the latter consists of unwooded lands while the 35 percent comprised the plantations of cleared lands.

The Imperial forests having a less area of the nude lands, the general adjustment was easily completed, so that the original condition of *genya* is retained only in the small portion of the north-eastern districts of Japan. The annual silvicultural work, therefore, was limited to the regeneration of forests after the trees are felled. Thus, the area of the trees planted for the space of ten years from 1898 to 1907 reaches about 18,328,22 *cho*.

The method and season of forest formation vary according to the sylvan conditions of the land, but generally speaking, those adopted at present are as follows:—

1. The natural regeneration.
2. Stool Shoots.
3. The artificial showing of seeds.
4. The planting of seedlings.
5. Slips.
6. The planting for sand protection.

Of the 1st and 2nd of these are generally called the natural formation of forests or “natural growth,” while the 3rd, 4th, and 5th are comprised under the name “Artificial planting.” For the artificial planting, much attention must be paid to the season in which the work is to be done. The best season is March and April and sometimes the work is also done in October and November.

The method of forest formation by means of the natural growth has most extensively prevailed, the greater part of the

regeneration of forests in ancient times being effected by these means ; in fact, a majority of the existing forests in Japan was brought into existence by the same process. When, however, the progress of economic forest workings has reached the stage as at present, this method requiring as it does a long time in the process of regeneration, and its results being far from meeting the desired end, there is a steady tendency towards the disuse of this method. Only in the case of forests in steep mountain sides as well as of protection forests where the special treatment is required, the natural method of seed sowing is applied to a considerable space of area either by the selection system or pre-regeneration system.

The sprout system is only applied in the case of the regeneration of forests for firewood. The trees which easily shoot forth sprouts are cut off close to the ground, and when a clump of sprouts come out from the cut, leave a few shoots taking off the rest. Trees thus grown may be felled in some 7 or 8 years in the quickest case, but in the slowest case, they take some 17 or 18 years. Thus, it will be seen that according to this method the period for the felling arrives soon and the outcrop is raised with great rapidity so that it produces a large profit with small labour, and hence the method is most extensively adopted in the forests owned by the people, and in the suburbs of large cities *Quercus serrata* Thunb. and *Quercus glandulifera* Bl. are most appropriately cultivated by this method.

The reproduction by pollarding consists of the cutting of stem at the 6 or 7 feet height from the ground, and letting the sprouts spring from the cut. This method is commonly used

for the regeneration of Yanagi (*Salix babylonica* L.) and Han-no-ki (*Alnus japonica* S. et Z.) planted along dams and pastures.

The artificial sowing of seeds is used side by side with the natural growth, chiefly in places where the natural growth is inadequate. According to the nature of the land and forests, this method is sometimes solely used. In this case, different ways of sowing are adopted such as sowing in strips, broad cast sowing, and sowing on ridges. Such trees as the Kashiwa (*Quercus dentata* Thunb.) which is planted with the object of preventing sand drifting are cultivated according to this method. Such trees as Kuri (*Castanea vulgaris* Lam. var. *japonica* Dc.) and Kashi (*Quercus speciosa*) are also cultivated by artificial sowing. In the northern part of Honshu, Akamatsu (*Pinus densiflora* S. et Z.) has been successfully raised by the method of sowing in strips, but at present, this method is only adopted in rare instances.

The method that most extensively prevails is that of the planting of seedlings. A greater portion of the State, and the Imperial forests is formed by this method. Of late, this method has come to be much used in the forests owned by private individuals. According to this method, the seedlings of 2 or 3 years' growth are transplanted to the forest land; the number of these seedlings planted per *cho* varies according to their species, but ordinarily speaking, they range from 3,000 to 6,000 per *cho*. Owing to climatic and other relations, the healthy growth of these seedlings is not always assured so that in one or two years afterward about 10 or 20% of these seedlings are supplementarily planted. There is not a single kind of the valuable trees of Japan that has not attained success.

under this method. It is obvious that the expense for the formation of forests must be economized as much as possible, and this plainly speaks in favour of the natural means of regeneration, but in such forests as those found in this country where trees grow irregularly and are mixed with weeds and undergrowth, it is by far more advisable to resort to the method of artificial planting than the natural regeneration.

The planting by cuttings is similar to the planting by seedlings and has enjoyed success. It can not be said that method is workable with all tree species, but in some species and in a few districts, the method is extensively adopted. For hundreds of years, Sugi (*Cryptomeria japonica* Don.) in the provinces of Higo and Hyuga were regenerated by this method covering an extensive area. Such trees as Doro-no-ki (*Populus balsamifera* L. var. *suaveolens* Loud.) in Hokkaido and Hiba (*Thujaopsis dolabrata* S. et Z.) in Noto province are also cultivated by this method.

The planting for the protection against the collapse of the soil adopted in dilapidated forests which have no prospect of being grown up under ordinary methods, but with every fear of the outflow of sand. As the preliminary work, the engineering work for the prevention of the collapse of the soil is adopted, and those tree species which make a vigorous and rapid growth with thick branches are planted. Regarded to the economic interests, these forests in future do not produce profits, but they are chiefly useful for the protection and recouping of forest lands. The trees adaptable to forests of this nature are Kuro-matsu (*Pinus thunbergii* Parlat.) Akamatsu (*Pinus densiflora* S. et Z.) and Hageshibari (*Alnus fir-*

ma S. et Z. var. *multinervia* Rgl.). Some times such weeds as Hagi (*Lespedeza bicolor* Turcz. L. *Sieboldi* Miq.) and Susuki (*Miscanthus sinensis*) are planted. These trees are adequately mixed up according to the condition of the land planted at the rate of 15,000 to 18,000 per *cho*.

In reference to the sand protection engineering work, we may mention such works as straw, faggots, turfs, stone masonry and dams. On the way from Shimonoseki to Tokyo passing through Kobe, in the provinces of Harima, Bizen, and Omi, there will be seen the verdant young growth of pinus species, arranged in the terrace of the reddish soil, which have been cultivated by this method.

The area of the plantation of the State forests and the number of seedlings planted thereon in Honshu in the space of ten years from 1898 to 1907 are given in the following table :—

	Species.	Area. <i>cho</i> .	Number of Seedlings.
Conifers	Hinoki { <i>Chamaecyparis obtusa</i> S. et Z. }	27,215	119,237,720
	Hiba { <i>Thuopsis dolabrata</i> S. et Z. }	239	820,751
	Sugi { <i>Cryptomeria japonica</i> Don. }	46,849	214,175,772
	Matsu { <i>Pinus species</i> }	27,670	122,406,314
	Kara-matsu { <i>Larix leptolepis</i> Gord. }	12,410	43,610,449
	Total.....	114,383	500,251,006
Broad-leaved Trees	Kusu-no-ki { <i>Cinnamomum Camphora</i> Nees. }	12,122	14,330,121
	Kunugi..... { <i>Quercus serrata</i> Thunb. }	6,082	19,312,389
	Total.....	18,204	33,642,510
Conifers and Broad leaved Trees.	Others, not mentioned above.....	22,891	84,504,169
	Total	22,891	84,504,169
Grand total.....		155,478	618,397,685

Thus it will be seen that during the last ten years, the result of the silviculture shows that the conifers occupy the area about 6 times that covered by broad-leaved trees. It is not so much to say that almost the entire part of the Imperial forests is covered by conifers, such trees as Hinoki (*Chamaecyparis obtusa* S. et Z.) and Sugi (*Cryptomeria japonica* Don.) occupy a greater portion, the rest being Kuro-matsu (*Pinus thunbergii* Parlat.), Aka-matsu (*Pinus densiflora* S. et Z.) Kara-matsu (*Larix leptolepis* Gord.) and Hiba (*Thujopsis dolabrata* S. et Z.). The cultivation of broad-leaved trees is confined to a small number of such trees as Kuri (*Castanea vulgaris* Lam. var. *japonica* Dc.) and Kunugi (*Quercus serrata* Thunb.).

The condition of the forests owned by the people is about the same as that of the State forests.

It is quite a notable fact that within recent years there is a increasing demand for conifers as the timber for buildings, earth-works and as the material for crafts, and in districts where the intensive forest working is conducted, there is an abundant growth of high forests of conifers. An observation of the State forests in the above table shows that the area occupied by *Cryptomeria japonica* Don. is 30.0% of the total area, *pinus species* 17.7%, *Chamaecyparis obtusa* S. et Z. 17.2%, *Larix leptolepis* Gord. 7.9%, *Thujopsis dolabrata* S. et Z. 1.4%, *Cinnamomum Camphors* Nees. 7.6% and *Quercus serrata* Thunb. 3.8%, while 14.4% are confined to a few species. Such conifers as *Cryptomeria japonica* Don., *Pinus species*, *Chamaecyparis obtusa* S. et Z. and also broad-leaved trees such as *Cinnamomum Camphora* Nees. and *Quercus serrata* Thunb. occupy

comparatively an extended area. In reference to these species, a further consideration is required concerning the demand in future. Thus, the Government has paid attention to the planting of broad-leaved trees and in order to encourage their cultivation, subsidies are allowed to local governments.

The planting of the chief trees such as Keyaki (*Zelkova acuminata* Pl.), Kusu-no-ki (*Cinnamomum Camphora* Nees.), Urushi (*Rhus vernicifera* Dc.), Doro-no-ki (*Populus balsamifera* L. var. *suaveolens* Loud.), Yanagi (*Salix babylonica* L.), Kurumi (*Juglans Sieboldi* Maxim.), Haze-no-ki (*Rhus succedanea* L.), Ho-no-ki (*Magnolia hypoleuca* S. et Z.), Kuri (*Castanea vulgaris* Lam. var. *japonica* Dc.), Kashi (*Quercus species*) is planned for, and efforts are made to utilize every forest land that can be found in forming the forests of these species.

Both conifers and broad-leaved forests which artificially planted are generally single-aged growth, of which pure forests occupying about 85% of the total area, and mixed forests only 15%; but with the increase of forests of conifers to the fact that such pure forests are susceptible to various damages, there gradually arose a necessity for the cultivation of mixed forests. The mixture of light demanding conifers with broad-leaved trees will not only afford considerable benefit as shelter wood, but also will stimulate the growth of the principal trees in those forests.

The success of silviculture depends very largely upon the strength of seedlings and the skill of labourers, so that seeds and seedlings are generally used which have been raised in districts where many years' experience was gone through. With the similar object in the State, and Imperial forests, the permanent

nursery beds have been established, and with the ever increasing expansion of the forest work, the number of nursery beds have increased so as to meet the increasing demand. Nursery beds belonging to the State at the end of 1907 numbered 349, covering a area of 967.720 *cho*, and those which belong to the Imperial Household number 113, covering an area of 148,280 *cho*. These beds belonging to the State and Imperial Household were established in the land in their possession in the neighbourhood of the Minor Forest Office (Those belonging to the Imperial Household at the outstation of the Bureau of the Imperial Forestry). When the State estate (or the Imperial estate) is not available in suitable places, the land owned by the people is leased for the purpose, but this forms only a minor portion, and will be gradually transferred to the land under the respective control. The work of raising plants in nurseries involves comparatively a large number of labourers. The demand for the labour is limited to certain season in which a large number of workmen are required, so that the vicinity of villages and towns as well as the neighbourhood of forest officers stationed is preferable for the sake of better management. For the purpose of the transplantation of seedlings, however, it is advisable that these nursery beds should be located in the vicinity of forests which afford facilities. In the State, and the Imperial forests, with the extension of the forest works, the number of nursery beds have been increased so as to afford facilities as much as possible.

The growth of seedlings varies according to the tree species, but as a rule when seedlings are grown for three years, and reached to the height of between 1.5-2.0 *shaku*, they are

transplanted to the forests lands. According to the nature of these trees, some owing to the slow growth may not reach a sufficient size adapted to transplant to forest lands in these three years, and some trees grow up to the proper size within comparatively a shorter period, so that there is more or less variations in the time needed for raising the seedlings in nurseries, but in most cases, these plants are transferred to the forest land in three years' growth. Seedlings of Sugi (*Cryptomeria japonica* Don.) may be transplanted after two years' growth, but such seedlings as Hiba (*Thujopsis dolabrata* S. et Z.) and Koya-maki (*Sciadopytis verticillata* S. et Z.) require at least 5 or 7 years' growth. In the northern districts of Honshu where the snow fall is plentiful, in order to avoid the damages caused by the redent family such as rabbits and rats, seedlings of a larger size are planted. In these cases, it takes at least 4 or 5 years even in raising such trees as Sugi (*Cryptomeria japonica* Don.) and Hinoki (*Chamaecyparis obtusa* S. et Z.).

The following table gives the amount of seed sown in the nursery beds, and the seedlings raised and transplanted in the State forests in Honshu between 1895 and 1907 :—

Years.								Seeds sown.	Seedlings Transplanted.
								Koku.	
1898	...	...	...	...	...	...	...	72.4	52,547,743
1899	...	...	...	...	...	...	...	54.1	59,415,317
1900	...	...	...	...	...	...	...	295.3	101,671,677
1901	...	...	...	...	...	...	...	416.4	155,622,510
1902	...	...	...	...	...	...	...	475.5	222,944,049
1903	...	...	...	...	...	...	...	353.6	307,028,777
1904	...	...	...	...	...	...	...	195.9	244,812,856
1905	...	...	...	...	...	...	...	164.8	185,827,976
1906	...	...	...	...	...	...	...	293.2	168,257,012
1907	...	...	...	...	...	...	...	805.5	193,789,400
Total	...	...	...	...	...	...	...	1,126.7	1,691,917,317

The forest of *Populus balsamifera* L. var. *suaveolens* Loud.
in Hokkaido.

According to the above table the amount of the seed sown and the number of the seedlings transplanted in the nursery beds of the State forests have increased year after year, and this fact indicates the gradual prosperity of the silvicultural works in State forests. A comparison of the results in raising seedlings between the conifers and the broad-leaved trees gave at first the ratio of 1 against 10, but owing to the encouragement of the cultivation of the broad-leaved trees the proportion has been considerably changed in recent years. Among the conifers, the most numerous species are *Cryptomeria japonica* Don., *Chamaecyparis obtusa* S. et Z., *Larix leptolepis* Gord., and *Pinus densiflora* S. et Z. and among the broad-leaved trees we may mention *Quercus serrata* Thunb., *Cinnamomum Camphora* Nees., *Zelkova acuminata* Pl., *Quercus* species, *Juglans Sieboldiana* Maxim., and *Castanea vulgaris* Lam. var. *japonica* Dc.. In the case of forests newly planted, with the exception of forests for the purpose of protection against collapse of soil, weeds and brambles are required to be removed during a certain period in order to allow seedlings to have a full growth. The best season for such removing is the summer when there is a rich growth of vegetation. The practice is sometimes repeated during a year according to the condition of forest lands and the growth of weeds. In ordinary cases, the removing of the grass is annually kept up for three years after plantation, and after that, it is continued for 14 or 15 years once in every other years.

In order to assist the growth of seedlings not only the elimination of obstacles is a necessity, but a sufficient protection must be rendered preventing various damages before they

occur. There are numerous causes which do harm to forests, but the most fearful is forest fire, the damages from which are most frequent at the time when the weeds are withered in winter season. Forests, owing to the old customs of making ashes by burning grass, are frequently subjected to the damages caused by fires. In forests covering an extensive area, the fire lines are drawn protecting the forests against fires which may be caught from the outside or that break out inside of the forests. These fire lines are generally established surrounding the forests or inside by the utilization of the topographical condition. The protective measures vary according to the nature of the lands, forests, and local conditions. Of these, we may mention such practices as the digging of canals, the building of dams, the plaining off the earth, the mowing or burning of weeds. The width of the roads thus opened are not uniform, but generally it ranges from 12 to 60 feet. If any engineering work is done, the road is narrow, but if not it is wide. In the latter case, for a fixed period, the ejection of combustible substances will be required every autumn. The fire line in 1907 in the State forests covers an area of 3,592 *cho*. Forest owned by the people are comparatively of smaller dimensions so that there are only few such provisions made and their total area can not be ascertained.

SECTION II. TRANSPORTATION OF FOREST PRODUCTS.

The forest administration, previous to the Restoration (1868), which was unduly inclined towards the preservation of forests, combined with the strategic policy of the different

clans to keep up the policy of secrecy regarding geographical and topographical conditions, left many bad effects upon the forest exploitation. The methods of timber transportation peculiar to various districts were adopted and these were hid from others. There was no felling of trees on a large scale, nor was the work continuative, so that there were not forest roads or the rivers opened for the purpose of effecting conveyance. The transportation by natural rivers and roads was however effected everywhere, and there were provisions for transportation, adapted to the topography of the land, and species of trees and kinds of timber. But owing to the development of the forest management in recent years, the forest owned by the State and the Imperial Household came to be regulated by the continuative policy and subjected to the felling of trees; roads were built, the rivers were opened, railways were constructed and the timber depot provided in all places.

The forest roads are generally found along mountain slopes. There are a large number of bridges spanning valleys, which owing to the shallowness of the water and to the precipitous descent is liable to destruction through sudden floods so that their construction must be made more durable, but which will involve comparatively a large amount of expense. The progress of the work under these circumstances had been very slow. For the space of ten years from 1896 to 1907, the extension of forest roads which newly built in the State forests of Honshu is 1,197,271 metres, requiring an expense of 1,490,600 *yen*. The forest roads built in the Imperial forests during this period have an extension of 71,593 metres

involving to the amount of 158,740 *yen*.

In the northern part of Honshu and Hokkaido, during the winter snow drifts are trodden hard and are made into a road with proper degree of slant. By the utilization of the smooth surface of the snow, upon which sledges are run conveying heavy and numerous timber with comparative ease and a small amount of labour. Workmen in local districts are skilled in this mode of transportation. The plan is simple, and the construction expenses small, but there is something striking the efficiency of this mode of transportation. There is another method of transportation adopted which goes under the name of "Shura" slide or "Shade" slide. According to this method, timber is laid and arranged in the form of channels upon which timber is glided down. The system is adopted in the celebrated Kiso and other places. The construction of these slides naturally varies with different districts, but the transportation of timber in the forest or to neighbouring places is conducted generally by this method all over the country there being several methods of a similar nature.

The conveyance by means of water is conducted everywhere in Japan, because the country is favoured naturally with many streams, and consequently there is a low cost of freight. According to the method, dams are constructed to preserve the water, which is now and then out off to sweep down timber along the stream. This timber is then caught at a stated place by means of fences or nets. In larger rivers, the method of floating down rafts is also extensively adopted. The method has been in existence from ancient times as may be seen in the instances of the river Kiso (for the Imperial

forests), the river Noshiro (for the Nagakisawa State forests) and the rivers Shin-gu and Yoshino in provinces Yamato and Kii, these rivers are being utilized in connection with the forests.

The dredging work consists of the removal of rocks and stones, so as to make the passage safe and to protect the forest land by the repairing the dikes. In some places, the water is kept in a reservoir so as to moor timber. Expenses needed for riparian works in the State forests in Honshu for the period of ten years from 1898 to 1907 amounted to 97,052 *yen*.

The area of ground purchased as the timber depot belonging to the State forests in Honshu from 1898 to 1907 was 1,214,935 square metres, the expenses needed for the same amounted to 484,985 *yen*.

At present, there are four timber depots under the control of the Bureau of Imperial Forests covering an area of 58.1 *cho*.

CHAPTER VIII.

THE ADMINISTRATION OF FORESTS.

SECTION I. THE ORGANIZATION OF FORESTS ADMINISTRATION.

As a result of the abolition of the Feudal system and the giving up of the estate of lords in 1868, forests in their posses-

sion have all been nationalized and since then, the departments in charge of these forests have been changed for a number of times, and in 1879, the Department of Home Affairs was charged for a time with the control of the State forests. In 1881, the Department of Agriculture and Commerce was created with the Bureau of Forestry, and since then much effort has been made toward the efficient forest administration with every prospect of the development of the industry.

According to the present organization, the Minister of Agriculture and Commerce possesses the right of control of the State forests in Honshu and all forests owned by the people. The Bureau of Forestry, established in the Department, has the charge of all the affairs regarding the forest administration. The control of the forests owned by the people is conducted by the Forest Law issued in 1897, which was revised in April 1907. The law as thus revised contained the necessary regulations relating to the protection forests in view of dangers arising from the ruin of forests and for the sake of the wellbeing of the people and the preservation of land, also regulation relating to the directions for silviculture in the forests owned by the people, and still others relating to the appropriation of land and the establishment of forest co-operative society for the complete utilization of forests. In these matters, the local governors are appointed to take the direct control while the Minister of Agriculture and Commerce has the right of ultimate supervision.

The management of the State forests is conducted by the Forest Offices established in accordance with the Ordinance No. 18 of 1886 and since then, there have been made more or

less revision in the official regulations. According to the present regulations, there are ten Major Forest Reserves throughout the country, each having Major Forest Office and they are subdivided into 211 Minor Forest divisions, having a Minor Forest Office respectively. Under these, there are provided 1,317 Protect Ranges, these offices and ranges being charged with respective functions. The number of officers in these Forest offices at present are shown in the following table:—

	No. of Officers.	
Directors of Major Forest Offices.	10	} Forest Commissioners or Forest Experts are ap- pointed.
Forest Commissioners (Specially in charge)	22	
Forest Experts	35	} Of the <i>So-nin</i> rank.
Deputy Commissioner of Forestry	20	
Chiefs of the Minor Forest Offices	211	} Deputy Commissioners, subordinate officials and assistant experts are appointed.
Forest subordinate officer	} (Specially in charge) 779	
Forest Assistant-experts		
Rangers	1428	} Of the <i>Han-nin</i> rank.

(Besides, there are 5 deputy-commissioners, 48 forest experts, 707 subordinate officials and assistant-experts are temporary appointed in charge of forestry affairs).

The following table shows the location and the extent of jurisdiction of Major Forest Offices and the number of Minor Forest Offices and the Protect Ranges under the jurisdiction of each Major Forest Office.

Major Forest Offices.	Location.	Area of State Forests.	No. of Minor Forests Offices.	No. of Protect Ranges.
Aomori Major Forest Office.	Aomori, Mutsu province.	1,322,262 <i>cho</i> .	31	175
Akita " "	Akita, Ugo province.	1,085,366 "	17	106
Miyagi " "	Sendai, Rikuzen province.	1,385,288 "	25	158
Tokyo " "	Tokyo, Musashi province.	956,649 "	19	105
Nagano " "	Nagano, Shinano province.	942,263 "	12	70
Osaka " "	Osaka, Settsu province.	545,791 "	16	105
Hiroshima " "	Hiroshima, Aki province.	225,044 "	21	138
Kochi " "	Kochi, Tosa province.	200,678 "	22	122
Kumamoto " "	Kumamoto, Higo province.	365,232 "	30	179
Kagoshima " "	Kagoshima, Satsuma province.	457,244 "	18	159
Total		7,485,998 "	211	1,317

From the above table, it will be seen that the average area of the State forests under the jurisdiction of a Major Forest Office is 748,600 *cho*, the largest being that of Miyagi Major Forest Office covering an area of 1,385,288 *cho*, and the smallest that of Kochi Major Forest Office, covering an area of 200,678 *cho*. The striking difference between the two figures must be attributed to the difference in the location of the State forests and to the state of the forest exploitation, but in a certain measure, the difference is attributed to the need of local administration. The areas under the control of the Minor Forest Offices varies according to the condition of the forests, the facilities of communication and to the amount of receipts. For instance, the Johen Minor Forest Office under the control of Kochi Major Forest Office covers

such a small extent of the area as 2,799 *cho*, while Iiyama Minor Forest Office under the Nagano Major Forest Office has an area of 297,813 *cho*. The reason why there is such a great difference in the area of the forests under the control of the Minor Forest Office must partly be attributed to the fact that in one case the forests occupy an important position in respect to the utilization of the output owing to the good communication facilities at large and on the other case there exist primitive forests which known no axes on account of the defective means of communications. The number of Protect Ranges under the control of a Minor Forest Office varies according to the same office. The average number of Protect Ranges in a Minor Forest Office is 5 or 6, but in special cases as in that of Kobayashi Minor Forest Office under the Kagoshima Major Forest Office there are found 21 Protect Ranges.

The above mentioned organizations are established in connection with the State forests placed under the direct control of the Department of Agriculture and Commerce, while in reference to the other State forests, there are provided by the special organs.

The State forests in Hokkaido covering an area of 5,781,373 *cho*, and the State forests of 3,000,000 *cho* in Karafuto belong to the control of the Department of Home Affairs, the chiefs of Hokkaido, and Karafuto being charged with the management of these forests. The State forests in Formosa covering an area of 2,903,960 *cho* are under the management of the Governor-General of Formosa under the control of the Minister of Home Affairs. The work in these forests has

either been just started or is under contemplation so that there is not much to be said.

The Imperial forests covering an area of 2,246,670 *cho* are under the control of the Department of the Imperial Household, and the business connected therewith is left in charge of the Bureau of Imperial Forests. There are established some seven branch offices and several outstations. The latest figures show that the number of such stations has reached 50. Each station is divided into from 2 to 15 sections with Forest Rangers to oversee each section. In the principal places, there are appointed forest inspectors for the purpose of rendering the protection. Forests owned by the people covering an area of 9,405,600 *cho* may be divided into those owned by shrines, temples, public bodies, and private individuals. Forests covering an area of 177,844 *cho* are owned by temples or shrines; by the decision of the parishoners and under the sanction of local governor, the output and other affairs are disposed of. Among these forests, there are some forests preserved for their scenic beauty.

Public forests covering an area of 2,656,000 *cho* are jointly owned by various villages. Among the forests owned by the people, the forests of this class now mostly devastated, but lately attention has come to be paid to the adjustment of the forests and plans relating to the building and utilization of forests have come to be systematically adopted.

Private forests covering an area of 5,880,113 *cho* are owned by private individuals, and with the exception of the intensive forests working in a few localities, there has prevailed a reckless felling of trees as in the case of public forests, so that local

governors are most enthusiastically engaged in the cultivation of forests.

In reference to the encouragement of forest planting owned by the people, there were appointed forest experts and circuit lectures concerning forestry were started. In order to give object lessons, model forests as well as nursery beds were established. The seedlings were conferred upon the people free of charge or at a low price. In cultivating the trees, encouragements were given by allowing subsidies; besides, there are various measures being adopted, among which there was adopted a method of publicly recognizing the meritorious services done towards the forest industry, the establishment of the forest association in order to give the lectures concerning the benefits derivable from the forest industry. Moreover, the Central Government grants subsidies for the encouragement of the planting several important species. It is, therefore, expected that the receipts from the forests will be greatly increased, contributing a great deal towards the benefit of the State, when the adjustment of forests should be successfully completed.

SECTION II. FOREST LAWS AND REGULATIONS.

As stated above, the Forest Law at present regulates the control of silviculture in private forests, the conversion of utilization forests to Protection forests, the release of protection forests, the forest offences, the use and appropriation of forest lands, and the forest co-operative society. This was published in 1897 and revised in 1907. In reference to the operation of this, many Imperial ordinances and departmental institutions

were issued. The Regulations for the Local Forest Committee contain the process concerning the conversion of utilization forests to protection forests, the release of protection forests, and the purchase and compensation payable for the protection forests. Regulations were also drawn up in relation to the forest co-operative society in order to restore the abandoned forests, and the completion of their utilization and of earth works connected with the forests. Further pertaining to the Forest Law, various regulations were published. The Law of State Forests and *Genya* was published in 1878, in which various items relating to the State forests were regulated. State forests whose preservation is a necessity for the protection of the land and the management of the other State forests and *genya*, with exceptions connected with the public use and public benefits and with a few special Regulations, are not permitted either to be sold or transferred. Care is taken not to make unnecessary transferences, and to aim at the honesty of the undertaking. Forests expropriated from shrines and temples are left in the custody of shrines and temples, affording the privilege to collect the products in these forests. In cases where there is a necessity for the protection of the State forests and *genya*, the way is opened for consigning such to the protection of cities, towns, villages or to a portion of these civic bodies. For the purpose of the encouragement of silviculture, under the contract of dividing the profits between the State and forest cultivators, the establishment of the percentage system in the State forests and *genya* was provided by the Imperial Ordinance. Some of these Regulations may be mentioned as follows:—

Mixed forest of *Abies sachalinensis* Mast. and *Picea ajanensis* Fisch. in Karafuto.

The Regulations for the Percentage System in the State Forests and *Genya* :—By these Regulations, the creation of the percentage forests in the State forests and *genya* is made. The term for the existence of these forests is within 80 years. The proportion of the division of the profits in these forests is determined by the Minister of Agriculture and Commerce, but the proportion of the share of the forest builders does not exceed 8/10. The builders bear the responsibility for the protection of the forests against flood, theft and other damages, and as a remuneration for their trouble, they are permitted to collect the under-growth, fruits of trees and the trees felled for the purpose of improvement of forests within 20 years after the planting of trees.

The Regulations for the State Forests in the Custody of Shrines and Temples :—By these Regulations, arrangements were made to the effect that at the request made by temples or shrines, the forests expropriated from shrines, or temples were to be left in their custody. The duration of the custody was not to exceed 15 years. Temples or shrines are under the responsibility to protect the forests against water and clandestine despolitation, as a remuneration of the service principal products corresponding to $\frac{1}{2}$ of the amount of the trees to be felled, may be appropriated by them.

The Regulations for Consigning the State Forests and *Genya* :—By these Regulations, the protection of some State forests and *genya* may be consigned to the whole or a part of the civic body. The term covered by these arrangements does not exceed 5 years. Those to whom these forests are consigned are under the obligation to protect them and for which service,

they will be compensated by twigs, branches, fallen trees, trees felled for the purpose of improvements, the fuel for domestic use and other minor-products which do not compose the essential substances of the forests.

What may be termed the financial characteristics of the State forests are the separation of the Forestry Fund from the ordinary expenses of forestry. The use of this fund as explained in chapter IV. forms the fund for the special exploitation of State forests which are expended for the survey of the State forests and *genya*, the preparation of the working plans, the planting of trees, and the purchase of forests. These items are dealt with according to the Special Account Law of Forestry Funds published in 1899. We have so far given the outlines of the principal Regulations, although there are others concerning the forests and their products, and the investigation and protection of forests.

CHAPTER IX.

FOREST EDUCATION AND FOREST EXPERIMENT STATION.

SECTION I. FOREST EDUCATION.

The progress made by the forest industry of our country during recent years is so great that it is enough to illustrate the remark that the development of industries is a reflex of

that of education. This progress in forest industry has kept pace with the astonishing progress of forest education. In 1882, there was only one forest school as the sole organ of forest education. It was established at Nishigahara, in the suburb of Tokyo, under the name of "The Tokyo Forest School," but now the schools which give lessons concerning forestry number 47, of which 2 are of the university grade, 4 are of the special school grade and 41 are of the industrial school grade (of which 19 are of higher grade while 22 are of lower grade).

Those which are of the university grade are the Agricultural Department of the Tokyo Imperial University and that of the Tohoku Imperial University. Those of the special school grade are the Morioka Higher Agricultural and Forest College, the Kagoshima Higher Agricultural and Forest College, the practical forest course attached to the Agriculture Department of the Tokyo Imperial University, and the similar course attached to the Agricultural Department of the Tohoku Imperial University. These schools have it as their object to instruct students in theory as well as in practice so as to enable them to meet with the demand of the forest industry both Government and people, and to qualify them as forest officials after their graduation. The Government is careful to treat well the graduates of these schools.

Remarks :—The practical courses attached to both of the Tokyo Imperial Agricultural University and the Tohoku Agricultural University are counted as distinct schools.

According to the latest returns, the Forest courses in the Agricultural Departments of the Universities have turned out, up to the present, 213 graduates, the various Higher

Agricultural Colleges and the Practical Forest courses attached to the Universities have sent out 665 graduates. Of the 41 schools of the Industrial School grade, 19 are those which give the higher course of forest education and which have it as their object to train experts desiring to offer their services to private forest enterprises. They are established by the local governments and are under the direct charge of the local governors, the Educational Department only supervising them indirectly from the necessity of unifying the industrial education of the country. They receive an annual State subsidy and the pupils enjoy the same privileges as the students of Middle School, namely, the exemption from conscription duty during the undergraduate days and the qualification to become State official of the lower order after graduation. Their courses are finished in from 3 to 4 years and the aggregate number of their graduates amounts to 457.

The forest schools of the lower industrial school grade number 22 in all. They are not accorded the privilege of the temporary exemption from conscription duty, though they receive a State subsidy. They are called "B Class Industrial School." The under-graduates of primary schools are admitted into these schools and are instructed in the elementary course of forestry which takes 3 years to graduate.

Besides those above mentioned, there exists a still lower order of industrial schools named "The Industrial Auxiliary School." They chose various subjects according to the requirements of the localities in which they are situated and give simple lessons to the pupils. Not a few schools are found among them which deal with the forest industry. There are

30 public agricultural schools which give some lessons in forestry to the students, though they do not have distinct forest courses. It was in 1900 that a temporary training institute of forestry was started in the Meguro Forest Experiment Station with the object of training officials to be employed in the service of the State forests. The students in this institute were instructed in Trigonometrical survey, polygonometrical survey, besides the general knowledge of forestry. It was the intention of the Government to turn out as many graduates as possible in a comparatively short space of time. The course of the school was to be finished in one year. However, it was abandoned in 1905 after having sent out a considerable number of graduates every year. The number of the graduates of this institute amounted to 385.

SECTION II. FOREST EXPERIMENT STATION.

Scientific forest experiments were first conducted in Japan in 1878 at a Forest Experiment Station established at Nishigahara in the suburb of Tokyo under the auspices of the Home Department. It was, however, brought under the charge of the Department of Agriculture and Commerce in 1881, when the aforesaid Department came into existence. The management of this institution was taken over by the professors of the Tokyo Forestry School at the same place when that school was opened. Again it was transferred to the charge of the Tokyo Major Forest Office, and subsequently in 1896 it was taken under the direct control of the Bureau of Forestry. On the commencement of the work of special exploitation of the

State forests, a tract of land amounting to about 14.6 *cho* was purchased at Meguro in the suburb of Tokyo with a view to enlarge the scale on which the aforesaid institution was managed and there was established experimental nursery beds and experimental forests in order to make investigations concerning indispensable matters in regard to the management of State forests together with the various important questions concerning forestry.

In reference to the present condition of the above-mentioned Forest Experiment Station, it may be summarized thus: Of about 14.60 *cho*, already mentioned, as the area of the institution, 5.70 *cho* is covered by a model garden for trees of native species, in which over 300 species of native forest trees are sown, 1.16 *cho* is occupied by a model garden for foreign forest trees in which over 90 varieties of foreign trees are sown, 3.89 *cho* are utilized by the experimental nursery beds for the various experiments concerning seedlings, over 7.20 *cho* is allotted to a experimental forest and the remaining part is made use of for the erection of a laboratory, an office, specimen rooms, official residence for the officials and the gardeners, and roads. There are exhibited more than 7,000 tree species both foreign and domestic in the specimen room. Matters relating to experiments may be stated as follows:—

A. Matters requiring special scientific investigation or researches.

B. Matters concerning the forestry of various provinces.

C. Investigations of the matters to be subjected to experiment by the various Major Forest Offices, the investigation

of the results of their experiments and the compilation thereof.

The following are being experimented upon in accordance with the above mentioned policy :—

1. Matters concerning soil and meteorology.
2. Matters concerning the silviculture and the protection of forests.
 - a. Experiments concerning seeds and seedlings.
 - b. Experiments concerning the transplanting of foreign species.
 - c. Investigations concerning injurious as well as beneficial birds, beasts, and insects.
 - d. Investigations concerning injurious fungi.
3. Matters concerning the growth of forest trees.
 - a. Preparations of the yield table and the volume table of the principal species.
 - b. Experiments concerning the thinning and open stand system.
 - c. Investigations concerning the growth of bamboo forests.
4. Matters concerning the nature of forest products and their use.
 - a. The scientific study of the nature of timber, with special reference to its industrial use.
 - b. Investigations concerning charcoal kilns and the products.
 - c. Study of the methods of antisepticizing timber.
 - d. Investigation of edible fungi such as *shiitake* and poisonous fungi.

5. Matters concerning implements and machines used in forestry.

The investigation of implements and machines for the transportation, afforestation, and the felling of trees.

The investigations now going on are those just referred to.

The results of those experiments and investigations have been compiled in the form reports of concerning forest experiments and are published for public inspection.

Forest experiments are conducted not only in the Forest Experiment Station belonging to the Bureau of Forestry, but also in specially nominated Major Forest office. These experiments are now conducted at the following four Major Forest Offices: Miyagi, Tokyo, Osaka, and Kumamoto. Though at first every Major Forest Office undertook this task yet subsequently the present system has been resorted to, it having been found expedient to entrust any local matter concerning forestry to a Major Forest Office within whose jurisdiction it occurs.

At a nominated Major Forest Office, only such experiments as may be most conveniently conducted in the locality in which it is situated are to be made. For instance, at the Miyagi Major Forest Office which is located in a cold region. methods for the afforestation of Buna (*Fagus sylvatica* L. var. *Sieboldi Maxim.*) and its utilization are invested, while at the Kumamoto Major Forest Office which is situated in a warm region, experiments are made on Kusu-no-ki (*Cinnamomum Camphora Nces.*) and camphor, and at the Osaka Major Forest Office, investigations in the study of bamboo forests are made.

Thus, the Bureau of Forestry and the nominated Major

Forest Offices conduct experiments with due enthusiasm, deriving much benefits from the results thereof by applying them in practice in the actual forest industry. Forest work conducted by private individuals also shares in this benefit. Every prefectural government also conducts simple experiments, putting into practice the results thereof to the afforestation in the respective locality

In conclusion, the sphere of forest experiments has been constantly extended in regard to the forest exploitation and the utilization of forest products etc. and bids fair to attain a considerable development.

CHAPTER X.

FOREST ASSOCIATION AND FOREST CO-OPERATIVE SOCIETY.

SECTION I. THE FOREST ASSOCIATION.

The development of forest industry can not be effected by the exertion of the Government along, there being a great many things which require the activity of forest associations for the purpose. It is especially the case in Japan where forests are of a different nature and aspects according to localities. Therefore, the necessity of forest associations is keenly felt in Japan where the forests are at a comparatively incipient stage of development and stand in need of direction and protection for the betterment of their effects.

The most prosperous forest association in Japan is the Japan Forest Association, which was founded in Toyko in 1882 and has now as many as 4,000 members, though it had 343 in its early stage. The members of this association comprise various classes of society, there being scholars, businessmen, land-owners etc. among its members. It has as its object the development and improvement of the forest industry, and as means for the attainment of its object, it distributes a magazine among the members reporting the general proceedings of the Association and giving information concerning practical and theoretical matters relating to forestry. Besides, the magazine contains scientific articles, miscellaneous information, answers to inquiries, the notices of newly published books, together with other various valuable articles of information which may stand the readers in good stead. The association holds a meeting once a month in which lectures are given and discussions allowed, and the exchange of knowledge through questions and answers on various matters concerning forestry both practical and theoretical is made, and moreover convenes a mass meeting of the members once a year which is held at a place of importance, different principal places being made the seat of this grand meeting, and in which lectures and speeches are delivered by scholars or businessmen, and conferences are held concerning the arrangement for the encouragement of the forest industry. Further, the association makes an excursion for scientific researches to neighbouring forests in order to enlighten the members through both ears and eyes, thus conducing not a little to the development of this industry in the various localities. In regard to the internal

Ficus Wightiana Wall. var. *japonica* Miq. in Formosa.

organization of the association, it is presided over by a Prince of the Blood, and the actual business of the association is conducted by one chief manager, 4 managers and a certain number of officials. Matters of importance are decided in the meeting of 20 councillors, and a committee consisting of 14 members take it upon themselves to answer all the questions put by the members. The expenses needed for the support of the association are borne by the members. Though this association is not engaged in actual forest work, it is rendering invaluable services to the Forest circle, contributing a great deal to the development of this industry.

There are local forest associations in various places which number 20 in all with a similar object to the one just referred to. They all distribute reports of the proceedings of the respective associations either periodically or from time to time. They also hold meetings whether periodically or otherwise and perform similar functions.

Some of these forest associations are subsidized by the prefectural governments and undertake afforestation work for themselves or rear seedlings laying out nursery beds, for the purpose of distributing them among the members. Others undertake the direction of forest work or drawing up plans at the request of those who are engaged in forest work. Still other hold lectures on forest work. These forest associations were at first few in number and were naturally carrying on their business on a small scale, the members of it being very small, but lately they have flourished at an accelerating rate, the member of the associations having considerably increased in number. They are reaping the fruits of their exertions by

successfully assisting one another in various ways.

SECTION II. THE FOREST CO-OPERATIVE SOCIETY.

Of all the laws of co-operative societies concerning forest work, one contained in the revised Forest Law promulgated in 1907 set down the aim of the Forest Co-operative Societies to the preservation of land and to protect forests from being devastated or to restore the already devastated forests or to make the replenishing of forests with a view to their utilization, while the Law relating to the co-operative societies engaged in the trade of the staple industrial products enacted in 1900 intends to do away with the various abuses concerning the trade in forests products and to promote the interests thereof, and the law of industrial co-operative societies, promulgated in the same year, is meant to promote the development of industry and economy.

1. The Forest Co-operative Society:—Japan has not been without some agreements between different villages for the control of forests owned by villages and the disposal of the products derived therefrom, but they have been simply private agreements devoid of the Government's guarantee, not having been established by obtaining the official sanction. The condition of the times having loudly called for the necessity of establishing this kind of a co-operative society, the Forest Law laid down the provisions concerning forest co-operative society and moreover the law of the forest co-operative society was promulgated by Imperial ordinance in 1907. By the above mentioned ordinance it was arranged

that in order to establish a forest co-operative society the following conditions should be required.

1. There must be the necessity to protect forests from falling into decay or to restore devastated forests to their former condition.
2. There must be a necessity for the joint work to turn the forests, owned by different parties, to good account.
3. There must be a necessity of this kind of co-operative society in order to arrange the necessary equipment for the transportation of forest products or to maintain them.
4. There must be a necessity for the co-operation of the parties concerned for the preservation of a forest from injuries.

The forest co-operative society is required to do its business within a fixed jurisdiction, the forest owners within its limits only being entitled to membership in the co-operative society. The establishment of the co-operative society is sanctioned when there exists an agreement of upwards of two-thirds of the forest owners entitled to be members of it and when the aggregate area of the forests owned by those who have come to an agreement concerning the establishment of a co-operative society exceeds two-thirds of the total area of forests of the locality, but subject to the approval of the local governor in the form of "Shadan-Hojin" (Corporate Juridical person). It is to be fined from 2 *yen* to 100 *yen* in case it does anything in conflict with the orders of the authorities in charge of it.

Organs for the Work :—As to the operative organs of the co-operative society, managers and supervisors are elected from

among the members. The term of office for the former is 3 years, and that for the latter is less than a year. The number of these officials is to be fixed by the articles of the co-operative society. Further, it is required of the co-operative society to hold a general meeting more than once during every business year to make reports of the general proceedings of it, and to discuss plans for the work and to draw up a budget of revenues and expenditures and a statement of accounts.

The exact number of votes of the member is fixed by the articles of the co-operative society. The proceedings are conducted in very much the same way as in any ordinary meeting of an association.

Though there are only a few forest co-operative society established by this law, a brief statement concerning the internal condition of them will not be superfluous. They all aim to preserve forests in a good state or to restore the devastated forests to their former conditions or to make use of them to the best possible advantage true to the rules for the organization of forest co-operative society already referred to. Some of them attempt to facilitate the transportation of timber by constructing forest roads or by renovating them. Some conduct patrols in the forests to keep them from robbery and arrange fire lines to protect them against a fire. Some draw up the working system and enforce them and if the member of the co-operative society does not work in conformity with these plans, the co-operative society attends to the work by itself, making the forest owner pay the expenses required. Some distribute the proceeds from the forests and cause the expenditure to be borne by the members in proportion to the

area of the forest owned by them. Some relieve the members of their payment of shares of the expenditure by making them substitute personal services. The right of voting is sometimes fixed as one vote for each 1 *cho* of forest owned or as one vote for the smallest area owned by any of the members. The mode of proceeding is similar to that of an ordinary one.

II. The Co-operative Society for the Staple Products. The law of this co-operative society has been promulgated with a view to eradicate evil customs concerning trade and to promote its interests for the purpose of encouraging the production of important products. The Department of Agriculture and Commerce has also issued an instruction directing the application of this law. Important forest products are governed by the same law. It has been laid down as a rule that those engaged in the manufacture or the sale of important products and those merchants whose callings are closely connected with this business may establish a co-operative society. District in which a co-operative society exist, must be larger than that of a county or a city. If the consent of two-thirds of the members be acquired together with the sanction of the Minister for Agriculture and Commerce, the organization of a co-operative society is rendered possible. All the owners of forests within its district are required to become its members. As to the composition of the co-operative society, there are a president, a vice-president and several councillors who are elected from among the members. Besides these leading officials, there are a certain number of examiners, whose function is to examine commodities. It is further laid down that the co-operative society may make a representation to the

Department of Agriculture and Commerce or answer the inquiries of the same Department. When it will not answer these inquiries and there is any one will not join the co-operative society in spite of the fact that he pursues the same calling as the members of the co-operative society, a fine varying from 2 *yen* to 100 *yen* is imposed on the offender. And those who use certificates on their commodities in a fraudulent manner, or apply forged certificates to them are punished with a fine of 15 *yen*, together with the imprisonment of less than 6 month or are simply fined from 10 *yen* to 20 *yen*. All these severities are meant to rectify the abuses attending the transactions and to promote the interests of this industry. Of the co-operative society which have been established according to this law, those which deal with forest products number 109, the aggregate number of the member amounting to 98,323.

Herewith are given the chief features of the internal conditions of these co-operative society with one or two principal modes of conducting their business.

Owashi Forest Products Co-operative Society in the prefecture of Miye which has been established with the one object above mentioned is to resort to the following modes in conducting its business.

1. Commodities are examined with due care to prevent reckless and careless production and fraudulent transactions.
2. The unification of the measure, capacity and the process of the preparation of goods.
3. Convenient arrangements for the benefit of those customers who have newly established themselves as timber

traders in the various localities are discussed, agreed upon and put into practice.

4. The establishment of Timber Depots both land and water.

5. The Dredging of Rivers for the floating of rafts.

6. Measures of precaution against floods and fires, the protection of roads and embankments, and the construction of forests roads.

7. Investigations and the compiling of statistics concerning the value and quantity of products in its district.

8. The protection of workmen and labourers as well as their proper control.

9. Protection of Sylviculture.

Again, the following measures are taken by the co-operative society of traders in Shiitake in the prefecture of Oita which has the same object as the preceding one.

1. To prevent the manufacture of commodities of bad qualities or of a spurious nature and their reckless production.

2. The improvement of manufactured articles and the extension of the markets for them.

3. To draw up statistics concerning the work of the members.

4. To reply to the inquiries of the members.

5. The appraising society is held for encouragement.

6. Courses of lectures are made or temporary training institutes are held.

7. Articles for export purposes are invariably provided with trade marks or other signs for the sake of distinction.

Otherwise the work undertaken is similar in substance to that of other co-operative societies.

SECTION III. PRODUCTIVE CO-OPERATIVE SOCIETY.

The results for the organization of this co-operative society has been laid down by law with the object of facilitating the development of industry and economy. Here is given the chief features of its composition.

1. Some co-operative societies have for their object the advancing of funds to members for their industry and the convenient arrangements for encouraging habits of savings (Credit Co-operative Societies.).

2. Some co-operative societies have for their object the making of the improvements in the productions of the members or to get them to make such improvements and to sell the products in the markets (Sales Co-operative Societies.)

3. Some co-operative societies have for their object the purchasing of those articles which are indispensable to the members as materials for their work or as necessities of life and selling of them to the latter (Purchasing Co-operative Societies.)

4. Some co-operative societies have for their object the adding of workmanship to what have been manufactured by the members or of accomodating them with the necessary implements or tools for their work (Productive Co-operative Societies.)

The above mentioned co-operative societies are legal corporations with either limited or unlimited liabilities. They can be organized when more than seven persons have agreed

to form a co-operative society with the objects above mentioned, subject to the sanction of the prefectural governor.

As to the investments of the members, they range from 1 to 10 shares, one share not being allowed to exceed 50 yen. The business of the co-operative societies is managed by managers and supervisors who are elected at a general meeting from among the members. The term of office of the former is 3 years, that of the latter being one year. A general meeting is to be held without fail once in every business year, and reports concerning the proceedings of the co-operative societies, and the discussion of budget are conducted in a way common to all deliberative meetings. The number of votes depends upon that of the shares he holds.

The following are the varieties of the co-operative societies concerning the forest industry:—

1. That dealing with the sale of charcoals.
2. That dealing with the sale of charcoals and the purchase of the materials thereof.
3. That dealing with the sale and the purchase of forest products.
4. That dealing with the sale of pine bracks.
5. That dealing with the sale of mushrooms.

Though the number of the co-operative societies now in existence is as few as has been previously referred to, yet there is no doubt that it will soon increase, there being many whose organization is now set on foot.

APPENDIX.

MONEYS, MEASURES, WEIGHTS AND VOLUMES OF JAPAN WITH THE ENGLISH EQUIVALENTS.

MONEYS.

<i>Yen</i>	2.080	Shilings.
<i>Sen</i> , $\frac{1}{100}$ <i>Yen</i>	0.246	Pennies.
<i>Rin</i> , $\frac{1}{1000}$ <i>Yen</i>	0.025	„

LONG MEASURES.

<i>Ri</i>	2.440	Miles.
<i>Cho</i>	5.422	Chains.
<i>Ken</i>	1.988	Yards.
<i>Shaku</i>	11.930	Inches.
<i>Sun</i>	1.193	„

SQUARE MEASURES.

<i>Cho</i>	2.450	Acres.
<i>Tan</i> , $\frac{1}{10}$ <i>Cho</i>	0.245	„
<i>Se</i> , $\frac{1}{100}$ <i>Cho</i>	0.025	„
<i>Tsubo</i>	3.953	Sq. Yards.
Square <i>Ri</i>	5.955	Sq. Miles.

CAPACITY MEASURES.

<i>Koku</i>	4.963	Bushels.
<i>To</i>	1.985	Pecks.
<i>Sho</i>	0.198	„
<i>Go</i>	0.019	„

WEIGHTS.

<i>Kwan or Kwanme</i>	...	...	...	...	...	8.267	Pounds,
<i>Kin</i>	...	...	...	...	...	1.323	„
<i>Momme</i>	...	...	...	...	...	2.116	Drams.

VOLUMES.

(Specially adopted for measurement of timber and fire-woods.)

<i>Shakujime</i>	...	...	...	...	...	12	Cubic ft.
<i>Tana</i>	...	...	...	...	...	108	Stacked Cubic ft. (a pile of fire-woods, 3 ft. wide, 6 ft. high, and 6 ft. long).
<i>Soku</i>	...	...	...	...	...	A bundle of bamboos or towigs tied up with rope of 3 ft.

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