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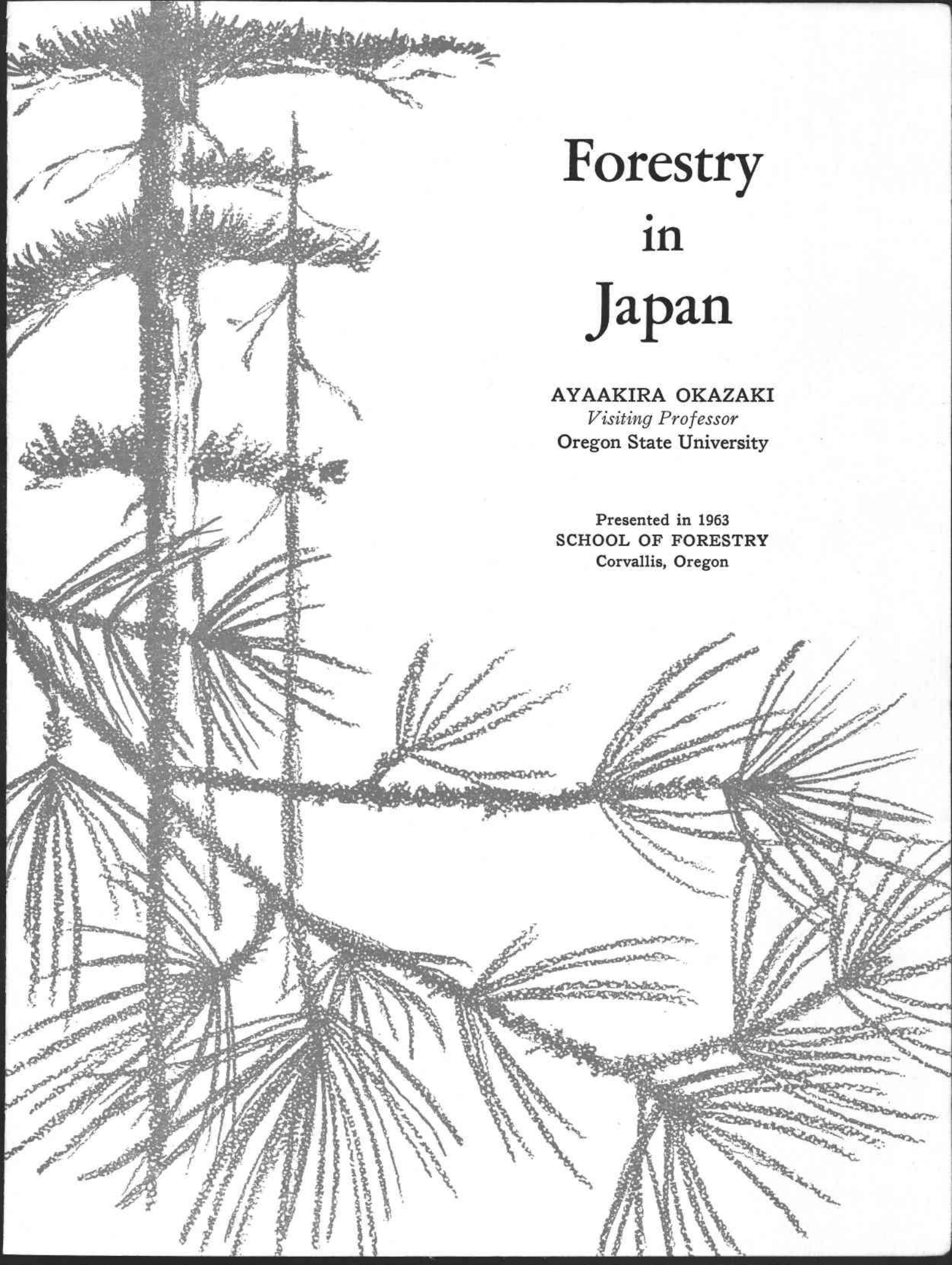

Forestry in Japan

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Visiting Professor
Oregon State University

Presented in 1963
SCHOOL OF FORESTRY
Corvallis, Oregon

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Preface

Japan, like England, is a country which must import food and raw materials and must export finished goods to make its living. With approximately the area of California, Japan has a population of more than 90 million people—more than five times that of California. Only about one-sixth of Japan's area is suitable for agriculture; more than half is in forest, largely on steep slopes of volcanic mountains, and the upper parts of many of these slopes are barren. Japan's intensively managed forests provide only part of the national wood requirements.

In 1955 my wife and I were in Japan for about two weeks; we liked it so well that in 1961 we returned to spend about two months. In each of these visits we spent a few days in Tōkyō and other chief cities where in 1955 there was much evidence of war damage most of which had been replaced by new construction by 1961. Evidently Japan, industrially and in a business way, was in the process of an amazing recovery and was moving upward economically at greater speed than countries elsewhere in the world—already building greater yearly ship tonnage than any other nation. In these main industrialized cities there were modern shops and department stores, and the people were dressed generally in westernized clothes. All of this was impressive, but of far greater interest to us were the farming and forest areas as well as the centers of ancient culture, where there had been little or no war damage and less change from old customs.

In 1961 we spent most of our time in Kyōto and in its farm and forest areas roundabout. For most of the past 1,200 years Kyōto and its vicinity have included the nation's capital and have been recognized as the center of Japanese culture. This area has many hundred temples and shrines; there are famous gardens which were old when English settlement began on our own east coast. In 1955 it seemed to us that in Japanese farming, forest work, sawmills, and plywood plants no work was done by a machine that could instead be done by hand by a man or a woman. This was less true in 1961, for in the tiny rice fields machines like "roto-tillers" were being substituted to some extent for hand work in preparing the land for planting; and in the woods and mills more power equipment was beginning to be used.

The Japanese by many centuries of religion and custom love and venerate nature and its works—mountains, rivers, waterfalls, snow, the moon, flowers, trees, forests, and so forth. The finest individual trees—sometimes up to six or eight feet in diameter and many hundred years old—if they have escaped the typhoons long enough—are found in the temple grounds. Each home has its garden, even if very small. The proper arrangement of flowers is emphasized. In each home there is the "tokonoma"—a slightly raised alcove in which are displayed the family treasures. A post rises to the ceiling at one corner of the tokonoma—a polished, peeled, round log usually about five to seven inches in diameter, the finest the owner can afford. The Kitayama forest in the outskirts of Kyōto produces the most famous and desirable of the tokonoma posts.

In forest management, as Dr. Okazaki tells you herein, there is extremely intensive handling of seedlings and cuttings in small nurseries, intensive staking of newly planted seedlings, intensive removal of weeds and grass from young plantations, and intensive pruning of growing trees. All of this has evolved through several centuries of management; it seems an art more than a science. Probably nowwhere else in the world is so much human effort applied per unit of wood produced. With present-day Japan changed to a primarily industrial country, it is not surprising that forest management now has a serious labor problem.

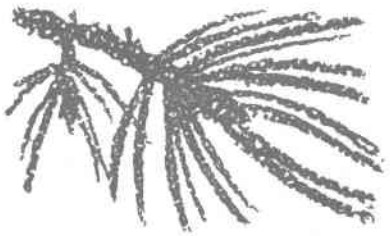
We first had the pleasure of meeting Dr. Ayaakira Okazaki when he, his wife Tsuru, and his daughter Fumiko came to call upon and have tea with us in the Miyako Hotel in Kyōto at the beginning of our visit there in 1961. Later we had the privilege of having them dine with us at the Miyako, of seeing these charming friends in their home in Kyōto, and also of having them with us in our home in Portland in 1963.

My 1961 diary contains the following entry:

> May 22: After breakfast Dean Professor Dr. Okazaki—drove me to the Forest School of Kyōto University. There with Okazaki, Tsunahide Shidei, Prof. of Silviculture, Hikoichi Sugikara, Prof. of Logging, and Ryoichi Handa, Asst. Prof. of Forest Policy and Economics, a seminar on Japanese, U. S. and world forestry—extremely interesting; luncheon served at same table with seminar continuing. Prof. Dr. Koichiro Ueda, world leading expert on bamboo, joined us. . . . Okazaki and I drove north a few miles to "Experimental Forest and Arboretum" of Kyōto University; here we met (several) of the tree breeding and other research men who showed us many interesting things, (including) most important collection of pine genus in the world—next to Placerville (in California).

Dr. Ayaakira Okazaki was graduated from the Forest School of Kyōto University in 1931. For about three years, 1933-1936, he studied forestry and landscape gardening in Europe—especially in Germany—and visited the United States. Most of his professional life has been devoted to work at Kyōto University—teaching and later administering forestry, landscape gardening, and the forest experiment station. His unique talent is exhibited by the fact that he now holds two chairs in his University, forest management and landscape gardening. He has published six books in the former field, four in the latter, and many shorter works and articles in both. In 1951 he visited schools of forestry in the United States. In 1961 he again visited the United States and Europe and gave lectures in Germany. He is a trustee of Kyōto University and is vice president of the Society of Japanese Foresters. In 1963 he was visiting professor at the School of Forestry at Oregon State University. His illustrated lectures at Corvallis were most valuable to staff and students, and are reproduced here for the benefit of a much wider audience.

David T. Mason
January 1964



Introduction

Agriculture and forestry, in their management, differ in each country according to the object of production which is prescribed by the climate, geology, and soil of each. They differ from industrial production because of great difficulty in applying productive techniques of the more advanced nations to other nations. As for industrial production, the first considerations are the economic background of the nation and the purchasing power of the people, while in agriculture and forestry the natural condition of the country should be considered as the basic premise of production. Hence, a superior forest-management technique in the more advanced nations cannot be applied directly in all other nations.

Nonetheless, the study of the forestry technique of other nations is useful. Although all of the better genetical methods devised for various species of pines in the United States cannot be applied directly for Japanese red pines or black pines, some of them will be useful immediately after a little change in device. Similarly, forest management in Japan, which has an entirely different structure, might nevertheless give hints to the forest management of tomorrow in the United States.

With this thought in mind, I would like to give an outline of the natural and social background, forest distribution, and wood resources in Japan which constitute the background of Japanese forest management. Then I will introduce in detail the age-old famous forestries of Kitayama, Yoshino, and Obi. Other famous forestries will also be described. All are typical of the intensive forestry methods of Japan, but of course these are not all of the famous forestries in Japan.

Following this discussion, I would like to refer to the supply and demand relationship of timber, especially imports and exports, and then to current problems of Japanese forest administration and the role of the forest as it affects Japanese culture.

I should like to express my heartfelt thanks to Dean W. F. McCulloch who has helped me very much. Without his help, this publication would not have appeared. The kind consideration of Mr. David T. Mason, chairman, and the members of the South Santiam Educational and Research Project, and the staff of the School of Forestry, Oregon State University, will also never be forgotten.

Ayaakira Okazaki

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(*All photographs are by Professor A. Okazaki.*)

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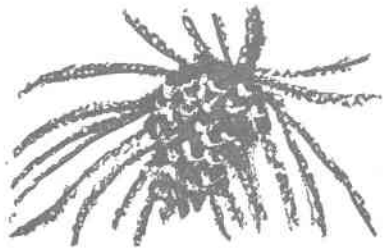


1. *Natural and Social Background*

Japan consists of islands located east of the Asian continent and near the western coast of the Pacific Ocean. Its total area is 91,345,000 acres, less than one twentieth of the United States and less than one and a half times that of Oregon.

The islands extend from longitude 145° 49′ 31″ E to 128° 06′ 23″ E, and from latitude 45° 31′ 16″ N (approximately that of Portland, Oregon) to 26° 59′ 10″ N (approximately that of Palm Beach, Florida). Thus the natural features of Japan are relatively complicated because of its extreme length.

The main territory of Japan consists of four islands: Hokkaidō (19,400,000 acres), Honshū (56,945,000 acres—about 92 percent of the area of Oregon), Shikoku (4,635,000 acres), and Kyūshū (10,365,000 acres).

In Hokkaidō there are two big plains which support agriculture. One is located nearby Sapporo, the sister city of Portland, Oregon, in the western part of the island. The second plain is in the southwestern part. There are two more large plains in the northern and eastern parts, but they are unsuitable for forestry or intensive agriculture because the climate is too cool and the soil is not fertile.

Except for these plains, Hokkaidō is mostly mountainous, especially in the center where highlands and mountains go up to seven thousand feet.

In Honshū, the highest region, are the so-called central mountains where there are many peaks more than ten thousand feet high. In such high mountains, trees cannot grow. A large mountain runs throughout Honshū, and plains are found only on seashores along the Japan Sea and the Pacific Ocean. They are mostly narrow except in the plains area in which Tōkyō is located and another whose center is Nagoya City. Thus Honshū is also abundant in mountainous land, well-covered with forests.

The same thing is true also in the small island of Shikoku. Shikoku Mountain runs through from east to west. The northern part of Shikoku and the southern part of Honshū surrounding the local "Seto Inland Sea" is a region of little precipitation.

In Kyūshū, the mountain range runs from

north to south. There are large plains in the north, a district in which heavy industry is centered. In the northwestern part and also in the southeastern there are smaller plains, but most of the area in Kyūshū Island is occupied by mountains.

Thus it is understandable that two-thirds of the total area of Japan is covered with trees and shrubs, and forestry is of the utmost importance in the nation's economy.

Since most of Japan is occupied by mountains or steep slopes, the area suitable for dwelling or agriculture is not large. Many mountains are nearly ten thousand feet high in the Japanese Alps and others of about three thousand feet are common. Thus, topographically, Japan is similar to Greece.

Japan can be divided geographically into two great regions by the Fossa Magna, a depression which runs about north and south, approximately across the middle of Honshū Island. The upper region of Japan above the Fossa Magna is called Northeastern Japan (North Bay), and the lower region Southwestern Japan (South Bay). Moreover, both parts have two sides, the Pacific Coast side and the Japan Sea side. Because geology and climate are different on these two sides, Japan can be classified quite appropriately into four parts. The four parts have faults in so many areas that the topographic features of Japan are very complicated.

Besides the monsoon, which is common in countries of Asia, Japan—excluding Hokkaidō—has a month-long rainy season from the beginning of June. It often has typhoons in late summer or in early autumn. On the Pacific Ocean side, more precipitation occurs in summer; on the Japan Sea side more in winter. Because of its cold current, the northeastern part running along the Japan Sea is one of the heaviest snowfall districts in the world. It is reasonable that Japan, extending over 1,250 miles from north to south, should show various climates, and many faults make them more complicated microclimatically, too.

According to the *Japan Statistical Yearbook,* the population in 1960 was 93,407,000 or 1.02 people per acre. This density is third in the world, ranking next to Belgium and the Netherlands. Taking into consideration, however, the fact that these countries are flat in general, while Japan is mountainous, Japan's lowland is actually the most dense in population. While the percentage of population increment has begun to diminish, at least since 1956, the absolute number is still increasing, although the population employed in agriculture, forestry, and fishery is decreasing even in absolute numbers.

This decrease is caused, first of all, by lower wages for labor in agriculture, forestry, and fishery (the first industry) compared with wages in manufacturing (the second industry) and in tourism and other services (the third industry). Secondarily, living conditions have greatly improved in cities, contrasting remarkably with retarded conditions in villages. This situation exists all over the world, but it is most pronounced in Japan.

Anyway, shortage of labor is one of the most serious problems of present-day forestry. For this reason, mechanization and development of road networks and of various kinds of automation should be urged strongly.

The annual quantity of food per capita is always about the same. Of course, some changes occur in the tastes of a nation. For instance, in the last century, Japanese rarely ate meat, yet the demand for meat increased after the Second World War. Still, rice is the main food. Although some people now eat bread instead of rice, the consumption of rice and wheat does not change conspicuously; that is to say, about five bushels of wheat per capita per year are sufficient in Japan. Therefore, agricultural crops should be produced according to the population in order to meet the demands of a nation, if exports or imports are not considered.

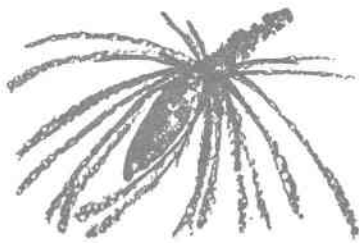
It is not the same situation for wood. The amount of wood consumption increases not only by the increment of population but also by the greater consumption per capita. This is proved by the fact that an advanced nation consumes more wood than an underdeveloped

nation, and a nation will consume more wood when its economy improves. Therefore, the amount of wood consumption, except in wartime, can be said to be a barometer indicating the degree of national culture, or its advance.

As already mentioned, Japan is and should be the land of forestry. Nevertheless, she imports a great deal of wood from the Philippines, Indonesia, the United States, Canada, the Soviet Union, and other nations. Fundamentally, Japanese forestry should become more intensive, especially in the less accessible parts of the great forest areas, but actually forest management is becoming, at least temporarily, less intensive because of a shortage of labor.

This is the reason why on the one hand, improvement should be made in road networks and mechanization of forestry operations, and on the other hand, why more wages and better accommodations should be granted laborers to keep them in forest lands.

In spite of the continuous increase of wood prices compared with those of other goods, the ratio of income in forestry, compared to other industries, is decreasing. This fact is very serious for foresters.



2. *Forest Distribution and Wood Resources*

The main factors which decide the distribution of forests generally are water and temperature. Except in special regions, Japan has such abundant precipitation that water is less of a problem than temperature. This is proved by the close correlation between vegetation and latitude or height above the sea level in Japan compared to other countries.

Then how should forest zones be divided? The most famous classification is that by Honda. In his opinion, Japan has four forest zones: tropical, warm, temperate, and cold. Japan lost the tropical zone by the Second World War, so she has three zones now.

The warm zone is sometimes called the subtropical or evergreen oak zone because it is abundant in many kinds of Quercus and Lithocarpus.

This zone originally was occupied by evergreen broadleaved tree species scattered over with deciduous trees. They were damaged by repeated fellings and fires, and many deciduous light-demanders and Akamatsu (Japanese red pine, *Pinus densiflora*) have appeared.

The temperate zone makes up one part of the deciduous broadleaved tree zones of the world and in Japan is called the Buna zone (Japanese beech, *Fagus crenata*). It extends from northern Honshū to the middle of Hokkaidō (45° 30′ N). Besides beech, the representative, the zone is abundant in deciduous kinds of oak, Tochi (Japanese horse chestnut), and other deciduous broadleaved trees. Moreover, in some regions, the zone contains natural stands of Sugi (Japanese-cedar, *Cryptomeria japonica*), Hinoki (Japanese-cypress, *Chamaecyparis obtusa*), Sawara (*Chamaecyparis pisifera*), and Hiba (*Thujopsis dolabrata*), all important Japanese conifers.

In the southern part of the temperate zone, grow many red pines and Kuri (chestnut, *Castanea pubinervis*) and a few beech. However, scarcity of beech should be ascribed to fellings and fires. The beech stand will come up some day, if it is not touched. Near the boundary between warm and temperate zones are many firs (*Abies firma*). As firs grow higher, beech and oaks are protected under them. If the firs, the upper stories of the stand, are removed, the light-demanders, such as Konara (*Quercus*

serrata), Kunugi (*Quercus acutissima*), and Japanese red pines grow up instead of beech and oak; of these the former will escape toward the north and the latter toward the south.

The cold zone, also called the Abies zone, is at high elevation in Honshū and the northeastern part of Hokkaidō. The main trees of this zone are Shirabe (*Abies veitchii*), Ohshirabe (*Abies mariesii*), Tōhi (*Picea jezoensis* var. *hondoensis*), and Kometsuga (*Tsuga diversifolia*) in Honshū, and Ezomatsu (*Picea jezoensis*) and Todomatsu (*Abies sachalinensis*) in Hokkaidō.

After being burnt out, birch (*Betula* spp.) and Yamanarashi (aspen, *Populus sieboldi*) appear at first, and, through the period of partially light-demanding broadleaved trees, the zone again will have a coniferous stand. If fires are repeated many times, only trees resistant to fire remain, such as Kashiwa (*Quercus dentata*) and Mizunara (*Quercus crispula*). In extreme cases nothing will remain but wilderness.

Many opinions have been published, but none of them chose cedar or cypress as representative of a zone, though they are most important species for forestry, and they are cultivated not only artificially but grow well naturally.

It is an important duty of foresters to build up a theory of forest distribution from the viewpoint of forestry. Distinction should be made, moreover, between the natural distribution of a tree species and the possibility of planting it beyond its natural limits. From the forestry standpoint too, there is a remarkable difference between the fact that a species can be cultivated and how well it might grow in a region. Further, attempts must be made to let the species adapt to the locality or, vice versa, to change the environment for better growth of the species. In any event, distribution of forest species should be considered only as a base for improving forestry. It is not an aim itself, but merely a means to reach the aim.

The whole area of Japan amounts to 91,345,000 acres, of which forest land totals 61,771,000 acres, about two-thirds of the country. This percentage is very high compared with other countries. Worldwide, about 30 percent of the land is occupied by forests.

Agriculture is an important industry in Japan, yet the area devoted to it amounts to only 15 percent of the land. The high percentage of forest is due to the fact that in almost all regions mountains or steep slopes exceed plains.

Because the present population is 93,407,000, forest area per capita is about 0.67 acres. This means that Japan will be able to supply the demands of the nation at least in the near future, if forest land is managed very intensively. In England, conversely, no matter how intensively forestry may be practiced, the country will not be capable of meeting its demand for wood. In contrast, countries such as Canada and Sweden can produce more wood than they consume. This is the reason why the technique of wood production is especially important in Japan.

The ownership of forests in Japan by absolute number and ratio of owners is given in Table 1.

Table 1. OWNERSHIP OF FOREST LAND IN JAPAN

Owner	Area	
	(1,000 acres)	*Percent*
National:		
National forests, Agriculture and Forestry Department	17,811	29
National forests, other departments	858	1
Public:		
Prefectural forests	2,493	4
Municipal forests	3,462	6
Property ward forests	1,446	2
Private:		
Forests attached to shrines and temples..	405	1
Industrial forests	1,784	3
Individual forests	31,031	50
Others	2,481	4
TOTAL	61,771	100

The forests are not distributed homogeneously. Private forests lie near villages, while most national forests occupy the more mountainous areas, mainly in Hokkaidō and Tōhuku, the northeastern part. A few are in the western part of Japan.

Table 2 shows that natural forests exceed artificial stands, especially so since almost all broadleaved forests are regenerated naturally.

Productivity of broadleaf forests is low, for they receive almost no silvicultural treatment, since efforts spent on coniferous forests are more profitable. Broadleaf forests usually have been utilized for fuel and charcoal, and owners expected natural regeneration by sprouting and put no labor into them. These stands should be managed more intensively as timber forests in the future, since the demand for fuel and charcoal is decreasing.

Another thing to be pointed out is the very large extent of wilderness. It should be used for other purposes or should be improved, even though kept as a forest-management area.

Seventy-three percent of the forest owners have less forest land than 2.2 acres each, and 94 percent of forest owners have less than 12.5 acres. Because their total area amounts only to 31 percent of all private forests, about 70 percent of private forests are owned by only 6 percent of all owners. Thus, it is evident that most forest owners cannot live on forestry alone. In many cases, forestry is no more than a subsidiary business in Japan. No matter how intensively it may be managed, a forest of a few acres will not support the owner. A forest owner with only fifty acres may be a small owner in the United States, but would be a large-scale owner in Japan.

Growing Stock

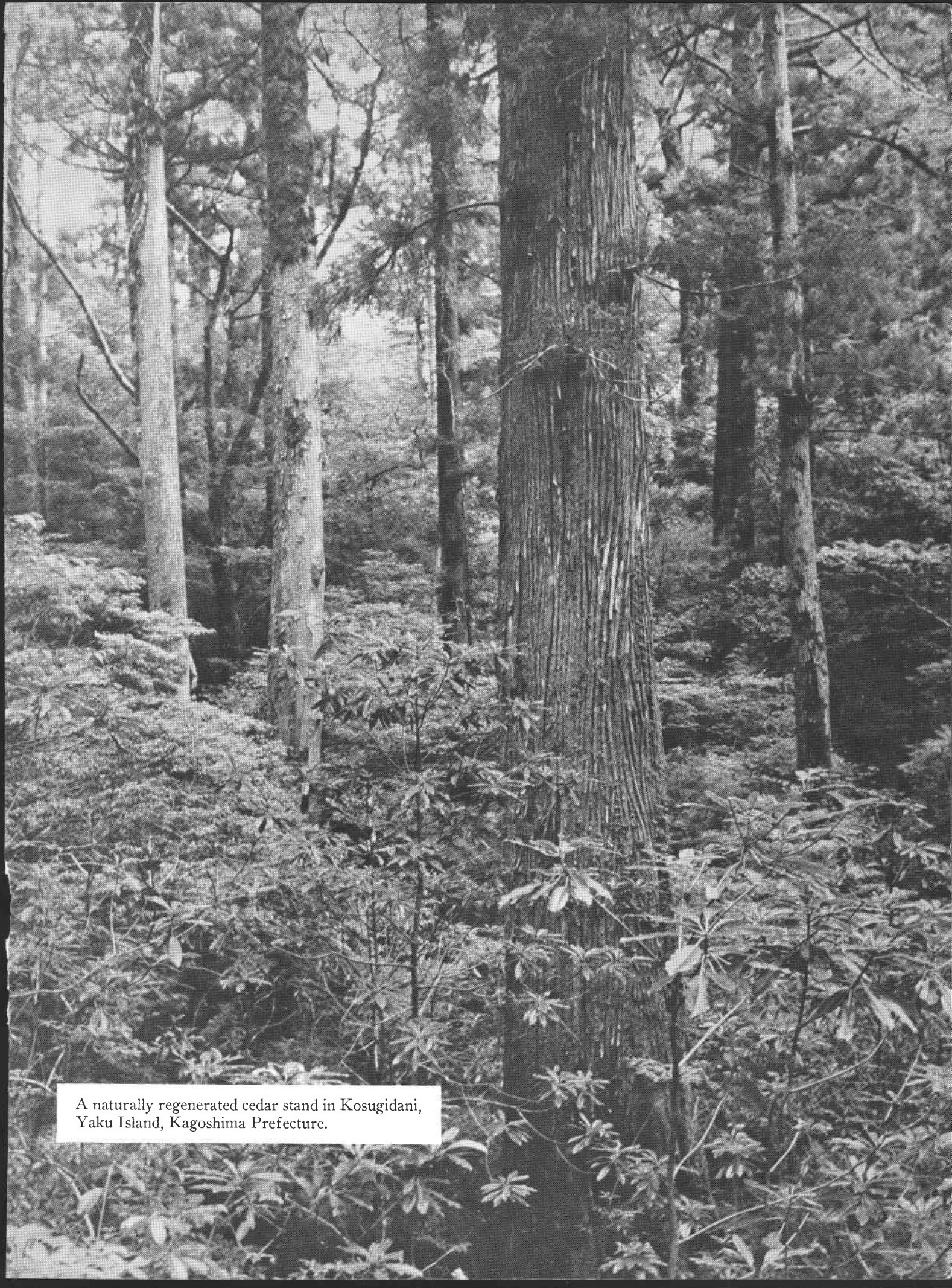
Statistics of the Bureau of Forestry show that the total amount of wood in Japan is about 65 billion cubic feet, about 47 percent conifer and 53 percent broadleaf; about 46 percent of the total is in national forests and about 54 percent in private forests. Since the area of private forests is twice that of national forests, it may be concluded that management is more intensive in the national forests. Yet, in some regions, the most intensive forestry is practiced in private forests.

The average growing stock per acre is about 1,100 cubic feet in all Japan at present. The ideal volume of a stand depends upon the site quality and species of trees. In good sites it should be possible to increase the average growing stock to 2,500 cubic feet. As a whole, Japanese forests should contain 1,500 to 1,800 cubic feet per acre as an average in the near future. From the viewpoint of climate and geological features, Japan could have more growing stock per acre than any other country.

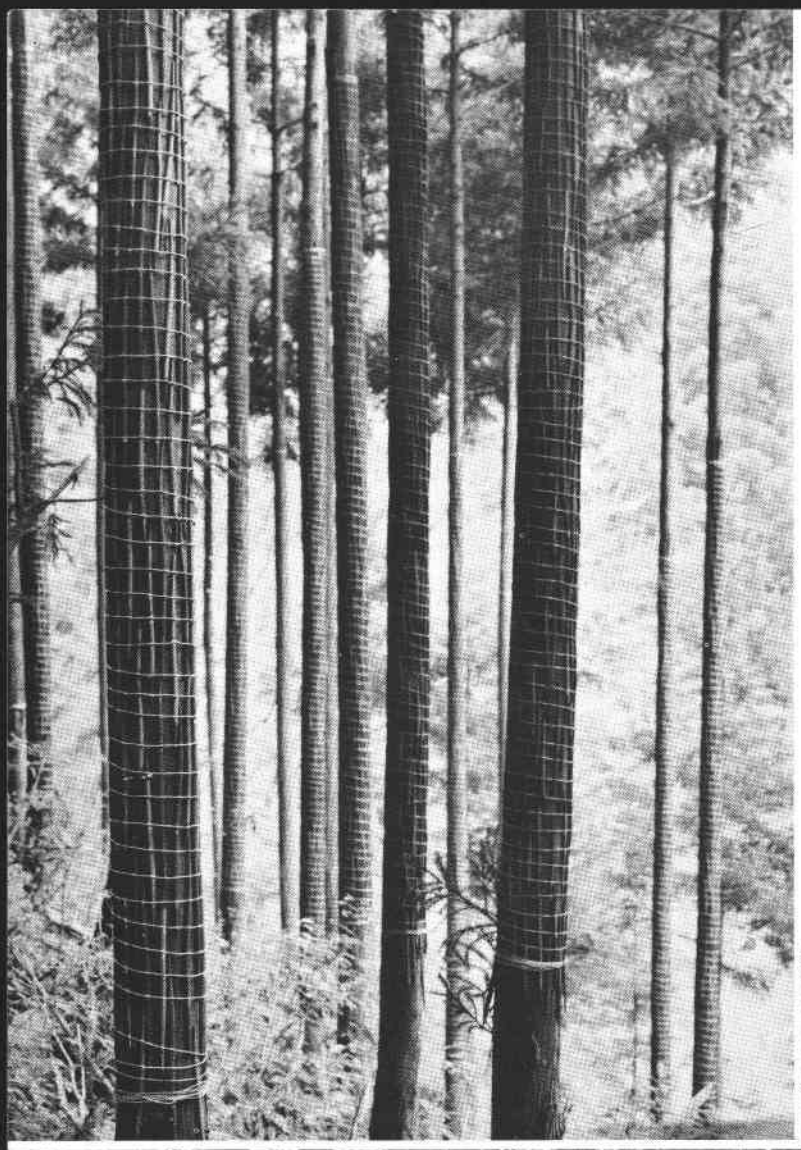
It is difficult to estimate the annual increment of wood. Estimates vary from 2 to 4 percent. The increment ranges between about 1.3 billion and 2.6 billion cubic feet annually, differing not only by the amount of growing stock, but varying with the climate in a given year.

Table 2. Forest Types of Japan in Thousands of Acres

		Forest land				Bamboo stand	Cutover and severely damaged	Wilderness
		Total	Coniferous forest	Broadleaved forest	Mixed forest			
Total	61,777	55,870	18,071	28,770	9,029	435	1,992	3,474
Artificial forest	.....	14,174	12,659	892	623	.....	.....	.....
Natural forest	.....	41,696	5,412	27,878	8,406	.....	.....	.....

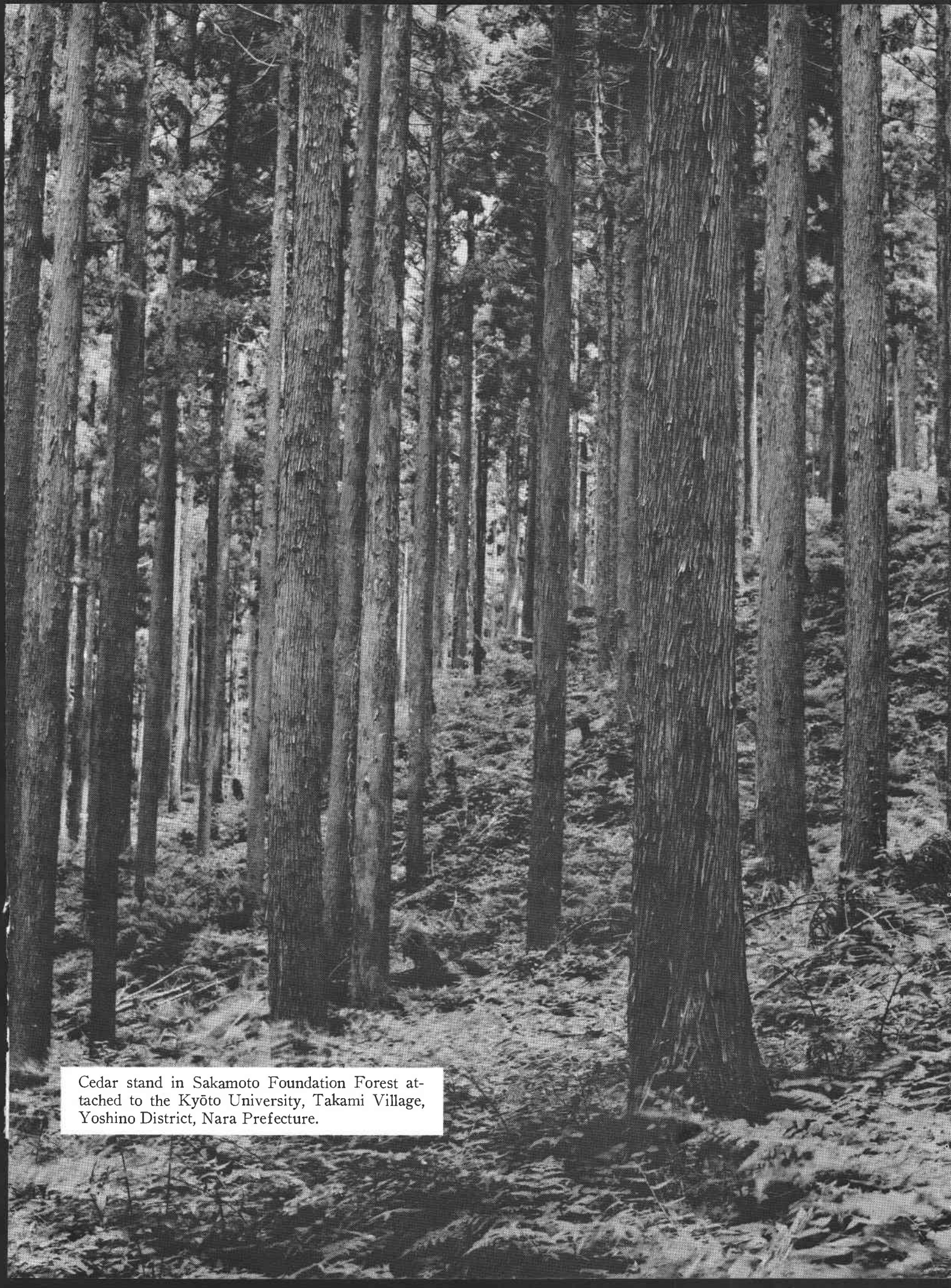


A naturally regenerated cedar stand in Kosugidani, Yaku Island, Kagoshima Prefecture.

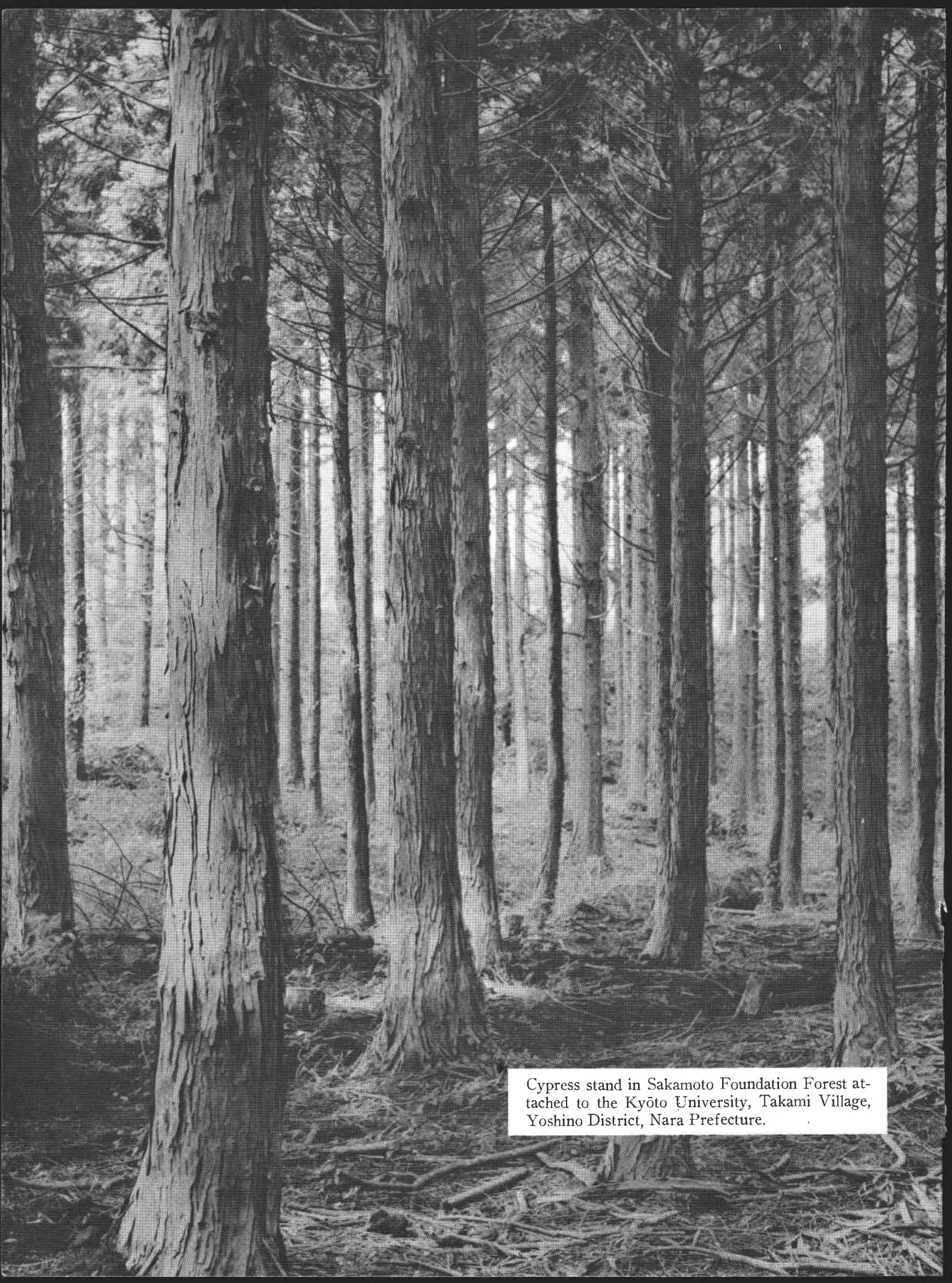


Cultivation of cedars with artificial crinkles, Kitayama Forestry, Kyōto City.

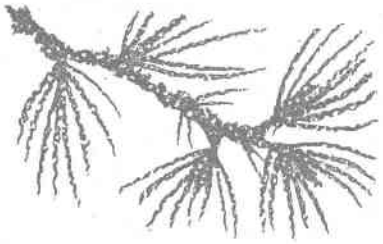
A stand of cedar produced by the one generation system, Kitayama Forestry, Kyōto City, Kyōto Prefecture.



Cedar stand in Sakamoto Foundation Forest attached to the Kyōto University, Takami Village, Yoshino District, Nara Prefecture.



Cypress stand in Sakamoto Foundation Forest attached to the Kyōto University, Takami Village, Yoshino District, Nara Prefecture.



3. *Kitayama Forestry*

Kyōto, the ancient capital of Japan, is surrounded by mountains except in the southern part. In ancient times, the mountains were natural fortresses against enemies, and for this reason Kyōto was the capital and the center of Japanese culture for a thousand years.

The area, drained by a local river, the Kiyotaki, is unique from the viewpoint of forestry. Forest management there is called the Kitayama Forestry from the name of the area. Two kinds of management are followed: one aims mainly to produce logs and the other, rafters. Logs and rafters of Sugi (Japanese cedar) are treated nearly the same way after cutting, but they have to be produced in different ways. The polished logs and rafters in Kitayama are of the best quality, and the forest management there is the most intensive.

The polished logs are produced by clear cutting small areas or by sprouting, while rafters are produced only by sprouting.

The area producing polished timber amounts only to about 1,200 acres; about seven hundred acres are supposed to be for log production and about five hundred acres for rafter production.

Quality is sometimes more important than quantity in the Kitayama Forestry. The demand for products is well defined. Too much should not be produced because they are used only for alcove-posts, beams, rafters, and so on. These logs are very expensive, but unless their production is limited, their value will easily decrease.

The reason why such a peculiar forestry—or rather, a wood producing art—has developed there, is based on the fact that Kyōto was the capital of Japan for a long time, and that the Japanese have long appreciated fine wood texture.

Natural Environment and Economic Situation

Kitayama Forestry practised in the district of Nakagawa is the most important; therefore, forestry in this district will be described. It is located about twelve miles north-northwest from Kyōto Station. It extends 1.6 miles from east to west and 2.0 miles from north to south, occupying 3.2 square miles, mainly on the right bank of the Kiyotaki River.

The district is mountainous, and it has very few plains excepting the narrow zone where people live.

It is cool in summer there, severe in winter. Average annual temperature is 58.0° F.; 81.3° F. in August and 36.5° F. in January. Annual precipitation amounts to 71.9 inches. It rains heavier in June (10.2 inches) than in September, the typhoon season (9.3 inches), and little in winter. In spite of the severe winter, accumulated snow amounts to 8 inches at most. This is very important because trees and sprouts are scarcely damaged by heavy snow.

This district has many natural stands of Japanese red pines and evergreen and deciduous species of Quercus. Generally speaking, the intensive afforestation of cedar is practised chiefly on the lower lands, while red pine is dominant on the summit and miscellaneous broadleaf trees halfway up the mountain. Also, there are cedar stands for the production of ordinary timber in Kitayama Forest lands and also some afforested areas of Japanese cypress.

People of the forest village used to bring out polished logs, rafters, or fuel sticks, carrying them on the head or shoulder, and exchange them for dairy products from the city. Today it is easy to bring out many logs and rafters in a short time anywhere by truck.

The importance of forestry in this region is evident from the fact that areas used for agriculture, dwellings, and other purposes total only 1 percent of the land; the rest is forested.

Most of the area is forest and most is privately owned. It is very difficult to know the exact economic situation, because people do not like officially to announce their income because of their concern with taxes.

The intensity of timber management here is shown by the fact that plantations for log production are weeded annually for the first 10 years and biennially for the next 10 years. Pruning is started in the seventh year and carried out some dozen times prior to final harvest at 50 years. In producing rafters, weeding is done about 30 times and pruning about 27 times before harvest at 55 years.

Tables 3 and 4 give the total production and value of logs and rafters through the final cutting.

Table 3. Income per Acre from Logs, Assuming Clear Cutting at Fifty Years

Cutting	Number of logs	Unit price	Value
First cutting..	400	$2.80	$1,120.00
Second cutting	400	2.80	1,120.00
Third cutting	400	2.80	1,120.00
Fourth cutting	400	2.80	1,120.00
Final cutting	800	2.80	2,240.00
Total ..			$6,720.00

Table 4. Income per Acre from Rafters, Cutting at Fifty-five Years

Cutting	Number of rafters	Unit price	Value
First cutting	1,840	$1.40	$2,576.00
Second cutting	570	0.85	484.50
Since third cutting	2,600	0.85	2,210.00
Total ..			$5,270.50

To discuss the economic conditions of Kitayama Forestry, however, the above mentioned data is not enough. It should be pointed out that more than 100,000 logs and more than 50,000 rafters are produced annually in this district. A log with a price of $2.80 is comparatively expensive. It costs several times more than ordinary timber. A log with natural fine crinkles is rarely produced and it sells for $300 because it is valued so highly as an interior corner post or alcove post in dwellings and tea houses.

This intensive forestry probably developed because the natural stands near the village were reserved as the Imperial Forest in 794

when the capital was moved from Nara to Kyōto. The timber produced was reserved not only for constructing the Imperial Estate, but also as a source of income to the Imperial treasury.

No exact information is available on the earliest production of cedar timber by sprouting. It is supposed that the innovator got the idea from naturally regenerated trees whose form must have been similar to those artificially established in later years.

Kitayama Cedars

The Japanese cedars in the Kitayama Forestry are divided into six sorts. Four are summarized as Shirosugi, or white cedars, since Shiro means white and Sugi means cedar. They are of excellent quality. White cedars have soft needles and obtuse crowns. Because of their slow increment, the timber is white and fine with good luster. Moreover, the white color will remain for a long time. Honjiro, meaning pure white, is said to be the best among the four white varieties. The needles of Shibahara are dark green and the crown is acute. This sort excels in growth; it can grow well on inferior sites, and is easy to root, too. Its weak point lies in the inferior quality of the wood.

Tanesugi, with stiff light green needles, has an acute crown similar to Shibahara. It grows most rapidly. The form factor of Tanesugi as well as Shibahara is smaller than that of Shirosugi. The timber, yellowish white, is apt to change to brown with age. Tanesugi cannot grow well in a locality of inferior quality as does Shibahara.

The cedars in this district sometimes have crinkles which are appreciated because they are rare. The cause of crinkles is not yet clarified. Some say that crinkles come out on a tree of an inferior locality and others say they are due to a sandy site. At present some foresters are trying to plant cuttings from a mother tree having crinkles, or to make crinkles artificially. A crinkled log is valued much more highly than one with a plain surface.

As already described, Shirosugi is inferior in growth and it demands a good site. Therefore, Shibahara or Tanesugi, whose increments exceed that of Shirosugi, are rather welcome nowadays.

Silviculture

Two silvicultural systems are used to produce polished timber in Kitayama, sprouting and clear cutting. The latter is also called dense planting or the one-generation system.

In the sprouting method, a forester cuts off a tree, leaving some branches on the stump. The branches soon grow up straight and the best of them are selected later for final cutting. The process is described in detail as follows: The first pruning is performed five or six years after planting, where several branches around the lowest part and the top of the stem are left while others are cut off. Some of the remaining branches will go on for a long time because the parent tree will be the base for future sprouting. The tree will bear many sprouts continuously which will be utilized for logs or rafters.

The number of sprouts left to grow varies according to the sort, age of the stem, site quality, and the method of nurture, depending mainly upon the purpose for which they are intended. That is to say, only a few sprouts will be left for logs and many for rafters. Shirosugi is used mostly for sprouting, while Shibahara and Tanesugi are usually managed by a clear-cutting system.

Regeneration is practiced by sowing seed or planting cuttings. In old times cuttings were planted directly on forest land, but now they are first cultivated in the nursery. Though sowing is rare in Shibahara and Tanesugi, the method of planting cuttings is generally applied for all sorts. Particularly for the cultivation of Shirosugi, only cuttings are available, because this variety bears less seeds and they do not germinate well. In the Kitayama district there is so little flat area that space around dwellings is utilized as a nursery.

Cuttings are planted mostly from the beginning of March until the beginning of April. Rarely they are planted also in autumn, for the

purpose of building up saplings which will have crinkles.

A mother tree from which cuttings are taken must be strong and generally is from fifteen to thirty years old. Cuttings, 16 to 24 inches long, are taken mainly from branches on the sunshine side by a sickle, and they are shortened to 12 to 20 inches before planting. Side twigs or needles on the lower part of a cutting are removed. Thus prepared, cuttings are placed in a tub filled with water before they are planted.

The base of a cutting is covered with clay. The cutting should be planted so deep that the part free from twigs or needles will be completely under the soil. The distance between two cuttings should be four to six inches and that between two series six to eight inches.

After planting, water or a dilute solution of fertilizer is given to cuttings, and they are screened from the sun until September. More than 80 percent of cuttings of Shirosugi will root, while only 40 percent of Shibahara and Tanesugi will do so. This difference is significant. An autumn cutting will not root as well as a spring cutting.

A spring cutting will be brought to the forest area after two years in nursery cultivation, and that of an autumn cutting after two and a half years. A cutting is rarely transplanted from one nursery to another, even though it may be intended for planting in another forest.

Site quality and proper selection should be considered before planting. Especially is this true with the sprouting system, since sprouts will grow up successively for a long time. Moreover, the system is so intensive that it treats every single tree carefully; therefore, an area near dwellings is ideal for this system.

A one-generation system where the entire tree is harvested is simpler than sprouting. Shibahara and Tanesugi, mainly used for this purpose, do not always demand a site of superior quality as does Shirosugi.

When the reforestation area is determined, herbs and grass are first cut, then carried away or burned. For March planting the area should be prepared in January and February.

Density of planting depends upon the silvicultural system and the quality of the site. Generally speaking, 1,600 to 2,000 trees are planted per acre for the sprouting system, or about 1,800 as a mean. In the one-generation system the number planted runs from 1,800 to 2,500 per acre. In both cases, cuttings are planted in staggered lines, not in straight rows, and a stake is set by each.

After-planting is made within one or two years after ordinary planting. Shirosugi is so excellent in rooting that, if planted carefully, there is little need for after-planting. If needed, Shibahara and Tanesugi are sometimes used to fill in between Shirosugi.

In ordinary silviculture, weeding is necessary only for the first few years after planting. In the Kitayama Forestry, however, weeding is necessary continuously to allow easier pruning. In weeding, vines too are removed.

One of the remarkable things in the Kitayama Forestry is that, in general, no thinning is done except in the depths of the mountain, and improvement cutting is not necessary.

The first aim of pruning is improvement of wood quality. Polished logs of Sugi should have straight, knotless stems with little taper. They must have a white and elegant skin with permanent luster, and should be of quality that is not easily cracked. For attaining this stem form, strong pruning must be repeated frequently. An alcove-post 10 feet long has a difference of only 0.24 inches in diameter between top and base, and no knot is visible. Thus pruning is especially important for the Kitayama Forestry. Branches should be pruned before they die. Moreover, the pruning should be heavy enough so sprouts will grow well and get enough sunshine. Such pruning is practiced in both the one-generation system and the sprouting system until the mother trees are cut. If this careful tending should be stopped, the ultimate log will not sell at a premium, but only at the usual price as a common log.

Specifications for pruning as used in the Kitayama Forestry can be enumerated as follows:

(1) A branch should be pruned down perfectly at its base. How skillfully this is performed depends mainly on the experience of the forest worker. He should neither strip the bark from a tree nor damage the tree itself. A stripped part of the trunk is likely to be attacked by bacteria and fungi.

(2) Branch expansion should be arranged equally in every direction. This is necessary to secure a straight stem of very little taper.

(3) Every big branch should be removed. If a big or thick branch remains on one side, the stem is apt to incline to that side.

(4) Every branch of a tree that edges up to another tree should be cut, because such a branch will damage another tree when it is blown by the wind. Care must be used here, especially in the sprouting system. When a branch touches the top of another lower branch, it should be taken off so the lower can grow into a normal tree.

(5) An adventitious bud that comes out from a stem directly should be removed, because it will be the base of a future knot if not taken off.

(6) If two branches are close together on a stem, one of them should be removed to prevent knots and bending of the stem.

(7) In the sprouting system, two branches of the same height should not be left close together because they interfere with each other and will be damaged.

Yield and Production Practices

Cutting age depends not only on size, site quality, species, and silvicultural system, but also on the purpose of the production. Generally speaking, in the sprouting system 30 to 60 years are necessary to build up a log 10 feet long and 4.8 inches in upper diameter, while 15 to 25 years suffice for rafters 10 feet long and 1.2 inches in upper diameter. The products of the one-generation system are only logs, and their final age is 30 to 50 years.

Just as in planting, there are two seasons in cutting: spring and autumn. The spring season runs from the latter part of March until early in April; the autumn season runs from the end of July until early in October. Because it would be difficult to strip bark and the wood might give an inferior luster if the cutting season were too late, rafters generally are cut from the end of July until the middle of August and logs from the middle of August until the end of September.

A tree will be stripped for drying in the forest soon after cutting. If the weather is bad meanwhile, wood quality goes down and it may have spots on the surface. Because such a log loses value, cutting should take weather into consideration.

As the famous forester S. Yamamoto asserts, the most important factors in Kitayama Forestry are selection of seedlings, labor, and opportunity. In addition, the time of cutting is especially important.

The main work after cutting is executed as follows: A cut tree is stripped from the base toward the top with a 12-inch wooden spatula; twigs at the top are left. The stripped timber up to that part where branches remain is placed on end against a standing tree in the forest or brought back to stand at the eaves of a house. In the latter case, the base of the timber should not touch the soil surface; therefore, a stump, plank, or a stone is laid between the timber and soil. In such condition, rafters are left about five days and logs for a week to let them dry. Top twigs are left in order to accelerate the drying process. The later the drying, the more dangerous it is to wood quality because of increased probability of bad weather.

After drying, twigs are cut off and then the log is cut to size. In general the bark is cut in lengths of 26 inches for the purpose of packing the polished logs and others. Although the length of a common timber is 10 feet, it is sometimes 12, 15, or 18 feet, taking 3 feet as the unit of increase. Because timbers always

should have some surplus length, a timber said to be 12 feet long will be really about 14 feet long. Rafters have no definite length. After bringing out a cut log from the stand, it is split artificially to the pithray by a circular saw to prevent natural crack. After inserting a wedge into the split, the lower end of the log is smoothed by a hatchet. Such a log will be kept in an airy barn where the split side is oriented to the outside to dry again. A log completely dried is thrown into water in an artificial basin for an hour to cure small cracks developed during the drying. Then the surface of the log is polished with fine sand to give it luster. It is very important to use very fine sand that will not damage the log.

Polished timbers are washed in water again, then laid outside the house. After drying, they are brought in a barn again where they are sorted. If they are not packed tightly, there will be a danger of cracking. Polishing is generally done before the contract of sale for rafters and after the contract for logs.

In every case logs and rafters are wrapped with paper at first, then packed again with bark of Sugi or straw matting for consignment.

The polished logs are used mainly as alcove-posts, beams, wooden frieze strips or entablature, window frames, balustrades, and so forth. Rafter wood is also used as staffs for ceiling plates.

The peculiar form of sprouting cedar is admired from the aesthetic point and such trees are often planted in Japanese gardens.

The best markets for products of Kitayama Forestry are in the larger cities, the three southern islands of Japan, and even in foreign lands.

4. *Yoshino Forestry*

Natural Environment and Social Situation

The Yoshino district with an area of about 622,600 acres and a population of about 107 thousand is located in the southern part of Honshū Island. The Yoshino River flows through the district westward and villages along the upper stream are in the center of the Yoshino Forest area.

Not only is the soil comparatively deep here, but its physical and chemical properties are also good. The porosity and clay content of the soil are ideal for the growth of two important species—cedar and cypress. The surface is covered with humus that decomposes easily.

The temperature changes remarkably, because the forest areas here are generally mountainous and lie between 1,600 and 5,000 feet above sea level. Therefore, we cannot compare the temperature of one site to another. The average temperature during the last decade in a representative location here will indicate the general tendency of the climate in this district. The range is from 39.6° F. in January and February to 82.8° in July and 85.2° in August. The temperature is not too low for the growth of cedar and cypress, since we find famous cedar forests also in the cold northern part of Japan.

With fertile soil, the Yoshino district owes its forest to abundant rainfall. While the river valley has 40 to 80 inches, high land has 80 to 160 inches. Much precipitation with high humidity seems to be indispensable for the growth of cedar, because we never find an excellent cedar forest in any region with light rainfall.

Notwithstanding its good natural conditions, as a result of inconvenient communication, this district has been left behind economically. Only one railroad runs through the district. However, another connection is its prefectural and lumber roads. Thirty years ago, the district had about 0.024 miles of mountain roads per square mile, but in 1960 the length reached 0.1 mile. Nevertheless, the state of its communications is inferior to other districts in the prefecture.

Rice fields under cultivation in the center of the forestry area yield a poor return, and almost all rice for local consumption is im-

ported from other prefectures. Thus the high cost of labor in the district can be understood easily. Sometimes the cost of labor is less by two thirds in famous forest regions where rice is obtained cheaply. Another reason why the cost here is high is that only highly skilled laborers are employed.

Because the district is generally mountainous, it is obvious that the most important industry is forestry.

A Glimpse of the Forest

The whole forest area in the district of Yoshino amounts to about 500,000 acres, of which 300,000 are mainly coniferous and 200,000 acres coppice. There are some other large inaccessible regions. The coniferous forest of 300,000 acres is extremely valuable.

Table 5 gives some idea of wood production in the Yoshino Forestry.

Table 5. NUMBER OF TREES AND GROWING STOCK PER ACRE

Age in years	Number of trees	Log volume
		Cubic feet
10	2,715	------
20	1,052	1,861
30	587	2,883
40	405	3,818
50	291	4,411
60	227	4,967
70	182	5,389
80	150	5,727
90	125	5,018
100	109	6,292

The average increment per year in the Yoshino Forestry is never less than 60 cubic feet. In addition to this, the quality increase is so good that the total price increase of the stand is enough to cover the high cost of production. Cedar and cypress are generally cultivated in separate groups, but mixed planting of both together according to site quality is one of the special features of the Yoshino Forestry. In addition to these two species, there are also scattered areas of pine.

Fifty-six percent of the whole district is artificially forested. The average growing stock is 60 percent of normal, but in the watershed along the Yoshino River the percentage is much higher.

History

During the Middle Ages some wood workers immigrated to the Yoshino riverside. These artisans intermingled with the original dwellers and developed a high cultural standard, quickly assuming rank and social position in the community.

About 770 years ago the technique of lacquered wares became popular all over the country. About 250 years earlier, lacquer wares were produced in quantity in this district. Plain wood for the purpose was supplied by timber craftsmen in these mountain villages.

Later, timber began to be exported out of the region. This resulted in an increase in timber demand and the abandonment of the self-economy of the past. Under the new development, the former makers of plain wood became forest laborers under the control of the chiefs of villages. From the district, timber was floated down the river to wholesale timber stores and there sold through brokers to buyers from large cities.

The number of trees felled increased rapidly and new reforestation was slow. With the increase in timber demand, forest resources decreased, thus bringing about a sharp rise in the cost of timber, although reforestation was greatly accelerated as a result.

With this acute shortage of timber, the people living in the Yoshino River area turned to agriculture, paper manufacturing, and sericulture sidelines, although people living in the mountain areas had to depend upon forest resources only. Their profits were, however, absorbed by those who supplied the capital, and as taxes were heavy, they had no chance to save money. In addition, forests were public property under control of the chief of a village, so the full expectation of silviculture was not realized. In accordance with these unfavorable

conditions and the inability of the inhabitants to pay high taxes, the chiefs of villages were obliged at last to divide the common forests among individuals. Forest owners later leased their property to moneyed individuals and received a portion of the profits after cutting.

The chief, together with the inhabitants, helped to protect forest areas, because he could then claim a small share of the profits derived from the sale of the timber. On the other hand, the capitalist did not have to pay much to purchase land and also could expect forest protection from the inhabitants without much extra expense.

The improvement of transportation enabled more distant areas to be opened for timber production and the enlargement of reforestation. About a century ago, the forestry of the Yoshino district was managed intensively with a longer cutting cycle than nowadays. Reforestation dates from about this time, when timber prices rose suddenly.

With the enlargement of markets and the development of commerce, forestry by leased land changed into forestry by industrial capital. The inhabitants, the original land owners, became forest guards or wage-workers, that is to say, land owners were subordinate to land contractors. In the case of a renewal of contract, the owner was inclined to sell his land, and thus big forest owners, as we know them today, became established. For the lessee it was more favorable to buy land and to manage it himself, because the cost of leasing gradually increased. The system of leasing forest land has almost disappeared, although 30 percent of forest land at present is still under lease.

Silvicultural Methods, Protection, and Management of the Yoshino Forest

Silviculture

The principal species grown at Yoshino are cedar and cypress. The ratio is 70 percent cedar to 30 percent cypress. Both geographic and economic conditions are suitable for growing cedars at Yoshino. Cypress is planted mainly in comparatively dry soil.

Besides these species, in special instances there is some reforestation of pine (*Pinus densiflora*) and various oaks, but the number of these trees cannot be compared with the abovementioned two. However, a mixture of a type of broadleaved tree is recommended to avoid soil depletion, even if it seems to be economically unfavorable.

Five or six different varieties of cedar grow in this district, although the distinction between each is small and unimportant since they are survivors of past generations. Of course, excellent parent trees are selected to obtain seeds. The number of saplings per acre is greater here than in any other region, so most of them are cut, leaving only the very best as crop trees. It is a fact that the demand for a general assortment of forest products has increased, and instead of only barrel timber as in former days, now a variety must be selected. The viewpoint of future use must also be considered.

Seed trees must be healthy and between seventy and eighty years old. Seeds from older trees are small and great care must be taken to avoid loss. The best season to gather seeds is from the end of October to the beginning of November when cones are about to open. Small branches bearing cones are cut off by a hatchet. The technique of crossing from tree to tree in search of cones high above the ground is wonderful.

Gathered cones are dried in the sun until they burst and the seeds drop out. Then the seeds are dipped in water twice before final selection is made. At the first dipping those seeds which float to the surface are rejected, and at the second dipping those which sink to the bottom are removed, leaving seeds with a specific gravity of 1.05 to 1.10 to be gathered and used.

These seeds are nursery-sown in March or April each year at a ratio of about three gallons per thousand square feet for cedar and cypress, respectively. In a year, cedar seedlings have grown to about five inches and those of cypress to about four inches. Then they are transplanted. After transplanting, manuring, and weeding, seedlings are allowed to grow to

about eight or nine inches before they are transplanted a second time. After leaving them one more year in the nursery, that is, three years after sowing, a cedar seedling reaches a height of about 18 inches and then is transferred to the forest, while cypress seedlings are left one more year in the bed.

Weeding and grading must be completed before planting is done on forest sites. On areas planted within a few years after cutting, scattered shoots are gathered and burned, but on places untouched for a long time weeds should be removed first. The best season for planting is from the middle of February to the beginning of March when the sap is not fully active. Indeed, the season may be somewhat delayed in the case of cedar. The second best season is the middle of autumn.

One of the remarkable characteristics of the Yoshino Forestry is its close planting. Also, it aims to cultivate straight, knotless logs fit for barrel making and construction timber. Timber for barrel making must have at least five annual rings per 1.2 inches. Thus, from 4,000 to 6,000 seedlings per acre have been planted in recent years. With the decrease in demand for barrel timber and to save cost of seedlings, the number per acre has diminished. It is, however, not comparable with the average number used in cedar reforestation in Japan, which amounts to about 1,500 at most. Another characteristic of the Yoshino Forestry lies in the careful mixing of cedar and cypress, which proves again the high standard of management.

Weeding and other cultural practices are carried out twice each year during the five years after planting and once in the sixth year. After that, only climbing plants are removed. The beginning of pruning depends on the growth of seedlings. Usually branches are pruned ten years after planting. This should be done in spring or autumn before the sap begins to move or after it has ceased to flow. Discolored shoots or leaves up to 4 or 5 feet above the ground should be removed with a hatchet. Repeated pruning is not necessary for cedar because dead branches fall off naturally. However, this is different for cypress; cypress branches must be carefully pruned to prevent ugly notches from forming in the trunk.

Branches of Hinoki never die, even if trees are planted close together; therefore, live branches, too, should be cut. Branches are removed up to 15 feet aboveground in a tree of about 30 years old, 20 feet in a tree of about 45 years and about 35 feet in a tree 60 years old.

When pruning, a skillful laborer climbs a tree by a special ladder, cuts small branches with a hatchet and bigger ones with a hand axe, never forgetting to shave cut areas. As a principle, branches under the largest spreading one should be removed, with the exception of trees composing the shelter belt. The removed branches are scattered on the soil surface to prevent the rapid growth of weeds.

Because of close planting in the district, improvement cutting begins after nine years of planting. In a good locality improvement cuttings are sold, but in inaccessible places they are left. Although profit is not expected from improvement cutting, it aims at better growth of the remaining stand, and the technique is so important that only a skillful forest worker is fitted for the task.

The most important culture, of course, is thinning. In the Yoshino district, thinning aims at the uniformity of the remaining stand. To carry out this object the saying "weak but often" is strictly adhered to. If the thinning is too late, increased increment will be inferior, and if too early, side branches will sprout from the upper part of the trunk and make the timber quality inferior. In the past, equality of annual ring width was indispensable for barrel timber, and, even though the demand for barrel timber has decreased, this uniformity is still one of the most important factors making for the superior quality of wood.

The peculiarity of thinning in the Yoshino district is its frequency. One of the reasons lies in close planting, but even when the number of trees in the stand is decreased, the frequency is much higher than in other regions. At any rate, oft-repeated thinning is important for the production of good timber and it shows clearly the intensity of forestry in this district.

Protection

Damage to forests in the Yoshino district is classified as meteorological, fire, or animal. Among various meteorological disasters, those by wind and snow are most severe, while damage by water is not serious, because a large cleared area never is left a long time. Damage by high winds can be very serious, but fortunately this happens very rarely—about once every decade.

Trees from 20 to 50 years old, when damaged, naturally lose their value, but full-grown uprooted trees still are valuable, although they sell at a little less than the normal market price. Wind damage to roads and structures is obvious and the costs are easily determined, but overall wind damage to growing stock is enormous and cannot be reckoned in terms of dollars and cents.

Damage by snow also is severe, because trees frequently are broken under the weight of a snowfall. The traces of great damage by snow in 1944 are even now seen in stands between 30 and 40 years old.

Compared with meteorological damage, disaster by fires is not serious. Most forest fires are caused by man's carelessness. Therefore, with the promotion of fire prevention this danger is likely to decrease. The decrease in the number of forest fires in recent years in the United States shows the value of fire prevention.

That fires broke out only three times in the ten years from 1942 to 1951 in the Yoshino district, and that the burned area was less than 13 acres, is proof that the inhabitants realize the seriousness of forest fires. Although the district has plenty of rainfall and humidity is high, fewer fires occur here than in any other region where climatic conditions are similar.

Naturally, wild animals are plentiful in a forest and much damage is caused by bears, wild boars, deer, hares, birds, and insects. Among these animals, hares are considered the most destructive. Wild boars break down trees and devastate forest areas, and bears tear off the bark of big trees. Damage by insects, however, is slight.

From the above-mentioned, it is clear that the biggest enemies to forest land in Yoshino are wind and snow. Therefore, studies should be made of the use of shelter-belts to reduce snow damage. Also, different densities of planting should be investigated as a defense against snow losses.

Management

Besides close planting of cedar and cypress and oft-repeated thinning, long rotation is a remarkable characteristic of the Yoshino Forestry. Several decades ago the cutting period was more than one hundred years, because forest rent was covered by the profit received from thinning, and timber with homogeneous and narrow annual rings must grow at least one hundred years before it can be used for making barrels and other articles.

As a result of decreased barrel timber demand in recent years and the abolition of leased lands, the rotation became gradually shorter. The shortage of timber directly after the war promoted this tendency. A recent working plan in Yoshino established rotation ages of 55 to 70 years for cedar and cypress and 60 to 70 years for red pine.

The importance of timber quality should be considered. If the Yoshino Forestry were to abandon its policy of producing good quality timber, it could not maintain past prosperity, because many forest regions exceed Yoshino in quantity of timber production. Although the demand for barrel-making timber has decreased, knotless good quality timber always is welcome on the market.

Use of Timber

Yoshino Sugi was produced mainly for barrel timber before the war, especially until about 1930. During the war production stopped, and though somewhat revived, the demand has greatly decreased. At present the demand for construction timber is surpassing that for barrel timber. The principal uses of the timber produced in this district are as follows:

Small logs

The smallest pole is called a coin log, because the diameter is one inch (about the same as the former coin in diameter). The timber to be thinned is, therefore, 12 to 13 years old and the length is generally 8 to 10 feet, and up to 14 feet in special cases. The logs are used as supports for Japanese ceilings, lattice, poles for eaves, and sticks for mountain paths. They are felled in April and left in the forest for two or three weeks after barking. After that they are cut into lengths of 7, 8, 10, and 12 feet and polished with fine sand. The surface then shows a beautiful luster.

General logs

The supply of general logs is the greatest. The diameter at the top end is more than 2 inches, and they are cut to lengths of 12 or 18 feet. These are used for common rafters, scaffolding, and so forth. Logs over 6 inches at the top are used for building construction, telegraph poles, columns, and boards. Only logs of fine quality are used as polished decorative uprights in Japanese houses. The cutting season is late spring or early summer, and after barking cut logs are left in the forest until autumn.

Polished logs

Only good quality logs having a diameter of 4 to 5 inches are polished. They are generally about 40 years old. The supply at present is supposed to be about 200,000 per year. Timber to be used is felled in September without stripping off the branches and bark. They are left to dry for three months standing upright against other trees. Most of them are cut into lengths of 10 to 12 feet, peeled by the riverside, polished with sand, and dried and scooped out on one side to prevent expansion and contraction. They then are used for alcove posts, lintel joints, and other special parts of a Japanese room.

Timber for barrels and butts

This timber was once important and peculiar to Yoshino Forestry. Lately, glass containers have been substituted for wooden barrels and the demand for butt timber has disappeared.

Utilization of leftover wood

Wood that is left over from making barrels and other assorted articles is used mainly for chopsticks; 90 percent of the chopsticks in the whole country are produced in the town of Shimoichi. They have a pleasant fragrance and are easily snapped apart, because the grain is at right angles to the annual rings.

Besides chopsticks, boxes for food and sugar, Japanese clogs, and tubs are made from leftover pieces of wood.

5. *Obi Forestry*

Several excellent forestries are found in Kyūshū Island, among which Obi Forestry is unique. Its characteristics are remarkable both in management and utilization. Undoubtedly it will be influenced by the development of forest management as a modern industry, and will possibly change little by little in the future. Planting density and thinning are influenced in the Obi district by the fact that cedars grow rapidly there, favored with high temperature and abundant rainfall. It is true that the forest management of a district is limited in its productive technique by environmental conditions to some extent. The fact that Obi Forestry is practiced in a windy area influences productive technique, too. It is, therefore, a risk to abandon a satisfactory former operating method for the "rational" ones. It will be safe to change only gradually after careful investigations from various angles, even if some improper points are found.

Natural Conditions of the Obi District

Obi Forestry is practiced in the southeast region of Kyūshū. It includes mountain ranges and river valleys amounting to about 200,000 acres. Approximately one-half of the Obi Forest is state owned and the other half is privately owned, in contrast to the Kitayama and Yoshino forests which are wholly privately owned.

The terrain of Obi district is fairly complicated. The soil is sandy loam or loam, rich in humus. Most of the zone is on steep slopes; little is on gentle slopes or level ground. Cedars grow here even on thin mineral soil, as do cedars in general at the zone of medial site quality. This is chiefly because of favorable meteorological conditions.

The district is warm and blessed with abundant rainfall, as the Black Current flows close along its coast. Average annual temperature is 63.5° F., with 24° F. recorded as minimum and 95° F. as maximum. It is far warmer than other forest areas which produce cedars as their main product. Snowfall is very scarce even in the mountains in winter. The growing period of Obi cedars, therefore, is long, presumably from the end of March until the beginning of November.

It is one of the most rainy districts in Japan, with more than 118 inches a year. This

varies from about 11.8 inches in April and May to more than 15.7 inches in June and July. It has much more rainfall than Yoshino.

Needless to say, a cedar is a tree of high water requirement. Not only water in the soil but also humidity in the air has an important bearing on its growth. But in this district the average annual humidity reaches 79 percent and is always above 70 percent throughout a year save for January and February when it is 60 percent.

History of the Obi Forestry

The origin of Obi Forestry is traced back to 1587. The planting of young cedars was carried out for one hundred years after that time, but with no conspicuous development, because the right to cut cedars was the monopoly of the lords. Despite good natural conditions for the growth of cedars, reforestation in so wide an area was impossible without the cooperation and understanding of the people. Thus, production could not even meet the demand of timber for houses in the local area itself, and common people could not even expect to use the cedars.

To correct this situation the lords first promoted the law of halves, dividing income equally with the people who did the planting. Later, to encourage reforestation, the lords divided profits two thirds to the people and one third to themselves. Since reforestation was promoted in this way, beautiful cedar forestries developed all over the district.

In the early clan-government era, whoever planted cedars was granted the right of proportionate sharing, regardless of land ownership. Hence there was no necessity for private possession and few privately owned forests existed. But later when a clear distinction was set up between national and private possession, community-owned forests came into existence. Division of these lands among individuals was the beginning of private possession.

These small private woodlands, however, tended toward gradual concentration, as small owners tried to expand their possessions. Eventually each former community-owned forest came to be possessed by one or two owners.

The Obi district is an old forestry area, as mentioned. Even in the early years it had had an outside sale of timber, emerging from the period of self-supplying production. Some capitalists in the district, therefore, recognized the profitability of forest management and tried to get forestries for investment of their capital. Thus, privately owned forestries of comparatively large areas came into the possession not of the people in the communities but of absentee people in other towns and villages. These large areas are well tended.

Sorts of Obi Cedars

More particular care is given to the sorts of cedars in Obi Forestry than elsewhere. The origin of cedars in the district is not clear, but it is said that there are both native and imported varieties in Obi.

It is reasonable to think that cedars of native descent and of foreign descent, planted in mixture, would produce new sorts by natural selection through the influence of weather and soil. It is presumed, therefore, that forestry sorts with different names are just mixed breeds. After all, more than ten sorts are counted in actuality in the Obi district.

Reforestation Methods

Forests of the Obi district are similar to other forestry areas, in that 86.3 percent of the district is mountainous. The people in the district support themselves by forestry products and labor, and they have peculiar forestry techniques. Their principal methods are discussed below.

Regeneration method

Two regeneration methods used after deforestation are direct slip-planting and transplanting. The former was applied mostly in the past and the latter is applied today.

In the former method, nurseries are not needed because cuttings are planted directly on mountain lands. Vegetation that covers the

ground is burned and cleared a year or two before planting; then a cover crop is planted. Buckwheat, soy beans, potatoes, and sometimes upland rice may be used for this purpose. If the plantation area is a field that never has been forested, the vegetation is burned or weeded and the plantation started immediately.

In preparation for slip planting, twigs are chosen from vigorous mother trees, 7 to 20 years old. In making cuttings, special care is required to cut off the base and remove the needles. Cuttings must be made without injuring the old bark at the base of the cuttings lest it should come off.

Attention also should be paid to the season of plantation establishment. The best season is usually from the end of February to the beginning of April when the new sprouts become as large as grains of rice. Cedar cuttings are planted about 6 inches underground in normal forest lands. It is important to pack the soil solidly around the cuttings so that they will not be disturbed by the wind.

The number of cuttings per acre is from 600 to 1,500. But many will wither, and this is the major cause for abandonment of direct slip-planting in favor of transplanting in recent years.

In transplanting, cuttings taken from the mother trees in the forest are not planted at once but put in nurseries. Cuttings grow well in nurseries, and it is natural that cuttings whose roots have sprouted should also grow well when they are planted later on mountain lands.

Numbers planted

In early years of direct slip-planting, 1,500 cuttings were planted per acre. Succesful establishment in the district, however, was actually less than that in other forest areas because only one-third rooted.

When the transplanting method was applied, the number planted per acre was only three hundred to six hundred, but the final cultivation number actually increased because very few of them withered.

There has been a tendency toward thicker plantations in recent years. Even in the Obi district, the number sometimes reaches more than a thousand, but this is less than in other districts and nationally the average per acre is 1,500. Sparse plantation then, is one of the characteristics of Obi Forestry. It must be stressed that the district is close to the sea, with strong winds every year. If foresters establish a thick plantation and carry out thinning, cedars are immediately in danger of wind prostration. Therefore, thinning is done after the fixed seasons of strong winds. But the roots of the thinned trees prevent the growth of roots of the remaining trees. If a wild wind comes in a year after the thinning, the remaining trees, whose roots have not grown enough, will be blown down easily. Thus, the thin plantation in the Obi district is considered to be well based from the viewpoint of forest conservation. Thin plantation also meets the demand for Benko lumber, as will be mentioned later.

Culture

In the forestries of Obi cedars neither regular thinning nor pruning is carried out. Though pruning is not always as necessary for cedars as for Japanese cypress, it always is carried out in intensively managed forests. It should be pointed out that no pruning is carried out in the Obi district where widely spaced plantation is the rule. But weeding of undergrowth and vines is done in summer and autumn for several years after the plantation, because in widely spaced plantations the closing of crowns is late.

Use of Obi Cedars

Obi cedars have been used since early days as ship timbers. The name Benko lumber is especially famous in the forestry world. When Obi cedars are mentioned we always think of Benko lumber. First of all, these cedars have high buoyancy and are soft. They grow very rapidly, and the average annual diameter growth reaches 0.6 to 0.7 inch. The width of annual rings in very young trees reaches 1.2 inches. Grain is rough and specific gravity low. A special feature of Obi cedars is that autumn

wood is wide in comparison with that of cedars in other districts.

Obi cedars have more resin than those in other districts, hence less absorption of water; this increases the durability of the lumber.

The outside boards of ships must be curved in use, so bending strength is required. On this point, Obi cedars are so strong and durable that they are seldom broken even in the collision of ships. Another advantage is that their soft woods cover the traces of driven nails.

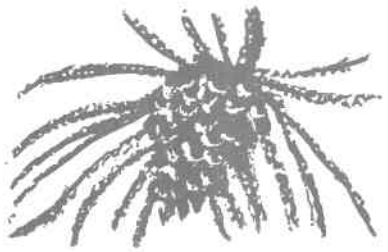
Because Obi cedars are not pruned, they have many knots, but they seldom make holes because they are mostly tight. This is, therefore, no disadvantage when using Obi cedars as timbers for wooden ships.

To decide the demand for Benko lumber in the future, actual results in the past must be examined. The number of wooden ships built from 1951 to 1960 was between 1,100 and 1,800, with no fixed tendency toward gradual increase or decrease. On the other hand, the number of steel ships built was between five hundred and seven hundred. Taking this into account, no remarkable change can be predicted in the near future. This will be inferred also from Table 6 in which the output of cedars in the Obi district in 1950 and 1960 is shown by their main uses.

Table 6. Output of Wood in Obi Classified by Use, 1950 and 1960 (Unit: M.b.f.)

	General lumber	Benko lumber	Logs for ships	Others	Total
1950..	54,000	17,000	4,800	7,400	83,200
1960..	59,000	19,000	350	9,400	87,750

Demand for Benko lumber has not decreased yet, so production of Benko lumber need not be reduced. Though Benko lumber is peculiar to Obi cedars, production of Obi cedars is only one third of that of general cedars. They have an advantage in that other cedars cannot be substituted for them.



6. *Other Famous Forestry Methods*

The three famous forestry methods already mentioned, Kitayama, Yoshino, and Obi, are not outstandingly famous among many other excellent methods. They are only three among many. Several famous forestry methods, other than these three, will be explained briefly, moving from the north to the south of Japan.

Tate-tate Cutting

Tate-tate cutting is a special selection method used in an area north of Tōkyō in Fukushima prefecture. This cutting method was known from the feudal age, but became famous only in the last thirty years or so.

In the Aisu district where Tate-tate cutting is carried on, the forest land is so steep that it is difficult to walk up. The soil is fertile. Snow two or three feet deep remains from the middle of January until April. Almost all stands are broadleaved coppice. A big-scale forest owner earns his entire living from his own forest, and a small forest owner finds a means of living by charcoal production from wood he buys.

As is true of forest lands in general, the national forest occupies the upper part of the mountains, while the private forest is on the lower part. The national forest has an abundance of old beeches, but the private forest consists of young oak coppice because the villages have repeatedly cut there to produce charcoal, and because oaks have been protected as a valuable source of charcoal. There are many oaks in the stands now, but if people repeat the clear cutting practiced for the usual coppice, oaks will decrease and other miscellaneous broadleaved trees will increase. Generally speaking the ratio of oak should not exceed 20 percent in number of stems, while the coppice here contains actually more than 50 percent in total.

Tate-tate cutting means to cut stocks by careful selection and to leave oaks to some extent intentionally. Tate-tate cutting favors growth of many excellent oaks of good quality. As a whole, the quality of oak charcoal is much better than that made of other species. Because the increment of oak is much higher than that of other trees, the income will increase remarkably by this method.

Sanbu Forestry

Afforested flat lands of cedar are mingled with cultivated fields in Chiba prefecture, bordering Tōkyō.

Almost all other forest lands in Japan are steep. In contrast, the Sanbu Forestry method here is managed on flat land. The site does not fit forest management by nature. It is very windy, and humidity and soil moisture will not permit natural growth of cedar. For this reason black or red pine was planted first, and cuttings of cedar were planted later under the pine.

The old-age stand possesses the character of a selection forest and a mingled stand at the same time. It is ideal for sustained yield under proper management. Sanbu Forestry is a typical method used near villages. The alternative utilization of the same area for forest products and agricultural crops is also a remarkable characteristic of Sanbu Forestry.

Afforestation by seedlings has been practiced for a long time, but that by cuttings was begun about two hundred years ago. The present oldest stand established by cuttings is 180 or 190 years old.

Two-storied stands of pine, cedar, or cypress are one of the peculiar appearances of Sanbu Forestry. In order to maintain a good forest including stands older than a hundred years, the forest owner must have a forest area of at least 20 acres. The average area of Sanbu Forestry is larger than that in other districts.

The ratio of broadleaved forest is small here; it does not exceed 10 percent.

The forest of pure cedar, and that which consists mostly of cedar, amounts to 81 percent in area and 95 percent in growing stock; thus Sanbu Forestry is a forestry of cedar, though the type and form are unique.

In Sanbu Forestry the cutting rotation is long, and from the intent to restrict utilization and to save growing stock rather than to produce big trees for special purposes. Thus, the cutting age is not prearranged, but trees are cut because of the temporary need or economic condition of the owner. Actually the rotation is gradually becoming shorter because of price increase in small logs.

Tenryū Forestry

The Tenryū river in Nagano prefecture (central Honshū) flows two hundred miles southward into the Sea of Enshū. The mountains along both sides of the river are covered with beautiful afforested stands of cedar and cypress, and this district is the center of Tenryū Forestry, embracing about 211,000 acres.

Some three hundred years ago, imported cedar seedlings were planted in the court of a shrine. These trees are still living and are the symbol of Tenryū Forestry. After that other shrines followed with planting in the courts, and this is said to be the origin of the Tenryū Forestry. Dealings of timber took place as early as 1617 and afforestation was encouraged in 1764.

Meizen Kimbara, a famous forester, planted first an area of five thousand acres under the motto "In order to control the river, we should control the mountain." He stimulated the famous Tenryū Forestry.

The district is steep and almost fully occupied by forest land. Average annual temperature is between 54° and 61° F., and annual precipitation is 80 to 100 inches.

Though the Tenryū Forestry has no special technical feature, it is very famous. The forest area is very large, and the ratio of forest land is also high. The total area of the district amounts to 233,390 acres of which 211,000 acres, or 91 percent, is forest. The ratio of afforested area is high here, 70 percent of the forest area is covered with conifers, 94 percent artificially planted. Generally speaking, the high ratio of planted forest land indicates a high development of forestry.

With the high ratio of planting, we should not overlook the high increment of growing stock. According to investigations in 1957, the average annual increment of this district amounts to 254 cubic feet, which is a remarkable mean on such a large area. Such a high increment does not depend only upon the fortunate natural circumstances, but also on the enthusiasm of the people.

Ate (Thujopsis) Forestry in Noto

Noto is in the north end of Ishikawa prefecture, on a peninsula in central Honshū extending into the Sea of Japan. Thujopsis culture here, known as Ate Forestry, is the most intensive among forest methods concerned with *Thujopsis dolabrata.* In ancient times there were no good timbers produced in the district of Noto. But because Thujopsis grew very well there, it was planted eagerly instead of the cypress that had been used until that time. It is still not clear if Thujopsis grew there naturally or was transplanted from other districts. Anyway, Thujopsis timber was well adapted to lacquer wares. Hence the active planting of Ate was urged at the time of the feudal era, and it was extended all over the Noto peninsula.

In Ate Forestry, first of all, there is a good possibility of sustained yield for the owners of even small forests. These little forest owners are farmers, and they work in their own forests in the leisure season for farm work. They are supported by the income from timber, which is pretty high because the timber is so valuable. There are no big dealers who buy a lot of timber at once, and most buyers purchase timber according to the demands of lacquer manufacture. From this standpoint, too, the selection system is better than clear cutting on a large area. Moreover, we should not underestimate the esthetic effect of the selective method that never strips the mountain.

Though income per acre is higher in the Ate Forest than in other coniferous forests, a large-scale forest owner should not manage all of his forests with Ate Forestry, especially nowadays when the demand for Ate does not increase markedly. However, Ate Forestry is prosperous if managed on a limited basis. It should not be extended beyond the district, because, just as with Kitayama Forestry, it aims at production of a special kind of timber.

Nishikawa Forestry

An intensive forestry called Nishikawa is practiced on 55,000 acres of forest in three towns and a village in Saitama prefecture just west of Tōkyō. Its origin is ascribed to the demand for a large quantity of timber several hundred years ago in the town which preceded the present Tōkyō. The timber was mainly transported by river from the west; therefore people called it Nishikawa timber (Nishi means west and Kawa means river). This forestry method became active because of a continuous timber demand in the city, and it has remained so for three centuries. Because forest management there aims at the production of small balks and long logs with a slender top, the cutting cycle is comparatively short.

Since this forestry aims at small square timbers, attention should be given to production of straight poles without taper and with few or no knots. For this purpose the following operations are practiced vigorously.

As in other intensive forestries in Japan, weeding is repeated often, that is, 15 to 20 times throughout a generation. It is repeated another five to seven times in the national forests. This shows the intensity of the Nishikawa Forestry.

Because the late snow in February or

March contains much moisture, it is so heavy that it often damages the comparatively young stands. Hence the ability of young trees to remain upright in the snow is of greatest importance. Damage depends upon the quantity and quality of the snow each year, and it cannot be estimated precisely. At any rate people must set the trees upright to prevent loss from the snow. Mixed planting of cedar and cypress, planting in staggered rows, avoidance of dense planting, and pruning and thinning, are all said to be useful for reduction of snow damage. In addition, snow-resistant types should be chosen for future planting, in spite of limited snow there compared with regions along the Japan Sea.

The cutting cycle is short, about 30 to 35 years for cedar and 40 to 45 years for cypress. This is pretty short compared with the average of 50 and 60 years in most districts, although everywhere it gradually becomes shorter nowadays.

One of the characteristics of Nishikawa Forestry is to let some excellent trees remain after cutting most of the stand. This is done to satisfy a temporary demand for timber of big size, but it will be useful also as reserve growing stock. The number of the trees to be left should not be so great that they depress the growth of newly planted seedlings.

Cut trees are stripped and left in the forest, and after drying they are transported to the yard of a factory where they are cut into required lengths.

In order to prevent the decrease of productivity of forest soil here, the species and sort of trees, cutting cycle and method, and fertilization should be taken into consideration seriously in the future. Another important problem in the future is labor. The district is so near Tōkyō that many young men are likely to leave for the city. The average age of forest laborers in Nishikawa constantly increases. This will surely bring about a shortage of labor in the near future. A counter-measure to the departure of young men should be sought in any policy for future management.

Chizu Forestry

Chizu is located in Tottori prefecture in the southwest portion of Honshū. Here afforestation has been practised for three hundred years. About 120 to 160 years ago, there appeared some excellent pioneers, and the famous forestry system nowadays owes its development to them. A hundred years ago people were warned not to cut trees carelessly and to plant the cutover land. Just at that time a forester experimented by taking some branches which were attached to the lower part of the trunk of a naturally grown cedar and putting these cut branches into the field in order to plant them in forest land after rooting. Since then the "red seedling" has become a special symbol of the Chizu Forestry.

Conditions in this district fit the development of cedar forestry. Owing to the wind from the Japanese Sea that contains moisture, annual precipitation amounts to 80 inches. The humid climate of cloudy days is not good for the health of people, but it is surely good for the growth of cedar. Besides red seedlings, there are some other characteristics in the forestry of Chizu—for example, intensive pruning and the understory cultivation of Ooren, a raw material for medicine and dyes. This material is a good minor forest product for people there.

The weak point of the Chizu Forestry will be use of red seedlings in the future because branches for such seedlings cannot be obtained in large enough numbers to supply the expanding development and extent of the forestry system.

Tane Forestry

A famous forestry of cedar and cypress managed by the selection system is located in Tane village in Shiga prefecture, south central Honshū, not far from Kyōto.

Foresters here aimed at the production of big timber. The timber was earlier utilized for making barrels for Japanese wine, but, keeping abreast of the times, the timber is now used mainly for building material. People dare not clear cut the stand. They select only individual trees one by one, although they clear cut during the War not by intent but by order of the Army.

Selective cutting, however, is not the same as seen in a typical forest managed by selection control. Almost all owners try to select individual trees when they need cash. After selective cutting of a tree, two or three big seedlings are usually planted. Thus, the forest type will be mixed; sometimes it will be of many stories with many big trees; sometimes it looks like an even-aged forest, but a clear cut area is never seen. When people do not need cash, they do not cut. Accordingly, the growing stock is so high that the average exceeds ten thousand cubic feet per acre.

In ordinary cedar or cypress forestry, foresters usually plant seedlings two or three years old, and the length of a seedling is usually less than one foot. In Tane Forestry, seedlings six or more years old are planted with lengths over three feet. People of Tane bring seedlings up in their own fields around their houses. They take great care of the seedlings and afterwards plant them in forest land very carefully. Because it snows heavily in this district, people must raise up the seedlings flattened down by the snow. They use straw rope for that, because the seedlings might be broken off if they used wire. The technique of pruning and cutting is also remarkable. This forestry is so intensive that it will never be practiced on a big scale, even though the timber produced in such a manner could be sold at much higher prices than that produced by ordinary methods. The Tane Forestry is said to be a method of taste rather than of enterprise, but the choice the people have taken and are taking will probably remain as the best for them in the future also.

Owase Forestry

There are many descriptions of the Owase Forestry in Mie prefecture, south central Honshū, fronting on the Pacific Ocean. Owase is always quoted as an example of decrease in the productive power of soil. Considering rainfall amounting to 140 inches and steep land of 20 to 30 percent in this district, the decrease should be ascribed rather to natural conditions than to forest operations.

People plant cypress densely here. It is common sense for foresters in Japan to plant cedar on fertile land, cypress on sites of middle quality, and pine on poor sites. Every forester feels the necessity for improving production.

Among most forest districts that are located on mountains or hillsides, Owase Forestry is an exception, because people there support themselves not only by forestry but also by fishery, through proximity to the ocean. Such a circumstance is sometimes profitable, but sometimes disadvantageous for the development of forestry.

Cypress usually grows more slowly than cedar, and yet the cutting rotation in the Owase Forestry is thirty-five years as a mean, because the purpose is to produce small logs. The shorter the cutting cycle, the more frequent the reforestation. Though repeated reforestation only is not the determinative for the decrease of productive power, as already said, it is certain that such treatment accelerates the decline of soil fertility.

Hita Forestry

Hita is among several excellent and famous forestry methods on Kyūshū island. The soil here is inferior but is offset by the high temperature and precipitation amounting to 80 inches. There are also more than a hundred foggy days per year. Along with this blessed natural circumstance, the leadership of the excellent pioneers also contributed to the present development of forestry. Here there were often disagreements between small-scale farmers and forestry enthusiasts, or between conservative old men and radical young men. Without the foresight of early pioneers, the present prosperity could not have been attained. The forestry of Hita is being practiced very intensively, and a special kind of arboriculture was undertaken before the present forestry for timber production.

According to old literature, the main product of this district a hundred years ago was not timber but lesser forest products such as bark, fruits, and ferns. Only recently has timber production become so important that 70 percent of the total income derives from this source.

Foresters of this district are very aware of differences in tree varieties. What is significant for them is not merely to plant cedar, but to plant a specific kind of cedar. They know well by experience which sort should be planted in which situation.

There are still many problems to be solved in the future for Hita Forestry. Apart from the problem of the present clone complex, the even-aged single stand of cedar seems to be dangerous from the viewpoint of insects or disease. Professor Sato of Kyūshū University proposes afforestation of a "cell type" planting to surround the cedar area with a protective zone of broadleaved trees. He likens it to a cell wall. If the extent of the cell is not large, this method will be useful to prevent damage by insects, disease, fire, and so on.

Sustaining the productive power of soil will be important in the future. Hita Forestry is younger compared with other famous cedar forestry methods, and decrease of productive power is not yet appreciable. But taking into consideration the rapid growth of the stand, countermeasures for decrease of increment in the future should be prepared.

The last problem is the rationalization of wood utilization. People of this district are not only managing forests but also manufacturing various kinds of timber goods. But if timber production does not meet current requirements for manufacturing, it may happen that they will overcut forests in the future. This might endanger Hita Forestry. Intensive utilization of raw timber may be one of the measures adopted to avoid the acute decrease of growing stock.

Several famous forestries in Japan have been discussed. Besides the systems cited, there are still other remarkable intensive forestries worth explanation.

The direction these famous forestries would or should take in the future cannot be anticipated, but it is clear that timbers carefully produced in these intensively managed forests will be more than welcome in the timber market.

Almost all of the above-mentioned forestries are those of cedar or cypress. Although they are two important trees from the viewpoint of forestry, other forestry systems affecting pine and larch should not be forgotten. Because there are no remarkable pine and larch forestries in Japan, it will be enough to explain the forestries of both species briefly.

Larch Forestry

The center of larch in Japan is in Shinshū, Nagano prefecture, about in the center of Honshū, west of Tōkyō. The Japanese larch, therefore, is called sometimes Shinshū larch, though it grows in other regions too, for example, all over Hokkaidō. It has been planted in Europe

and America chiefly because of its resistance to disease.

Planted larch has increased remarkably in Japan, too, because of more rapid growth than other conifers in northerly forest lands. Recently many young larches are being attacked by shoot-blight disease.

Because knowledge of foresters about larch is not as great as about cedar, cypress, or pines, they must take special care in larch silviculture.

The larch grows naturally in regions where average temperatures and precipitation are comparatively low. But afforestation actually extends all over regions of high latitude or at high elevations. That the stands of larch are readily attacked by disease might be ascribed to the above-mentioned fact. The proper soil for larch is porous and easily penetrated; that is, sandy loam is welcome.

Larch seedlings are planted in spring or in autumn as are other conifers. The selection of season depends upon soil, climate, and labor force. When the roots of seedlings planted in autumn are pulled to the surface by frost heaving, they should be stepped on in early spring. Because of rapid growth, the number to be planted per acre is eight hundred or less in general, but on sites near the market where thinned poles are sold readily, 1,200 or more are planted. Larch does not grow well when it is replanted on clear-cut land; that is to say, the tree species should not be planted over two generations or more on the same site.

Preparation for planting should be executed carefully to prevent attacks of mice and rabbits. Among many conifers, larch is most likely to be attacked by forest animals. Shoot-blight disease and forest animals, especially mice and rabbits, are the most terrible enemies of larch. We should not overestimate larch, but we should not omit this from the best tree species because of the above-mentioned weak points at present.

The afforestation of larch, now mostly limited to the eastern and northern parts of Japan, should be examined also on comparatively high sites in other regions.

Pine Forestry

In the past, pine was regarded as an enemy of forestry, because the site where pine is naturally grown fits neither cypress nor cedar, both regarded as more important species. After the War, pine played an important role as a timber source, and it has been utilized for pulp because Japan lost one of the best sources for pulp, southern Saghalien, where there is a large quantity of fir and spruce.

While the ratio of Japanese red and black pine was 39 percent of the total amount of timber for pulp in 1946, it became 63 percent in 1955. The quantity reached 150 million cubic feet in 1955, twelve times the quantity in 1946. Accordingly the price has gradually increased, and pine has taken a place among the important trees.

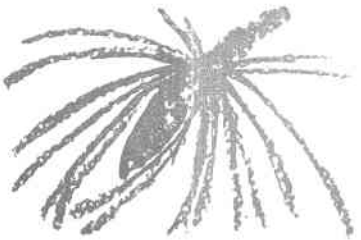
Red pine is most widely distributed. Most stands of red pine are naturally regenerated. It grows well on a poor site with very little care; hence the growing stock per acre is less than for cedar, cypress, or larch, which are artificially cultivated.

The distribution of black pine is more restricted than that of red pine. The best known stands are on both shores of southern Kyūshū. In general, red pine grows inland, black pine on the seashore. Though black pine is said to be stronger, red pine is more important for present forestry purposes. Description will be limited, therefore, to the characteristics and treatment of red pine.

Red pine demands much light for regeneration and growth. The main root penetrates deeply into the mineral soil. Side roots are associated with ectotrophic fungi. The drier the soil, the more fungi develop, and this is the very reason why red pine can grow also in poor soil. Red pine regenerates well on brown soils. On the northern slope it might suffer

from competition by shrubs and herbs; therefore, the planting of seedlings is necessary for regeneration. A clear cutting system in strips or the silvicultural system leaving seed trees here and there are the most usual methods. In these cases natural regeneration may be expected without active treatment. Recently, however, people have begun to try planting of seedlings because the timber of red pine is gaining much more attention. In this case 1,500 to 4,000 seedlings are planted per acre.

The trunk of Japanese red pine tends to curve easily. This characteristic is not so bad if the tree is used as raw material for pulp, but to overcome this natural weak point we should plant at least 1,500 seedlings per acre.



7. *Supply and Demand of Timber*

The economy of Japan has developed remarkably in recent years. Although the percentage increase is not always uniform, and the base of Japanese economy is not as firm as that of the United States, the recovery from the War's havoc and the general prosperity are rather more conspicuous than was expected. The timber market especially has become more active compared with that before the War; hence the economic situation of forest owners is now better.

The timber supply amounts to about 25,751,000 M.b.f. and demand to about 22,632,000 M.b.f. as Table 7 shows. Forest products are mostly consumed in Japan, and the increase of timber demand year by year can be seen in Table 8.

The remarkable increase in consumption

Table 7. Supply and Demand of Timber in Japan in Recent Years (Unit: M.b.f.)

Year	Supply							Demand		
	Total	Stocks at end of previous year	Production			Chip of left-over timber	Import	Total	Export	Consumption
			General raw timber	Chip timber	Total					
1936	12,619,905	2,888,787	7,972,763		7,972,763		1,758,355	9,988,727	854,179	9,134,548
1940	14,562,569	2,829,045	10,892,903		10,892,903		840,621	10,621,311	1,807,504	8,813,807
1950	13,482,559	2,650,244	10,795,029		10,795,029		37,286	11,333,551	36,862	11,296,689
1960	25,751,216	3,296,386	18,353,837	497,424	18,851,261	901,210	2,702,359	22,631,935	681,733	21,950,202

(Ringyo Tokei Yoran, 1962.)

Table 8. Increase of Timber Demand Classified by Use (Unit: M.b.f.)

Year	Total	Timber for construction	Pulp timber	Mine property	Other timber
1954	15,839,600	5,513,184	2,745,576	1,046,963	6,533,877
1960	21,950,203	8,255,371	5,389,888	1,104,162	7,200,782

(Ringyo Tokei Yoran, 1962.)

is found in the production of pulp, fiberboard, and chipboard. Substitute materials are devised and used for crating, mine props, telephone poles, and so on, and eventually timber demand seems to be somewhat stable.

Use and Assortment of Timber

Timber for construction

The increase of new building always is remarkable after a war. But what is the role of timber in construction? Dividing construction material in two, i.e., timber and nontimber, in 1960 buildings or houses made of timber were 403,946,000 square feet and those made of nontimber 246,407,000 square feet, or 61 percent timber. However, the increase in percentage is more remarkable in wood substitutes compared with that in 1959. Table 9 shows the changing trend in building material.

Table 9. Transition in Building Materials in Last Decade

Year January-June	Timber	Nontimber
	Percent	*Percent*
1952	90.0	10.0
1953	85.2	14.8
1954	83.0	17.0
1955	81.6	18.4
1956	76.6	23.4
1957	74.5	25.5
1958	72.4	27.6
1959	66.2	33.8
1960	61.1	38.9
1961	56.8	43.2

The absolute consumption of wood as building material continues to increase, and wood is indispensable also for so-called nontimber buildings, yet the transition in building materials should be noticed. Also, it should be noted that the price of land itself has shown a tremendous increase; also, that the timber price increased much more compared with other materials, which leads to the building of many-storied high buildings of nontimber. For example, the timber price became 2.2 times higher in the last decade, while iron and steel showed an increase of only 7.5 percent, and cement actually showed a decrease of 22.3 percent.

In October 1958, dwellings in Japan numbered 17,430,000. More than half were 20 years old or more; that is, they should be rebuilt or at least repaired.

Though the increasing speed of population increase gradually is falling off, the absolute number of households is still increasing by 260,000 each year. Moreover, destruction by disaster is so enormous that timber demand for dwellings will never decrease in the near future.

Pulp timber

As shown in Table 8, the most remarkable increase of timber is concerned with pulp. After losing the enormous resource of pulp timber in Saghalien by the War, Japan must now depend on Hokkaidō for fir (*Abies sachalinensis*) and spruce (*Picea jezoensis* var. *hondoensis*). Pine was scarcely used before the War, but for some time it has played the most important role in pulp production. At any rate, more than 90 percent of pulp timber was pine and less than 10 percent other conifers until 1954. In recent years, however, the price of

coniferous wood has risen because of the shortage caused by rapid development of the pulp industry. On the other hand, the price of pulp has shown a tendency to decrease; therefore, many pulp companies have begun to use hardwoods as raw material for pulp.

Thus, the ratio of coniferous wood for pulp manufacturing in 1960 decreased to 46.5 percent while it was 62.2 percent in 1959. Pine decreased to less than a third of the cedar and cypress or fir and hemlock. Instead of coniferous wood, hardwood timber will be used more and more for various kinds of pulp, although the growing stock of broadleaf trees per acre is comparatively small.

Mine props

Most mine props were pine and the ratio of consumption of mine props was nearly ten percent of the total amount of timber until 1952 or 1953. In recent years, however, the demand has decreased remarkably because of the depression of the coal industry and also because of appearance of substitutes. Although coal production in 1960 and 1961 increased compared with that in 1958 or 1959, and the mine fields became deeper, yet the demand for mine props decreased gradually.

As in the case of pulp timber, broadleaf timber is more likely to be used for props nowadays. It was only 14 percent of the supply in 1954, while it exceeded 50 percent in 1959.

Wooden ships

In 1960, half of the 97,500,000 tons of domestic shipments were carried by wooden ships. In spite of the increase of packages, the transportation charge per ton is still $2.19 by the National Railroad. Thus, it is difficult to determine the increase in construction of wooden ships in the future, although it can be expected, for instance, that the demand for Benko lumber will not decrease noticeably in the near future.

Timber for vehicles

Timber is used for railroad vehicles and for automobiles. The demand of timber for railroad vehicles differs according to the kind and type. Generally speaking, a passenger car demands 1.19 M.b.f., an electric car 0.80, an engine car 1.61, and a box car 2.71 M.b.f. of timber. The total consumption of timber for construction of new cars amounted to 26,693 M.b.f. in 1959. Besides that, timber for repairing cars amounted to 6,356 M.b.f. in 1952-53, but it decreased remarkably because of construction of steel cars in recent years.

The Bureau of the National Railroad bought much foreign timber in 1960. Its purchases included 28 percent domestic wood, 49 percent American Douglas-fir, 18 percent lauan, and 5 percent other foreign timbers.

One of the most remarkable industries in recent years in Japan is the manufacture of automobiles. A standard truck needs 1.86 M.b.f. of timber, a truck of small size 0.72, and a bus 1.53 on the average. Trucks and buses, too, will be made mostly of steel in the future. Therefore, the timber demand for the automobile industry will stay about 100,000 M.b.f. a year for the present, in spite of the tremendous development of the automobile industry.

Ties

There are two kinds of demand for ties. One is for repair and another for new track; 90 percent of timber for ties is for repair and only 10 percent is for new track.

The total length of the National Railroad in Japan is 21,735 miles. Also there are 6,213 miles of private railroad and 3,105 miles of forest railroads. The National Railroad in total has in use and must maintain about 50 million ties; private railroads about 20 million; and forest railroads about 10 million.

The durability of a tie varies according to tree species, quality of timber, situation of the railroad, and the frequency and weight of trains. Because of many curves and high humidity, durability is comparatively short in Japan. Without a preservative it is 8.2 years for chestnut, 11.4 years for cypress, 13.5 for Hiba, 5.9 for pine, 2.0 for beech, and 5.9 for elm, while with preservative 12.5 years for chestnut, 14.9 for cypress, 12.5 for pine, 13.5 for beech, and 10.1 for elm. As a mean, the

durability of a tie is between 12 and 13 years.

Taking the data of ties bought in 1960, the percentage of miscellaneous trees amounts to 42.3 percent and that of beech 34.5 percent. Compared with the data of the past, the use of pine ties has declined greatly. The most important railroad construction of today has given up use of timber as ties and will use concrete instead.

Piles

Piles are used as fundamental materials for high buildings, civil engineering, harbor engineering, and so on. They must be strongly resistant against moisture, because they are driven into the earth. Thus, larch and red and black pines in Honshū and larch, spruce, and fir in Hokkaidō are used for this purpose. According to the statistics of the Ministry of Agriculture and Forestry, the ratio of piles sold in 1960 was 71.3 percent larch, spruce, and fir; and 28.7 percent red and black pines.

The demand for piles increases in proportion with the development of engineering. Only because of a shortage in supply of domestic long piles, the use of foreign piles is increasing at present.

Electric poles

Electric poles are divided among wood, concrete, and iron materials. As the purpose of iron poles is not the same, the rival of wooden electric poles is concrete poles. At present most electric poles are wooden—16,500,000 out of a total of 17 million. Most timber poles are cedar, with some pine, spruce, and fir in Hokkaidō where cedars do not grow. The main regions of pole production are in central Kyūshū and southwestern Honshū.

Because buyers of electric poles are mostly national or prefectural bureaus, the price fluctuation is small compared with that of general timber. The price of one M.b.f. has varied between 32.8 and 39.4 dollars in recent years.

Timber for bridges

There are more bridges per mile of road in Japan than in most countries because of its topography. In principle, bridges should be made of permanent materials such as stone, concrete, or iron, but more than 30 percent of the bridges still are made of wood in Japan. It is not easy to estimate the quantity of timber consumption for bridges, but about 46,600 M.b.f. were used for bridge construction in 1960.

Timber for fixtures

Fixtures include shutters, sliding doors, lattice doors, and so forth. The quantity of timber for fixtures depends on the style and construction of houses and buildings. The total demand of timber for fixtures was estimated to be about 593,000 M.b.f. in 1960 and it exceeded the use in 1959 by 17 percent.

Species used for fixtures include among domestic trees, mainly cedar, cypress, Sawara cypress, spruce, fir, and Thujopsis. Owing to their price increment, species such as American cypress, Alaskan spruce, Noble fir, and spruce, fir, and lauan probably are being used now.

Packaging timber

It is natural that the demand for packaging timber would increase in proportion to development of the national economy. Especially the production and consumption of fruits, vegetables, and eggs, which need packaging timber for transport, has continuously increased in recent years.

The peculiarity of packing in the last decade is the enormous increase of corrugated board instead of wooden boxes. The increase of timber price accelerated this tendency, and many wooden boxes used for transport of fruits and vegetables have been replaced by corrugated board since 1960.

Further, the demand for packing was changed by the use of pallets and containers. The total is estimated to be 500,000 to a million sheets, although the number of standard sizes that fit a freight car or truck is still small. The sum of packing timber including corrugated material in 1960 amounted to 1,264,700 M.b.f., which is more than 1,695,000 M.b.f. of raw wood.

Timber for furniture

Furniture in Japan is made of wood or steel. Though many desks, chairs, and lockers are made of steel nowadays, they amount to only 10 percent of the whole furniture production and 90 percent is made of wood.

Wooden furniture is made in two styles, Japanese and western. The best chest of drawers is made of Paulownia, the next best of cinnamon. Katsura, alder, mulberry, and Paulownia are used for mirror stands and needle-cases, while oak, ash, Zelkova, mulberry, cherry, and teak are used for tea-chests of drawers.

In western style the main items manufactured are chests of drawers, sets of living-room furniture, book-shelves, desks, bureaus, chairs, and various tables. They are made mainly of hardwood timber, especially of birch, oak, ash, beech, Kalopanax, Katsura, and linden. New semihardboards and chipboards have developed the limit of use.

The furniture industry is small and 80 percent of the manufacture is privately owned. In fact, furniture often is produced by a family. Even a company is of small size. According to 1957 statistics the total amount of timber used for furniture was estimated to be 55,000 M.b.f. The ratio classified by species was 50 percent lauan, 17 percent birch, 6 percent oak, 4 percent ash, 3 percent linden, and 20 percent others; 95 percent of the furniture for export was made of birch.

Timber for pencils

Except for several factories, the pencil-making industry is small. Most of the factories have less than one hundred employees, and they are mostly contractors for several big manufacturers.

Production has increased remarkably since 1958. Material for making pencils should cut very easily. Among domestic species, ash, and linden are likely to be used in Hokkaidō, while cedar and cypress are utilized in Honshū. Besides domestic timber, incense cedar has been imported for about a quarter of century and amounted to about 4,200 M.b.f. in 1960; it comprised a fifth of the whole consumption of timber for pencils.

Wood for matches

In 1958 when the deflation policy was executed, the production of matches decreased to some extent, but already in the next year the amount of product reached 400,000 match tons. (A match ton means 60 dozen large boxes 5.5 x 7.5 x 9.5 centimeters. Each contains 10 small boxes, and a match ton therefore is the volume of 7,200 small boxes of the kind usually bought and used in Japan.)

First of all, wood for matches must be soft because it is cut in small pieces. Besides this, it should burn without smoke and soot. For this purpose *Populus sieboldii,* a kind of poplar produced in Hokkaidō, and *Pterocarya rhoifokia* are mainly used. But recently much foreign raw timber has been imported. The amount imported from the United States was 4,700 M.b.f. and that from the Soviet Union 1,200 M.b.f. in 1960. These are not small amounts; the total match-wood in this year was estimated to be 36,400 M.b.f.

8. *Trade and Price of Timber*

The price of timber recently has increased considerably as already cited. Before giving statistics concerning timber price, it should be pointed out that this price increase has brought greater timber imports. In order to stop the price increase, the federal government was forced to cut more than the normal yield of the national forest and also to import much timber.

By this policy, and also because of a slight depression in general, the price of timber began to decrease around the end of 1961 and it is fairly stable now.

Table 10. Imported Timber from Various Countries, January-September (Unit: M.b.f.)

Source	1958	1959	1960	1961
Lauan ..	1,399,667	1,792,387	1,935,757	1,750,294
U.S.S.R.	191,473	308,633	390,057	402,864
America	131,663	193,578	234,315	539,218
New Zealand (pine) ..	11,131	46,511	62,172	65,116
Others ..	28,682	75,860	80,265	117,239
Total ..	1,762,616	2,416,969	2,702,566	2,874,731

Kind and quantities of timber imported in recent years are shown in Table 10.

The import of coniferous wood from the Soviet Union, the United States, and New Zealand is extensive. Among them, imports from the United States increased especially in 1961. As the table shows, lauan timber, mainly from the Philippines, is the largest import. It was 72 percent of all imported timber in 1960 and was estimated at more than 60 percent in 1961.

The import of timber from the Soviet Union has gradually increased in proportion to the shortage of domestic timber year by year. The quantity for three years resulted from an agreement between the Soviet Union and Japan. The quantity agreed upon in 1960 was 310,000 but it was in fact 376,000 M.b.f. Further, the quantity shipped in was 600,000 to 630,000 M.b.f., in spite of the agreed quantity of 550,000 in 1961. In 1962 too, the delivered quantity exceeded the agreed quantity.

The imported timber from the Soviet Union classified by assortment and tree species is seen

in Table 11. As shown in the table, spruce and fir are in greatest quantity. It is noticeable that pulp timber and larch increased in 1961.

Table 11. TIMBER IMPORTED INTO JAPAN FROM U.S.S.R. CLASSIFIED BY ASSORTMENT AND TREE, JANUARY-SEPTEMBER (Unit: M.b.f.)

Type	1958	1959	1960	1961
Pulp timber, conifer	31,848	53,756	75,483	101,508
Pulp timber, broadleaf	.....	2,991	5,112	12,673
Spruce	35,245	59,570	50,985	29,122
Fir	91,673	132,847	191,061	175,176
Larch	27,481	46,941	61,068	68,394
Others	5,226	12,528	6,348	15,989
TOTAL	191,473	308,633	390,057	402,862

The forest resource in the far eastern region of the Soviet Union is located near Japan and the abundant growing stock is mostly conifers, so Japan is a good importing country.

American timber has two meanings in Japan. In the broad sense, timber produced in North America is called American timber, i.e., it includes, for instance, pine produced in Canada or the United States and walnut or hickory in the central United States and also mahogany produced in Mexico or Central America. Timber for common use which is substituted for Japanese wood and which is produced mainly in Alaska, British Columbia, Washington, Oregon, and California is American timber in the narrow sense.

Not many kinds of trees included in American timber actually are imported in Japan. The most important species along the northwest Pacific coast are mostly conifers, such as Douglas-fir and redwood, with the exception of a few broadleaved trees.

About twenty coniferous species are called American timber. The eight main species are cited below.

(1) Douglas-fir, *Pseudotsuga menziesii.* This tree has many names such as red fir, red spruce, and Oregon fir; in Japan it is generally known as American pine.

(2) Western redcedar, *Thuja plicata.* This tree has many names such as redcedar, canoe cedar, and western cedar; in Japan it is usually called American cedar.

(3) Port-Orford cedar, *Chamaecyparis lawsoniana.* This tree is called Oregon cedar and white cedar, and is known in Japan as cypress.

(4) Western hemlock, *Tsuga heterophylla.* This tree, with other names such as British Columbia hemlock and hemlock spruce, in Japan is called American hemlock.

(5) Alaska-cedar, *Chamaecyparis nootkatensis.* This tree has many names such as Sitka cypress, yellow cypress, and Alaska cypress, and is known in Japan as American thujopsis.

(6) Western white pine, *Pinus monticola.* This tree also is called white pine, fingercone pine, and mountain pine.

(7) Sitka spruce, *Picea sitchensis.* This tree also is called tideland spruce, western spruce, and yellow spruce.

(8) Incense-cedar, *Libocedrus decurrens.* This tree also is called white cedar, juniper, and redcedar.

The History of American Timber in Japan tells that the first timber was imported about a century ago, and the total price amounted to only about $1,000 on the average. But it is clear that in the early days American timber played a significant role. It was about 1896 or 1897 that the American timber was closed off.

About half a century ago, timber was carried as a commodity in transactions in the Fukagawa market and the oldest forestry magazine (the *Japanese Forestry Bulletin*) recorded the price of American timber monthly.

The First World War which broke out in 1914 exerted a remarkable effect on the Japanese economy. The sudden rise of freight rates made it economically impossible to import American timber and the trade ceased temporarily. In the beginning of 1916 there was no American timber in the markets of Tōkyō.

The freight before the War was $12 to $13 per thousand board feet. It became $60 in 1918, but it fell to $15 at the end of 1920. Because of the price rise of domestic timber, the development of American equipment, and foreign money gained during the War, Japan began again to import much American timber. Besides the big timbers and cants of American trees, logs of American hemlock, cypress, and cedars gradually were imported.

The truce in 1918 and the conclusion of the treaty of peace in 1919 became the changing period for importing American timber. The *History of American Timber in Japan* tells also that the import of timber has developed remarkably since 1919.

An impetus to import was a great earthquake in 1923. The Japanese National Government designated timber as one of the materials of acute demand, and itself became a buyer of American timber, importing 236,200 M.b.f. The policy probably was correct, because the domestic timber price rose rapidly because of shortage. It should be noticed that the increase of timber import also continued after that. This is shown in Table 12.

In review, here are the reasons why the import of American timber increased so rapidly.

(1) The prosperous condition resulting from the First World War accelerated the urbanization of people, causing a shortage of dwellings. Such a condition increased the demand for timber and raised timber price as a matter of course.

Production of domestic timber increased steadily, from 3,850,637 M.b.f. in 1912 to 5,255,379 in 1921, but still it did not cover the increased demand. Therefore, the national government decided to decrease the customs tariffs and this promoted the import of American timber.

(2) After the War, the freight fell suddenly—from $48.80 per M.b.f. in 1919 to $11.00 in 1924.

(3) Timber cutting along the west coast of the United States developed remarkably during the War. But after the War it brought overproduction and gave Japanese buyers a good opportunity to purchase the excessive production.

(4) The forest roads then in Japan were so poor that it was too costly to transport domestic timber to markets by rail or trucks.

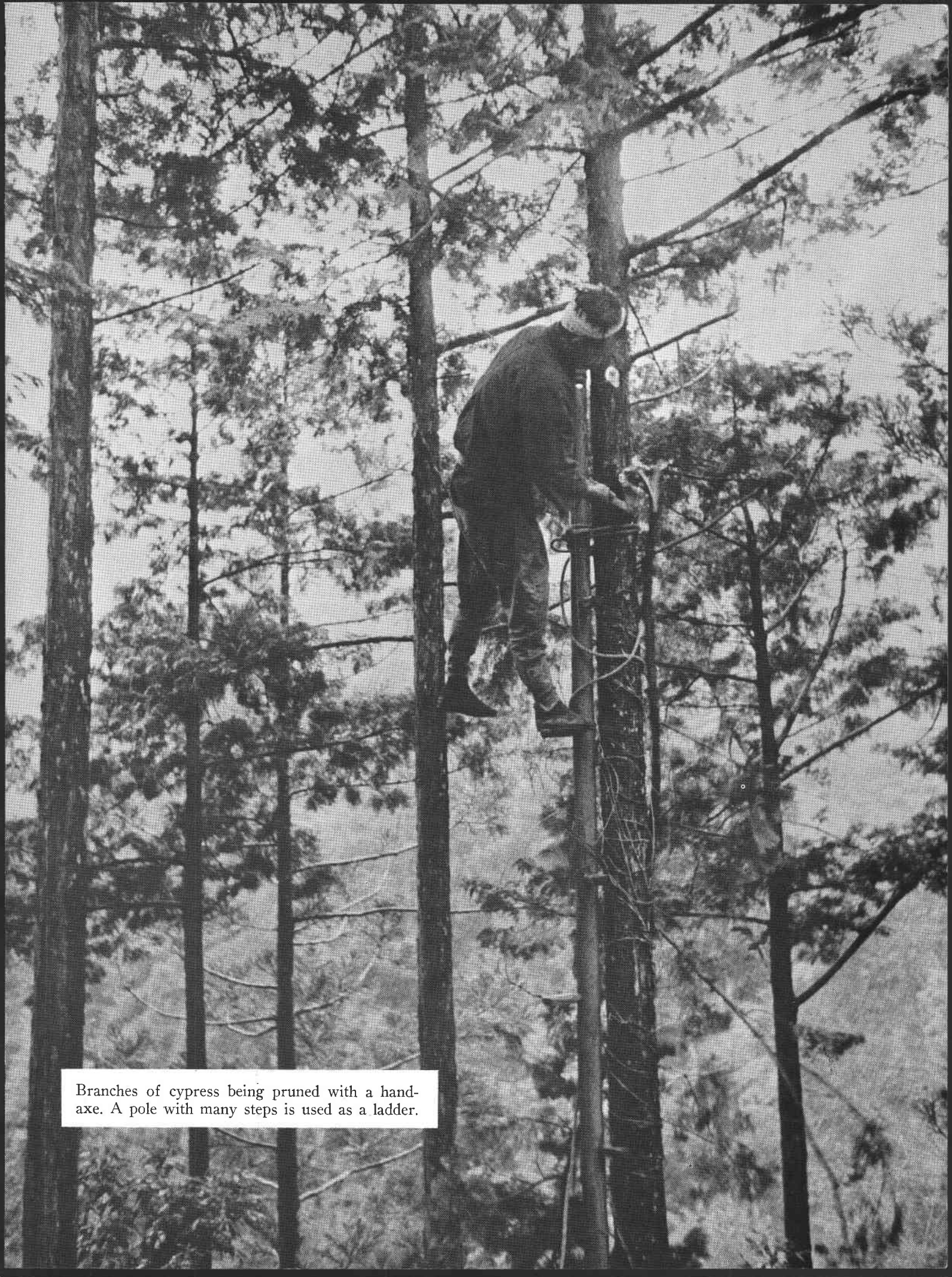
Thus, the import of American timber developed rapidly for a while. But as a matter of course, Japanese forest owners and dealers in domestic timber in the forest regions began to stand against the policy and asserted that the customs tariffs should be raised. It is easily understood that there were violent arguments on customs tariffs between dealers in domestic timber and buyers of American timber. The Japanese government raised the custom tariffs partially in 1929, so the amount of timber import in 1929 decreased by 20 percent compared with that in the preceding year.

From the emergency of July 1937, imports were restricted until 1941 when they were stopped by law to freeze Japanese funds in the United States.

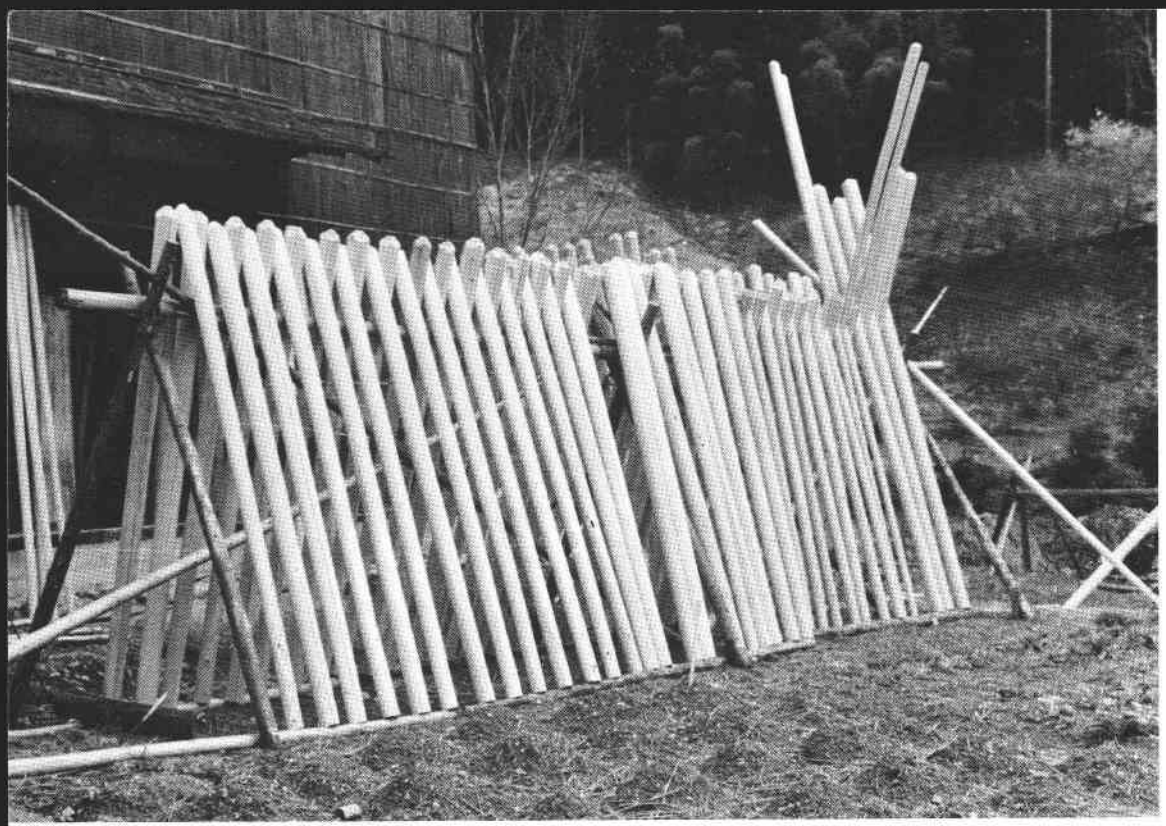
Before the timber import stopped, American timber that was strong and cheap was used widely in the whole of Japan for construction of wooden bridges, various kinds of schools, offices, hospitals, factories, warehouses, and so on.

Table 12. North American Timber Imports into Japan 1912-1926

Year	Timber from U.S.A.		Timber from Canada
	Volume	Value	Volume
	M.b.f.	*Dollars*	*M.b.f.*
1912	16,415	2,703,394	1,181
1914	10,747	1,900,766	236
1916	9,920	3,201,327	3,306
1918	46,531	20,350,000	5,196
1920	89,047	42,011,111	1,653
1922	688,050	95,488,888	37,555
1924	1,100,810	25,511,111	71,332
1926	1,194,227	81,891,666	64,600

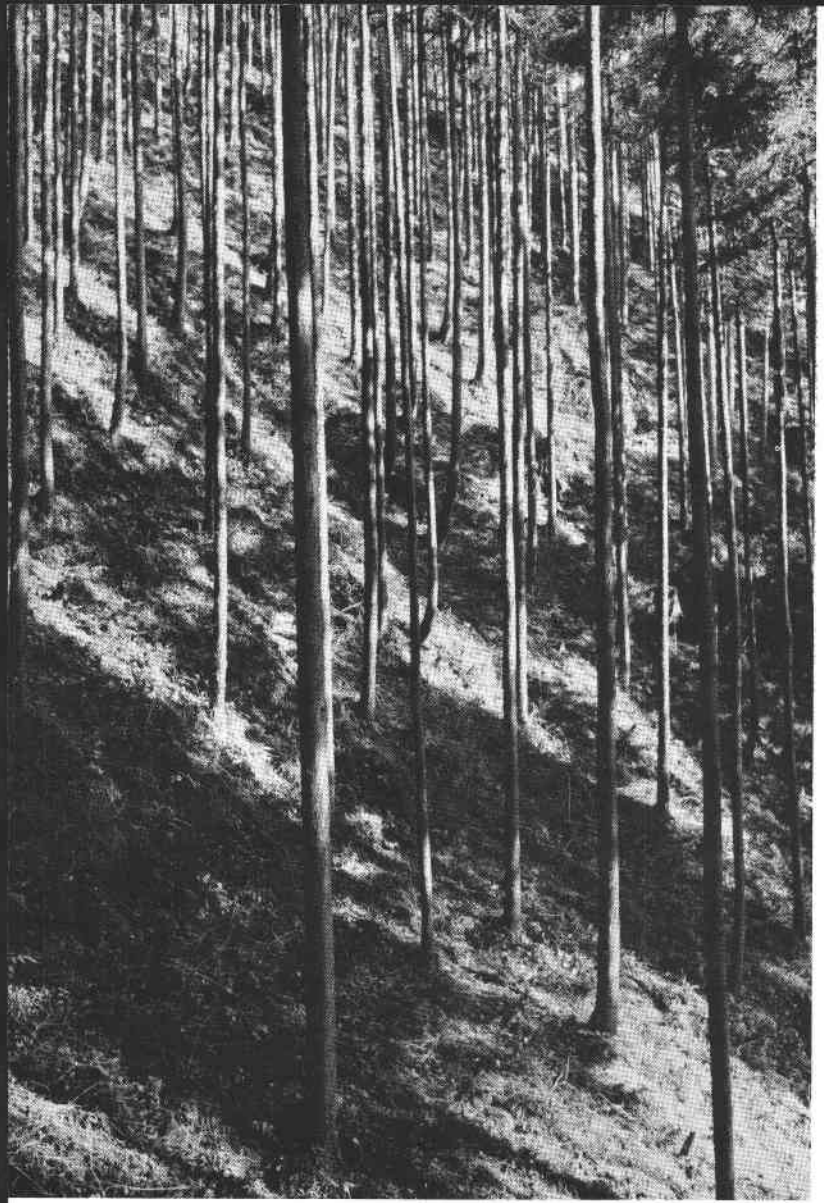


Branches of cypress being pruned with a hand-axe. A pole with many steps is used as a ladder.



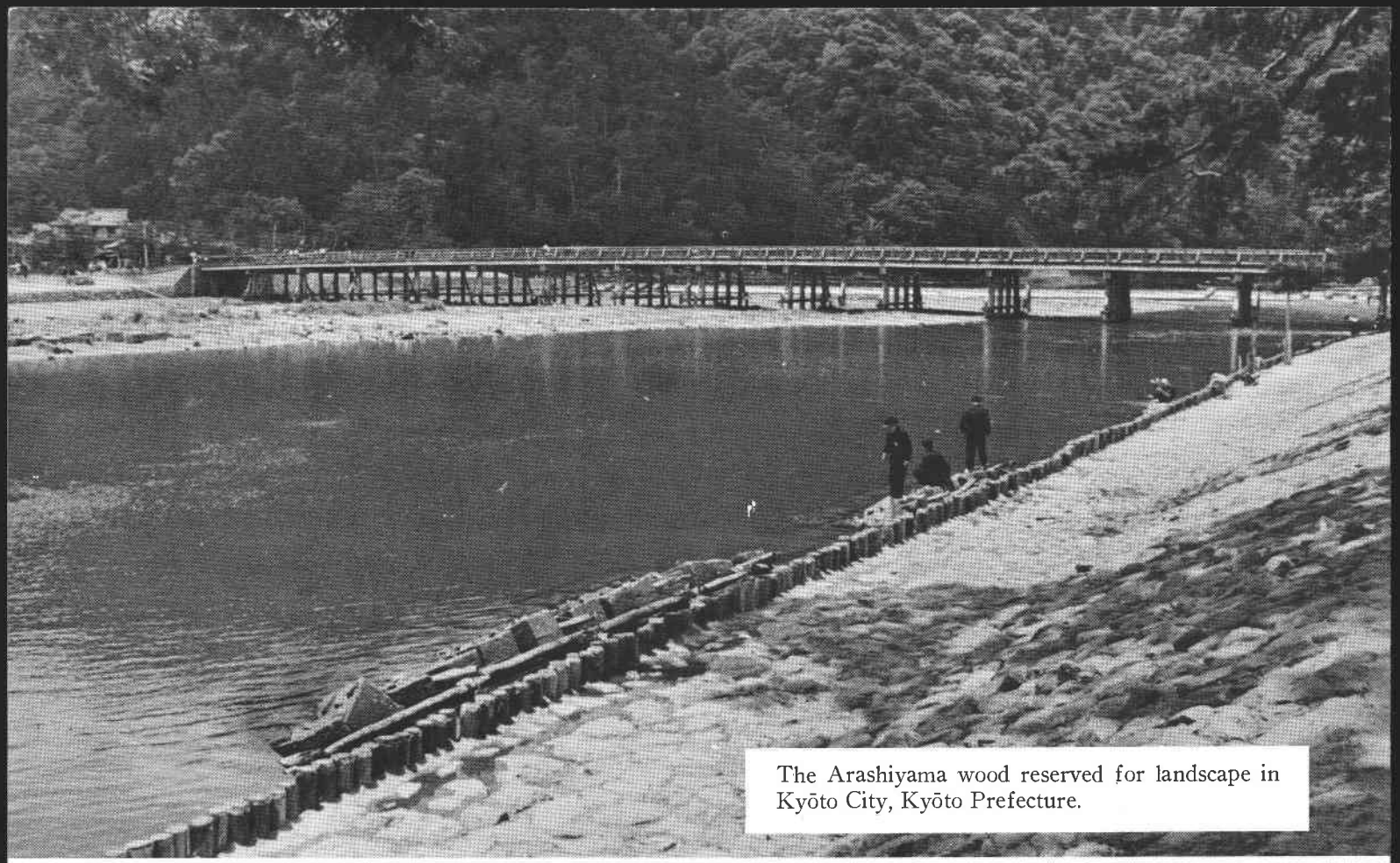
Polished poles are dried outside. Ogawa village, Nara Prefecture.

A stand in Obi, Miyazaki Prefecture (below).

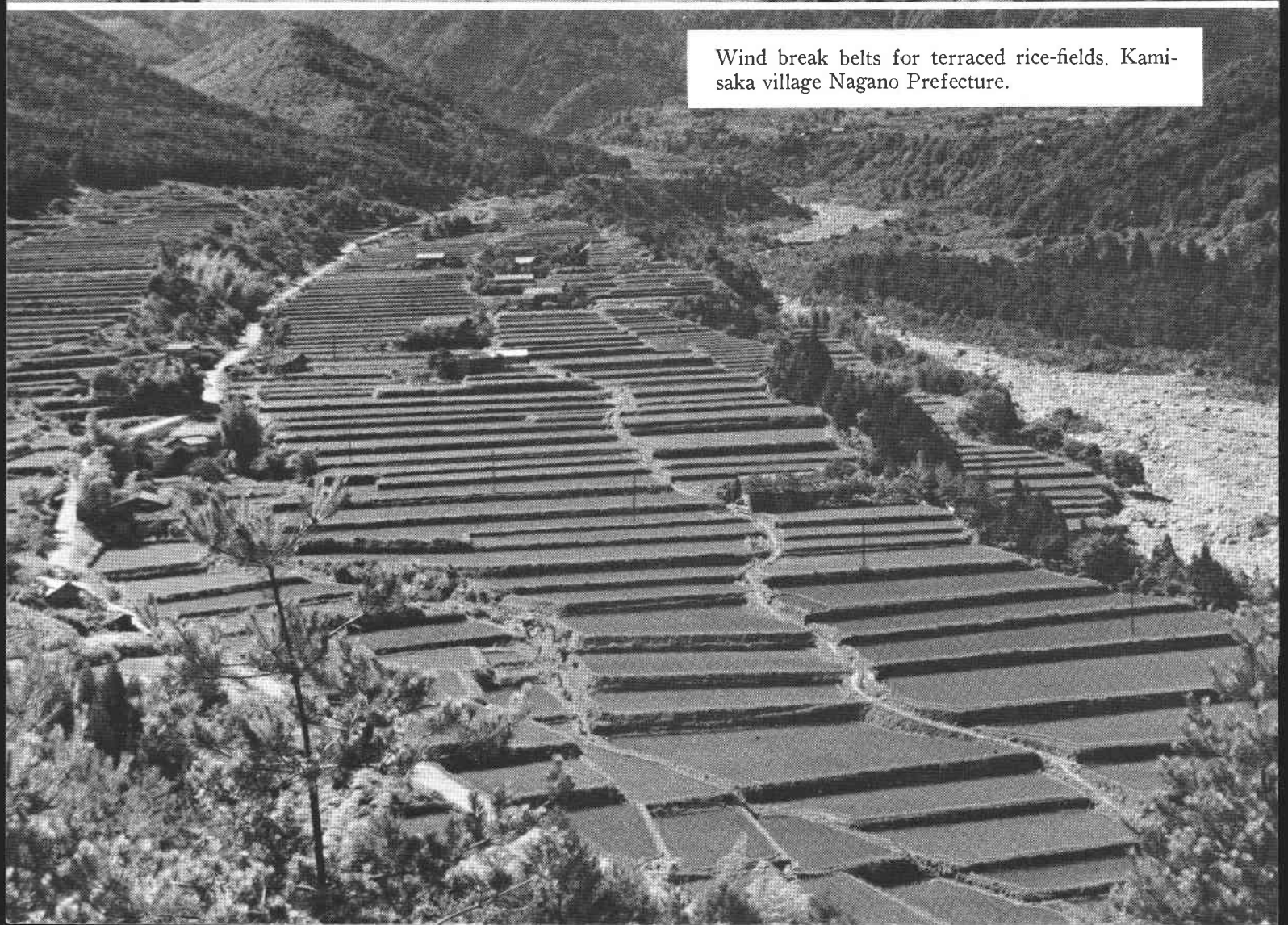


A stand of Nishikawa Forestry, Agano Village, Saitama Prefecture.

A stand in Oguni, Kumamoto Prefecture (below).



The Arashiyama wood reserved for landscape in Kyōto City, Kyōto Prefecture.



Wind break belts for terraced rice-fields. Kamisaka village Nagano Prefecture.

Among various tree species, the American pine (Douglas-fir) was used most. While balks of big and middle sized American pine were used for wooden ships and vehicles, quantities of raw logs and timbers sawed by order in the United States were imported afterwards.

After 1945, when the Second World War came to an end, Japan was under the supervision of the Occupied Forces, and importers began to try to import timber from the United States again, but in vain. It was not until February of 1948 that plank, amounting to 2,454 M.b.f., was imported in Yokohama harbor for the first time after the War. In the next year, 1949, a few balks and boards of Douglas-fir were imported by the government. It was expensive, however, compared with domestic timber; therefore, the import did not develop. When the import of timber at last was brought out from under government control and the distribution-control of timber was abandoned, January 1950, civilians re-entered the lumber buying business.

But for a while, the import did not become active because of the deflation policy and also the outbreak of the emergency in Korea. Since the latter half of 1952, import has been active. This comes surely from the fact, too, that the price of domestic timber rose, reflecting shortages, while on the contrary, the price of American timber, through lower freight rates, actually decreased. Thus, the imported timber amounted to about 118,100 M.b.f. in December 1953 and also in January 1954. After the first half of 1954, imports gradually decreased because of the depression until the second half of 1956 when domestic timber price was becoming higher and higher.

In 1957 prosperity in all industries began. Although imports were decreased in the latter part of the year because of problems associated with the balance of international economy, the total of imported timber from the United States amounted to 108,472 M.b.f., 60 percent greater than the total of the former year. The increase in 1958 was only slight, because of the tightening of monetary circulation.

About 175,420 M.b.f. were imported in 1959, more than expected. The increased demand for large timbers for metropolitan and other types of engineering, the boom in building as the result of the decision to hold the Olympic Games in Tōkyō in 1964, and enormous attention to erosion control and watershed management by the government surely contributed to the large import.

The Japanese economy made progress also in 1960, and timber import amounted to more than 200,000 M.b.f. in proportion with the development of industry in general and also by the price rise of domestic timber. In 1961 the import increased again, and the amount in July reached the maximum quantity since the War.

Table 13. Timber Imported from North America, 1949-1960

Year	From U. S. A.		From Canada		From Alaska	
	Volume	Value	Volume	Value	Volume	Value
	M.b.f.	*Dollars*	*M.b.f.*	*Dollars*	*M.b.f.*	*Dollars*
1949	5,923	747,988	.....	.....	.....	.....
1951	13,559	1,940,997	127	30,080	.....	.....
1953	122,455	9,639,816	15,253	1,231,877	.....	.....
1955	63,558	6,894,480	5,932	530,713	1,694	153,152
1957	108,472	13,657,647	10,593	1,089,286	2,966	339,872
1959	175,420	19,649,655	5,508	452,077	12,711	1,268,436
1960	207,199	24,345,647	11,440	.....	16,525	.....

Because an enormous amount of timber was imported from just the two states of Oregon and Washington, the Oregon legislature passed a bill to forbid export of timber cut from state forests. But because the United States federal government did not raise an objection to timber export to Japan, this trade probably will continue to develop in the future. Such a tendency is shown in Table 13 which gives the timber import from North America year by year.

Though the import gradually increased in general after the War, the amount does not yet reach that imported before the War. The main causes include the raising of freight rates, the increase of timber consumption in the United States, and the decrease of forest resources as a result.

The absolute growing stock in the United States is still enormous, and forests formerly remote likely will be utilized in the future as better road systems are built. Since Japan cannot expect to increase forest resources in the near future, and the United States federal government does not hesitate to export timber to Japan, it is reasonable to expect the import of timber from the United States to continue in the future.

Timber prices increased tremendously after the War. If such a trend had occurred worldwide, the rate of rise in Japan might still be the greatest. Between 1955 and 1961, the price index of wooden products advanced nearly twice as rapidly as the average price index in the same period.

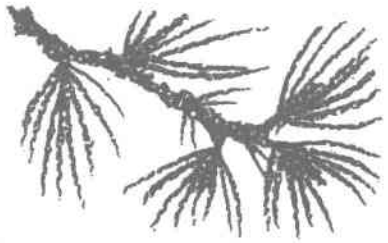
A comparison of price index for timber and price index for commodities in general, shows a remarkable change. Taking a base price for materials between 1954 and 1956 as an index, here are figures for the month of January in recent years:

	Commodities	Timber
1956	354.4	527.3
1957	373.8	490.2
1958	356.0	589.9
1959	342.6	596.3
1960	355.6	623.4
1961	361.2	726.2

In November 1961 the commodities index stood at 372.1 and the timber index at 844.2.

Since other products did not show a remarkable change of price in these several years, why did timber alone? There may be many causes, but it is clear that the supply could not cover the demand, and the supply could not be increased as rapidly as various products in factories. Moreover, the shortage of timber is a world-wide phenomenon. In order to depress the rise in timber costs, the government decided to undertake the supplemental cutting of 280 million cubic feet in national forests and 140 million cubic feet in private forests in 1960 and 1961, and also to increase imports of foreign timber. Thus, the timber price, which seemed to rise continuously, has at last shown a tendency rather to decrease, and it is quite stable now.

A noticeable characteristic of timber price in recent years is the inversion in price of middle-sized and small-sized logs. That is, the middle-sized log that was higher than the small-sized log by 7.3 percent in 1955, became cheaper than the latter by 0.6 percent in 1961. Whether such a tendency is temporary or will be continued for a long time cannot be guessed certainly, but naturally it must have an effect on the silviculture and management of forests.



9. *Forest Policy and Administration*

The forest policy of a state reflects its forestry development. In Japan there was an epoch-making union of forest policy in 1947. Before then, public forests belonged separately to three organizations. Most were inland national forests administered by the Department of Forestry, Ministry of Agriculture and Forestry. The national forest in Hokkaidō was administered by the Ministry of Inner Affairs. The last forest property was that of the Imperial House, administered by the Household Department. Though the forest of the Emperor was not large in area, its content was splendid.

The three agencies were united as the "National Forest" in 1947 and are now administered by the Forestry Agency, Ministry of Agriculture and Forestry. Thus the center of the forest policy in Japan is the Forest Agency. The agency deals with the forest policy of privately owned forests besides the management of the National Forest itself. The organization chart of the Forest Agency is summarized on page 52.

Forest Management

The management of national forests is indicated by the Operative Division. Fourteen regional forestry offices throughout the country make the actual plans. They do not seem to be located homogeneously. That is, they center in Hokkaidō and the Tōhoku region (northern Honshū), but few are in the western part of Japan. However, the ratio of national forest in the northeastern part of Japan is high, and thus the distribution of regional forestry offices is rational.

The practical offices for management of the national forest are the district forestry offices numbering 340. One regional forestry office may administer 14 or 15 district forestry offices and another may administer about 50. In extent the regional offices manage from 400,000 acres to 2,200,000 acres. Several ranger stations are in a district forestry office and they supervise national forests.

The Guidance Division aims at the supervision, guidance, and aid of private forests in-

MINISTRY OF AGRICULTURE AND FORESTRY

FORESTRY AGENCY

Forestry Administration Division	Guidance Division	Operative Division
Forestry Administration Section	*Planning Section*	*Operative Section*
Forest Owners Association Section	*Reforestation and Protection Section*	*Accounting Section*
Welfare Section	*Erosion Control Section*	*Audit Section*
Labor Section	*Research and Extension Section*	
Personnel Section		
Forest Products Section		

cluding forests of companies and shrines and temples and public forests other than the national forests. In the lower organization, the Forestry Division or Forestry Section of a prefecture is controlled to some extent by the Guidance Division of the Forestry Agency. The head of a prefectural government is president, and all divisions and sections there are officially ruled by him. But in fact, forestry policy and operation are in the hands of the chief of the Forestry Division or Forestry Section. Because these divisions or sections of prefectures adhere closely to the Guidance Division of the Forestry Agency through subsidy and other financial conditions, the supervision, guidance, and aid of private forests by the prefecture is closely connected not only with the prefecture but also with the Guidance Division. Besides private forests, the Forestry Division or Forestry Section of the prefecture sometimes deals with the forest belonging to the prefecture itself. Nevertheless, the most important task for the Forestry Division or Forestry Section of a prefecture must be supervision, guidance, and aid for the private forests of its territory.

Management of the national forest is planned and practiced by forestry specialists and the commanding system is united. Management of private forests varies according to the extent, kind, and value of the stand, and other situations of the owner. Management of some private forests is very intensive, exceeding that of the national forests from the technical viewpoint, but their number is small. Most private forests are managed extensively, and forestry technique there is on a low level.

Supervision and guidance should be practiced for extensively managed private forests. The present policy concerning supervision, guidance, and aid of forestry in Japan is based on the belief that in a democratic society, the freedom of a person should be respected and the property of a civilian should be protected. This principle must, however, premise no hazard to the public welfare.

As we know, there are effects and results of forest practices other than a profitable yield. We call them in general "indirect effects." It is true that the forest owner should not manage his own forest without due regard to the public welfare as influenced by these indirect effects.

In most cases the beneficial treatment by the owner also will be useful to the public. That is, when forest management aims at sustained yield and is intensive, it will not damage the public welfare. But it might happen rarely that an irresponsible forest owner devastates his forest without considering the public welfare.

Especially when a forest owner is forced to find sudden and unexpected financial aid from his forest products, his forest often will be devastated whether or not he knows that such management will cause losses in the future. If overcutting on steep slopes on large areas causes tremendous damage to public good, the freedom to cut his own forest should be restricted somewhat. This is the reason why the supervision of private forests is indispensable. The method of supervision for private forests has varied greatly. In the period when ownership was not firm, supervision was strict, but it has been loosened in the constitutional state. It must be said that actual supervision is stricter for publicly owned forests than for purely private forests.

The forest law until 1939 ordered the owner to make a forest management plan, and after acknowledgment by the supervising forestry division the plan was permitted to be put into practice. For private forests in general the management was to be checked only in cases where the forest land might be devastated. In fact, however, the purely private forest was left to take its own course. More direct supervision followed after the amendment of the forest law in 1939. But since then, too, it has been a rule that an owner need not always obey the law if he cuts his forest solely for his own household use.

Although the motive was not the same in and after the War, overcutting has surely devastated the forest in Japan. Especially the private forests located near towns were overcut. In compensation for overcutting, and for the safety of the nation's land, a great extension of silviculture has been urged, and a temporary law for planting on forest land was enacted in 1950.

A new forest law in 1951 provided that private owners should submit to the Forestry Department a new management plan for their operations. Approval of the plan provided control by the department instead of direct supervision. These forest plans should aim at sustained yield, development of productive power, and the preservation of land. For sustained yield, cutting should be restricted and a minimum amount of planting must be provided. For the development of forest production the clear cutting of young stands should be prohibited, tending and thinning must be practiced, and forest roads must be developed. For the preservation of forest land, the treatment of protected forests must be taken into consideration.

The object of forest planning is not only for privately owned forests but also for national forests. In fact, however, stress is put on private forests because often they will be managed without care if there is no prescription.

In ordinary forests, except reserve forests, the owner may cut his own timber only by making a report when the stand reaches the age to be cut; but if the stand is under the age, he must first get permission to make the cut. The age to be cut is determined by the Forestry Division of the prefecture according to tree species and district condition.

Reserve forests

Considering that Japanese forestry is being managed generally on quite steep slopes, clear cutting over large areas seems to be dangerous in most cases. Forest lands that seem especially easy to damage, and hence important to public welfare, are designated as reserve forests by the Forest Agency through the report of the Forestry Division or Forestry Section of the prefecture.

Japanese forest law divides reserve forests into seventeen kinds—for preservation of land, erosion control, scenery, public health, water resource, timber for ships, and so forth. In these reserve forests, the owner should not cut his own trees, graze domestic animals, or cultivate land without permission of the president of the prefecture. Moreover, the minister for agriculture and forestry sometimes designates the method of forest management or protection.

Now, the reserve forest is divided into two kinds according to the grades of restriction, i.e., strictly reserve forest and ordinary reserve

forest. The former is less numerous than the latter.

When the designated forest is privately owned, the prefecture or nation may restrain the freedom of the forest owner. In a democratic nation, the federal or prefectural government must compensate for that. What is difficult is the fair valuation, because no two forests are the same and the government is not always rich enough to compensate forest owners equitably. In fact, forest owners sometimes complain. From this point of view, it is desirable that forests which should be reserved be national forests, and this is the reason why the Forestry Agency is striving to buy privately owned forests. Of course, the government cannot force the owner to sell, but if the owner of the reserve forest does not obey the law and cuts trees without permission, the Forestry Agency may buy the forest by coercive measure.

In the ordinary forest, too, as already mentioned, the cutting of young stands is restrained by forest law. In this case, the government lends to the owner the estimated amount for young stands at a low rate of interest in compensation for the restraint of cutting.

This is the present state. But the forest law will be revised again in the near future, and in the coming law, loaning will be unnecessary because the restriction will be abolished in ordinary forests. Silviculture has been developed remarkably in the last decade, and the economic situation of the forest owner has been improved much by the value increase of standing timber. Besides the abolition of cutting restrictions, the new forest law aims at a change in the system of forest plan, administration, and application on reserve forests. The change in system of forest plans especially is concerned with the policy of the federal government.

The managing plan for privately owned forests will be reconsidered and the forest law of 1951 will be corrected again in the near future.

As already mentioned, the temporary law for planting was enacted in 1950. But the government must give aid for enforcing planting. In fact when the owner of small forests carries out planting, he is privileged to get a subsidy of 30 percent of the required expense from the federal government and 10 percent from the prefectural government. Because of difficulty in estimating the required expense, the owner actually accepts nearly the same subsidy per acre, but it cannot be denied that the planting has been much encouraged by such subsidy. The total of this subsidy amounts to 80 percent of the forestry budget of the government.

An owner of a large forest is privileged to get a long-term loan at low interest. The reforestation loan to the owner of less than 12 acres is at an annual interest of 4.5 percent. This percentage is very low for Japan where interest usually is much higher than in other countries.

The subsidy for compensation of cutting will be abolished, but that for road establishment will continue and even will be increased in the future.

Forestry Extension Service

Another way of helping owners of private forests is the forestry extension service started in 1959 under the federal and prefectural government. The aim of the service is to help villagers to become capable of thinking for themselves and to undertake proper activities in forest treatment on their own initiative.

Extension activity is divided into two kinds. One uses personal contact, with the village agent inspecting the forest area in his charge and thus keeping in close touch directly with forest owners and others interested in forestry; the other uses an indirect method, with the agent distributing material for the extension efforts which the prefectural government carries on through mass communication media.

As for kinds of extension service, activity relating to reforestation such as nursery practice, planting, and tending is remarkable. On the contrary, such services as forestry machinery, timber processing, and wood chemistry are not active because such services require rather high skill and equipment.

The government extension service consists of a forestry course on the air, a monthly publication, *New Knowledge on Forestry,* other publications, supply of news sources and information to the press throughout the country, and distribution of movie films and slides on forestry.

On the prefectural level, periodicals and other publications on forestry are issued, and forestry activity is stressed through local press, broadcasting, movies, or slides.

Then for the improvement and modernization of rural communities, promotion of group activity by youth is essential. In the forestry extension service, efforts are made for promotion and instruction. Study groups independently select the proper projects for their local conditions and continue their study and work.

10. *Forest Education and Research*

Forestry education is entrusted to the universities, two-year colleges, and senior vocational middle schools.

One of the most remarkable revolutions after the War in Japan is in the educational system. For comparison, the educational system in general before the War must be outlined.

Prior to the War, compulsory education was carried out in the primary school for six years. This system was established firmly so early that even thirty-five years ago there were scarcely any unlettered people.

After completion of the course, about one-third or one-fourth of the students advanced to the middle school of five years. In most of the middle schools, general education subjects were given. Besides these ordinary middle schools there were a few vocational schools, such as middle schools for agriculture, forestry, technology, and business or commerce. Some middle schools were for boys only and others for girls only. A remarkable difference between the status before and after the War is that in the past a middle school had a course of five years and it was limited to boys or girls who passed the entrance examination, while at present it has only three years but is a compulsory course; and except in special schools, boys and girls learn together. No examination is now required to be a pupil.

In the past a pupil who completed the five-year or rarely four-year course was required to pass a difficult entrance examination to go to high school (senior middle school) where the term was three years. After graduating from the high school, the pupil was qualified to be a student of a university. The entrance examination was allocated among graduates from the high schools if their number exceeded the seating capacity of a department of the university, but so far as forestry was concerned almost all graduates could enter any university they wished.

Besides ordinary high schools where natural and social science were taught in detail, there were vocational high schools, too. The pupil who graduated from the ordinary middle schools or from the vocational middle schools could be a pupil of a vocational high

school after passing the entrance examination. After the War, the obligatory term was lengthened from six to nine years. To be a pupil of a high school, the student must pass an entrance examination at present, too, but it is far easier than examinations before the War. By contrast, the entrance examination of some universities is now difficult.

Some vocational middle schools and some institutions which were vocational colleges before the War have become universities, and the number of present universities supported by the federal government is about 70, or 10 times the number of those before the War. The main cause is the increase of would-be university students, especially girl students.

Forestry Education

In the old system, Japan had departments of forestry in four of seven universities, Hokkaidō, Tōkyō, Kyōto, and Kyūshū. In Japan, the Department of Forestry has always been one division of the faculty of agriculture.

Besides these departments of Imperial universities, there were seven national colleges of agriculture which contained departments of forestry. There were also vocational middle schools of forestry supported by prefectural governments in forest lands.

After the War, according to the suggestion of the Supreme Commander of the Allied Powers, the Japanese educational system was revised and separated colleges joined and developed into universities. Thus, there are now 20 universities provided with forestry departments under the federal government, 2 under prefectural government, and 2 private, totaling 24. The course content of many universities is now being improved, and departments of forestry of the four former Imperial universities which have graduate courses are comparatively excellent in all respects.

The four universities mentioned are supported by the Japanese federal government, in contrast to universities in the United States where schools of forestry are either state or privately supported. Thus, it is comprehensible that there are remarkable differences concerning aims and formation of forestry education patterns among various American universities. Although curriculum, for instance, is entrusted to each university in Japan too, it is actually quite similar, even down to individual units given in Japanese universities. Curricula and units concerning forestry are nearly the same, not only in these four federal universities but also in all twenty-four universities that have forestry.

Kyōto Forestry Department

It will be enough, therefore, to describe the status of the Department of Forestry of Kyōto to illustrate the present status of forestry education in Japan.

The Kyōto Department of Forestry program extends over four years with eight semesters. Freshmen and sophomores take chiefly such fundamental courses as differential calculus, chemistry, physics, botany, and geology in detail; and philosophy, aesthetics, logic, psychology, literature, German or French, and English, and so on.

Besides fundamental courses, sophomores take general agriculture and applied meteorology as professional subjects. Students have much to learn in junior and senior courses. In fact, in the newly established universities several professional courses, such as forest botany and forest mensuration also are taught to sophomores.

The first semester in Japanese universities begins at the beginning of April and ends at the beginning of October. The second semester continues from the middle of October until the beginning of March. Examination is held after each semester. Compared with the system of schools in the United States, the number of examinations is very low. To help students gain knowledge, the American system probably would be better.

The kind of courses given in the third and fourth years are listed below. Curriculum for general forestry students, courses and units, 1962: forest ecology 4, silviculture 2, forest

protection 2, forest management 4, forest mensuration 2, forest policy 4, forest law 2, soil science and fertilizer 2, surveying (Part I) 2, surveying (Part II) 2, forest geology (Part I) 2, forest geology (Part II) 2, landscape gardening 2, erosion control 4, forest engineering 2, engineering of wood transportation 2, wood physics (Part I) 2, wood manufacturing (Part I) 2, forest products chemistry 4, practice in general forestry 2, practice in dendrology 1, experiment in wood histology 2, practice in surveying (I) 1, practice in surveying (II) 1, practice in forest geology 2, seminar on foreign forestry 2, exercises or experiments for special subjects 2, graduation thesis 5.

Curriculum for wood technology students, courses and units, 1962: wood physics (I) 2, wood physics (II) 2, wood manufacturing (I) 2, wood manufacturing (II) 4, technology for improved wood 4, wood machinery 4, wood histology 2, forest products chemistry 4, forest management 4, forest policy 4, forest ecology 4, erosion control 4, engineering of wood transportation 2, landscape gardening 2, practice in wood physics 1, practice in wood manufacturing (I) 1, practice in wood manufacturing (II) 1, exercise in wood factory 1, practice in wood machinery 1, practice in general forestry 1, practice in dendrology 1, experiment in wood histology 2, seminar of foreign forestry 2, exercises for special subjects 2, graduation thesis 5.

In both departments 84 units are required for graduation.

Thirty-five students admitted to the Department of Forestry will be divided into two curricula, that is, general forestry and wood technology, before promotion to the third year. They are divided usually in the ratio of 2:1. Students in these two curricula must write a graduation thesis under the leadership of the professor, assistant professor, and assistants of the institute. This is the reason why few subjects are required in the fourth year.

The Department of Forestry in Kyōto University has six chairs: silviculture, forest management, wood physics, landscape gardening, erosion control, and engineering of wood transportation. Forest policy is attached to the Department of Agriculture and Forestry and forest products chemistry is attached to the Department of Agricultural Chemistry. Also four chairs in the wood research institute support education in the wood technology curriculum. Besides these, other chairs in the faculty of agriculture and other faculties of Kyōto University help to complete the instruction. Each chair has its fixed number of instructors, that is, one professor, one assistant professor, two assistants, and half a lecturer (an exclusive lecturer for two chairs). Concerning curricula and organization, there are only small differences between the four major universities, though the status of forestry in newly established universities is still poor in some ways.

Students who have completed the determined units and passed the oral examination for the graduation thesis are qualified to graduate and they get the bachelor's degree. They and graduates of other universities, too, can become graduate students after passing entrance examinations again. The fixed number is two per chair for the master's course and one for the doctor's course. A graduate student is qualified to be a master when he gets 30 units in two years and writes a graduation thesis. He will be qualified to be a doctor when he gets 50 units (including 30 units of the master course) and completes a dissertation. Actually, most graduate students get a master's degree after two years, but only a few get a doctor's degree after five years. The Universities of Hokkaidō, Tōkyō, Kyōto, and Kyūshū have graduate courses leading to both master's and doctor's degrees.

The two-year college constitutes in itself a complete educational institute. The number of these colleges is not great. They give graduates of senior middle schools (high schools) a higher education with special vocational emphasis, helping to develop them into useful members of society.

The number of the senior middle schools giving forestry education is 86, and the aim there is to train people who will work eagerly on programs based upon scientific knowledge.

Graduates from the departments of forestry in colleges or senior vocational middle schools mainly will become federal and prefectural government forestry officials, forest researchers, or employees of pulp or timber manufacturing companies. Graduates of master's and doctor's courses mainly become research specialists or instructors.

Besides these regular schools there is a forestry training institute conducted by the Forestry Agency. This institute was established in 1952 as an organization attached to the Forestry Agency for in-service training of its members and employees of regional and district forestry offices. These trainees are then sent to special universities, research institutes, or the governmental training institute, to acquire particular knowledge and skills.

Also, forestry education is given in forestry educational institutes established and operated in each prefecture. Most of these institutes are in the forest experiment or forestry training stations. Such prefectural institutes are devoted to the training of forestry technical aides in the employ of the prefecture or technical experts in the employ of private companies. They are similar to the ranger school programs of the United States.

Research

Connected with education, the status of research is important for developing forestry. The institutes devoted to research in forestry are laboratories attached to the departments of forestry of universities, the governmental forest experiment station, and prefectural and private research institutes. While forest laboratories attached to universities inquire into scientific principles and study basic problems, the government forest research institutes depend on the objectives of the research conducted.

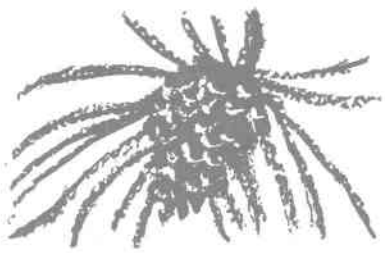
In some schools of forestry and forest experiment stations in the United States a decade ago stress was placed on education rather than on research. In Japan, at least before the War, great importance was laid on research. At present, education and research are equally esteemed, yet many fundamental research projects are carried out in university forest laboratories though the facilities and budget there are poorer than in other research institutes.

The governmental forest experiment station has its headquarters in Tōkyō, and it has six branch stations and three sub-branch stations throughout Japan. At the headquarters overall experiments and research throughout the country are the main pursuits, while the branch stations emphasize local experiments. Because experiments concerning wood technology and chemistry are of a common character, the branch stations do not touch them. This is also the case in the United States, that is, such experiments are being pursued *en bloc* in the forest products laboratory in Madison, while experiments for silviculture, forest management, forest protection, and so on are conducted in various regions.

Governmental forest experiment stations carry on their technical work in these divisions: forest management, silviculture, forest protection, forest influences, forest chemistry, wood technology, and soil survey.

Besides the stations supported by the federal government, there are also thirty-eight prefectural forest experiment stations or training institutes where forest research and technical instruction applicable to local conditions are undertaken.

Private research institutes are few, but, for example, some pulp company tree breeding institutes are vigorously conducting research.



11. *The Forest as a Background of Japanese Culture*

Wood was an obstruction in old times, as it is even today in some places in advanced nations. The ratio of forest land in the whole area of a country and the condition of the forest are, however, barometers indicating the culture of countries today.

The major purpose of the forest is the production of timber—especially from our viewpoint. But besides timber production, other important values come from the forest. Generally speaking, a reserve forest in Japan is essentially designated because it provides one or more of these values.

The forest influence on the preservation of land, supply of water, erosion control, and so on should be highly appreciated. It would be proper, therefore, to explain here the esthetic value of the forest—a factor that interests all people.

In Japan, the esthetic value of the forest sometimes has been considered to be adverse to the economy. This is not necessarily true in all cases. As an example, from olden times Arashiyama has been an especially famous scenic area among many other beautiful areas in Kyōto. The chief feature of the landscape there is the beautiful Oigawa River and its bordering hills covered with pines, cherries, maples, and other broadleaf trees. In spite of the small area, only amounting to about 150 acres, the beauty of the wood is remarkable. Without this magnificent stand, Arashiyama could not be a scenic place. Granted, the same wood is important economically, too.

Careful investigations have compared the possible timber income with the possible recreation income due to the scenery. The value of the annual wood increment on this old forest is $543.24. Because Kyōto is the home of Japanese culture, some 12 million people come here annually, and nearly 4 million visit Arashiyama. They bring to the hotels, cafes, and shops serving this famous area from $1.3 to $2.1 million a year. Of course this is a vastly greater income than is currently available from timber harvest. Even if the old forest were cut and

a vigorous young forest produced in its place, it is estimated that the timber income per year would not exceed six thousand dollars.

The wood of Arashiyama is a national forest, and no one can suppose that it might be cut. From the previous data we can see easily how important it is to keep this wood, not only as a reserve forest for beauty and recreation but also for its contribution to the local economy.

This example proves the superiority of maintaining for its esthetic value a highly popular forest area in a densely populated region. It is not only a scenic element but it has great economic value. However, there might be a contrary case where it would be better economically to utilize the forest for timber production, although possible alternative uses seemed important. Even in this case we should not decide at once to utilize the forest for timber production because it is economically more profitable. First there must be investigation to determine clearly all the values involved. In the case of Arashiyama, there is no scope for further argument; esthetic use is better than commercial use. Arashiyama might be a special example, but the role of the forest in the landscape is always significant to some degree.

Japan has 20 national parks, 19 quasi-national parks, and nearly 200 prefectural parks. The national parks or quasi-national parks are large. On an average, 68 percent of the area is national forest and 77 percent is forest land. For the Aso national park in Japan, as for the Grand Canyon national park in the United States, the forest is not indispensable; but these are exceptions. At least in other national parks in Japan, the forest is one of the most important elements. Forest features vary according to the location and environment of each national park, and the characteristic features of the woods make a strong impression on visitors. As a whole the value of any forested park is so obvious that the cutting of trees is restricted and even strictly prohibited in special sites by law.

For the protection of national beauty, the collaboration of the National Park Division of the Ministry of Welfare and the Forestry Agency of the Ministry of Agriculture is exceedingly important. The management of reserve forests for scenic values must be varied from that of the general economic forest. The importance of a reserve forest for landscape use is greatest in natural parks, including national and quasi-national parks, but apart from such parks, the role of timber stands as a background of culture is important.

A brief description should be given of the role of trees in the culture which is peculiar to Japan. Since olden times the people have dedicated shrines to calm the soul of a god or a great man. The original shrine was a deep forest, later the yard of a shrine was surrounded by a wooded area, and much later a special building was constructed as the sacred place. In early Japanese literature a symbol meaning shrine is pronounced wood; there are scarcely any shrines, even in the cities, today without a wood; almost all enormous alders or cypresses designated as national monuments are in the court yards of shrines. Woods are often attached to temples, too. The role of trees was always important in cemeteries and always is seen in the tombs of Emperors and aristocrats.

Next consider roadside trees. They antedate boulevards in modern cities. People planted roadside trees as far back as the early 1600's. They were useful mostly for a guide, to give shelter in summer, and for landscape value, rather than for timber production.

The country people also show a great attachment to trees. They frequently plant trees around their farmhouses for protection against sun, sand, waves, and fog, besides planting them to form windbreaks. Thinned trees are used as building timber and can be sold to help in any financial stringency of the household.

Many more examples show an intimate relationship between the forest and culture.

Centuries ago castles frequently were established in existing woods in Japan as well as in European countries. The castles of Fontainebleau and Versailles in France are good

examples. In Japan, however, woods were artificially established around the castles for various purposes. The most famous is the present residence of the Emperor. Many old pines grow there and make the residence magnificent.

Intimate relationships between woods and hunting are found everywhere. Especially in Germany they are intimately connected, as is well illustrated in the name of the well-known journal *Forst-und Jagdzeitung,* although there is scarcely any description of hunting in it nowadays.

A forest or wood has been used sometimes as the central background theme in literature, pictures, and music since olden times in Japan as well as in Europe and America. One wood is carefully preserved in Japan because of its place in a famous play.

To symbolize dignity and privacy, a forest is indispensable. Although it is a recent tendency for forests to be utilized for active recreation, they have been intimately connected with Japanese culture since the oldest times. Foresters are apt to think only of timber production by the word "forest," but they should not forget other important roles of the forest besides timber production.