

JAPAN'S FORESTS.

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During June and July, 1947, the writer was fortunate enough to obtain one month's leave from Occupational Army duties and carry out a limited tour of some of Japan's forests and allied industries. Permission for this venture had originated from the N.Z. State Forest Service through Army Headquarters. There were many administrative difficulties to be overcome and the matter of procuring interpreters and translators was no easy one. Travel facilities in occupied Japan are very restricted and allied military controls make such a tour very arduous. Had such factors been easier, a longer and more profitable time could have been spent over all Japan.

This article is concerned with a description of the forests and timber industries visited together with impressions of what was seen. But firstly two paragraphs are included to give some idea of Japan's geography and her general forestry position to-day.

1. Geography.

Japan proper consists of four islands lying between latitudes 30° and 46° N. and longitudes 129° and 146° E. The most northern of these four islands is Hokkaido; Honshu is the main island, Shikoku the smallest, and Kyushu the most southern. It is a mountainous (75% to 80%), rugged country with small plains and montane basins, and short swift rivers. It is largely of volcanic origin, and to-day there are active volcanoes as well as several thermal regions. Forestry has been extensively employed for erosion control on the poor soils of the rugged hills.

The climate tends to be one of extremes, there being great seasonal and latitudinal differences. The mean annual temperature of Tokyo (Lat. 35° 30' N.) is 57°F. with a seasonal range from 28°F. in winter to 86° in summer. In the extreme north the temperature reaches well below zero and in the south as high as 100°F. Tokyo's annual rainfall averages 59 inches, while other regions vary from 89 inches in Kyushu to 42 inches in Hokkaido. During midsummer the humidity is very high with resultant unpleasant living conditions. The climate of Japan is greatly influenced by oceanic currents, both warm and cold, and by its proximity to the continent of Asia. It can be said that the country varies from sub-tropical in Kyushu to cold temperate in Hokkaido.

2. Japan and Forestry—General.

The land area of Japan proper is 147,416 square miles while her population just exceeds 77 millions. In spite of this, 60% of the land

is under forests of various kinds, while only 16% is used for agriculture, giving 4.5 persons per cultivated acre. Feudalism still prevails with the result that 46% of the agricultural land is tenant cultivated.

Forest ownership and administration are rather complex. Ownership falls into the following groups with the percentages of area shown :—(2)

Private	...	...	...	...	44%
Community, Temple, Shrine	...	...	...	...	19%
State	...	...	...	...	37%

Prior to 1947 some 5% of the present State Forests were Imperial Household property ; these are considered among the best in Japan. State Forests are administered by the Minister of Agriculture and Forestry through the Forestry Bureau, while private and community forests are controlled by the Home Ministry through the Provincial Governors. All are bound by the National Forest Act of 1907.

During the war, Japan's forests were as heavily exploited as were those of many other countries. This was due largely to loss of supplies from the Philippines and other Pacific Islands. Large areas were felled, little replanting was carried out and normal silvicultural plans were abandoned. Now labour is difficult to obtain because food production is of primary importance. Even in normal times only 24% of the total labour employed in the timber industry is on a full time basis. Large areas are felled in winter and spring, the "off" agricultural season, and in many cases this is sufficient to keep the mills supplied for the remainder of the year. This is definitely the case with the small mills where logging and milling work are alternated by the few employees. Wages are low as shown by figures for 1939—7/2d. for a 9½ hour day, 25½ days per month, for a skilled mill worker.

The forest lands of Japan can be classified into the following types :—(2)

Conifers	...	...	...	...	24%
Hardwoods	...	...	...	...	40%
Mixed conifers and hardwoods	...	...	...	...	23%
Bamboo	...	...	...	...	1%
"Wild land" (treeless or almost so)	...	...	...	...	12%

The best stands are found in Northern Japan, and a third of the total estimated volume of all forests in Japan Proper is found in the northern island, Hokkaido. In spite of its large areas of forest, the country is not self sufficient in timber but must rely on imports, particularly of pulpwood.

The following table shows the chief commercial timber species of Japan.

Japanese Name	English Name	Botanical Name
Hinoki	Cypress	<i>Chamaecyparis obtusa</i>
Sawara	Cypress	<i>Chamaecyparis pisifera</i>
Sugi	Cedar	<i>Cryptomeria japonica</i>
Akamatsu	Red pine	<i>Pinus densiflora</i>
Kuromatsu	Black pine	<i>Pinus thunbergii</i>
Momi	Fir	<i>Abies firma</i>
Tsuga	Hemlock	<i>Tsuga sieboldii</i>
Ezomatsu	Spruce	<i>Picea jezoensis</i>
Todomatsu	Fir	<i>Abies mayriana</i>
Karamatsu	Larch	<i>Larix kaempferi</i>
Asunaro		<i>Thuopsis dolobrata</i>
Akakashi	Red evergreen oak	<i>Quercus acuta</i>
Nara	Red evergreen oak	<i>Quercus crispula</i>
Kumugi	Deciduous oak	<i>Quercus semicus</i>
Kiri	Paulonia	<i>Paulonia tomentosa</i>
Kuri	Chestnut	<i>Castanea vulgaris</i>
Buna	Beech	<i>Fagus crenata</i>
Keyaki	Zelkova	<i>Zelkova serrata</i>

3. Localities Visited.

A section will be devoted to each place visited and impressions will be added. Because of the easier administrative approach, only State Forests were visited.

(a) Yamaguchi Province : Honshu.

The New Zealand Occupation Force has control of the Yamaguchi Province on the south-western extremity of Honshu lying between latitudes 34° and 35° N. It is almost entirely broken hilly country to a height of 3,200 ft. Two-thirds of the land area is forested, and most of this is either communally or privately owned, there being only one State Forest of any size.

The forests contain mainly Hinoki, Sugi and Akamatsu, with Kuromatsu on the coastal and low lying regions. Nowhere are the trees left to grow very large, 2 ft. D.B.H. being about the biggest seen outside parks and protected places. A close rotational management seems to have been adopted under clear felling or shelter wood systems. All slash is collected for fuel. In addition areas of evergreen oak and chestnut are managed for the production of charcoal, the chief source of domestic heating.

Most felling is done in the agricultural "off" season (winter and early spring); after being topped, the full logs are left to dry so as to reduce their weight for transportation. Bark of both Sugi and

Hinoki is removed immediately after felling and used for roofing. Logging methods are primitive and made possible only by the cheapness and abundance of labour. Logs are either manhandled down steep inclines or propelled on a sledge (kinma) over sleepers, guided by a bushman. Transport to the small mills, most of which are in towns, is by carts, wagons (horse or oxen) or motor. Most mills are small and use the State electric power, their motors seldom exceeding 20 h.p. When working, daily production is about 250 cu. ft. Most operate only circular saws but some have introduced band saws and Pacific benches. There is a tendency to encourage small private enterprises, with the result that mills are numerous, small and perhaps a little antiquated in their methods.

On the northern boundary is the only State Forest of the province; it is also the only apparent virgin stand of timber in the region. It is the Namera State Forest of 6,125 acres divided into 37 compartments, some of which have been clear felled and replanted. The biggest and commonest trees in the old stands are Momi and Tsuga with quite a large number of Hinoki, Sugi and Akamatsu as well. Only Hinoki and Sugi are being replanted. Typical mature trees were about 36 in. D.B.H. with 70 to 75 ft. of log.

Logging methods are typically primitive but in places cables are used to span gullies. A bush railway is the final transportation to the central log yard for dispersal. Here large logs were being allowed to rot for lack of equipment big enough to handle them. Two local mills, both water powered, were being supplied from this source but the balance of logs was going to a nearby city for sawing. All aspects of work in the forest are being hindered by labour and supply shortages.

(b) Kochi Province: Shikoku.

This province is the centre of greatest forestry activity on Shikoku and much of the forest area is owned by the State. The area visited was in the vicinity of Aki-Nahari-Yanase in the south-eastern corner of the island at a latitude of $33\frac{1}{2}^{\circ}$ N. The climate here is greatly influenced by the warm ocean current which passes up the coast. In consequence, temperatures are more even and the rainfall is high, averaging 156 inches per annum—as much as 235 inches have been recorded.

Radiating from two large log yards (a capacity of 1,100,000 cu. ft. each) on the coast there is a system of 110 miles of private narrow gauge railway using both steam and internal combustion locomotives. Logs are hand sledged, chuted or brought by aerial cable to loading yards where loading winches are generally employed. The average capacity of each log train is 4,000 cu. ft. Very few of the logs from this area are sawn there, most being shipped to the big cities of

Kobe and Osaka where they are sold to private companies. The policy of the State has been to foster private enterprise, sometimes at a financial loss to itself. Loading of ships has been an everlasting problem because of the frequency of typhoons and tidal waves.

The forests are largely coniferous and include in particular Hinoki, Sugi, Momi and Tsuga all of which seem to thrive in the wet climate. For this reason neither of Japan's two pine species are found here to any extent. Patches of broadleaf forest contain evergreen oak, Keyaki and *Shiia sieboldii*, the latter being sought after for charcoal. The coniferous forests are in two categories, planted and naturally regenerated.

The managed natural forests have been partially felled, never more than 50% being removed. Records of an experimental plot showed that 40% of the stand was removed in 1926 and that the trees ranged up to 260 years in age. On the sunny southern slopes regeneration was good but not in the gullies. In 1935 all trees over 8 cm. D.B.H. were measured to obtain an increment figure for the 10 year period. The volume per acre was found to be 4,300 cu. ft. and the periodic annual increment 1.7%. Similar plots have been noted in other areas, all to determine what time is required to restock after partial felling, the efficiency of natural regeneration and the annual increment. No conclusive results have as yet been obtained.

Some years ago, large areas were clear felled necessitating complete restocking. Only Sugi and Hinoki were planted, as these are the easiest species to propagate and are of greatest use and value. Nurseries have been badly neglected and many have been turned over to vegetable production, so that present tree stocks are very low. Germination seen was very poor, being only about 15%. Screens are not used, but adjustable rice straw shades are substituted to give protection from the sun or frosts as needed. The main nursery disease is a virus (*Phyllosticta cryptomeriae*) which is being combated with Bordeaux mixture or burning the soil. Lining out of year-old seedlings is usually done in flying nurseries throughout the forest. Other methods of propagation being adopted to try to increase stock are layering and cuttings (Sugi only) and giving wildings one year in a nursery.

Wrenching is not insisted upon, but if a seedling has a very long tap root it is nipped off when removed from the ground. Planting is usually done in patches following the contours; distances and lines are not carefully marked. Spacing is usually 8 ft. x 8 ft. or 6 ft. x 6 ft. but often varies according to the steepness of the country. Pruning is not often done but if labour is available it may be carried out in conjunction with the first thinning, particularly in Hinoki. Management of State forests is on a 100 year rotation for Sugi and 120 years for Hinoki, but private forests are worked on a much shorter term.

On a mountain (3,400 ft.) in this area a fine stand of timber is being preserved as a national treasure. The following are figures taken on 27 acres of this stand : (3)

Species	Trees per Acre	Volume per Acre Cu. ft.	Volume per cent.
Sugi	94	20,485	84.6
Hinoki	5	388	1.6
Momi	11	2,119	8.8
Tsuga	18	988	4.0
Deciduous	12	212	1.0
Total	140	24,192 cu. ft.	100

Here it is worth noting the presence of the camphor tree (*Cinnamomum camphora*) on the southern peninsulas of Japan. It requires a sub-tropical habitat and therefore is only found on those extremities where the temperatures are warm and the rainfall heavy. Kochi Province has two zones of camphor where the oil extraction industry is thriving with good production (2% by weight).

(c) Kagawa Province: Shikoku Island.

The forests visited were near the city of Takamatsu (Lat. $34\frac{1}{2}^{\circ}$ N.) and are of a very different nature from those of Kochi. The two main forest tree species found here are the black and red pine growing under rather adverse conditions. The climate is much drier (39 inches per annum) and hotter than any other part of Shikoku, and there is a very poor soil overlying granite. As most of the forests in this area are within the Inland Sea National Park, they are managed as protection forests.

Generally speaking, fire is not a serious problem to Japanese foresters, but in this area fires do occur, particularly in the hot spring from March to May. During the past two years two fires have occurred, each burning about 40 acres of forest.

Being a coastal region, the chief pine species is the black pine (*P. thunbergii*) which is found in pure stands, as well as with red pine (*P. densiflora*) in some areas. The latter occupies zones at a greater distance from the sea and at a higher altitude. Neither species has grown into good trees; black pine in particular is usually very twisted, stunted and slow growing. In places pruning has been done, but with little care, stubs being very prevalent. Partial cutting has been carried out experimentally, varying from 40% to 70% removal, but for optimum regeneration and increment 55% removal is said to be best.

One forest visited contained both species, but they were of a terrible form, due to climate, aspect and poor soil. After 60 years it was found that the limited growth had almost ceased. Consequently *Alnus* was interplanted among the pines in an attempt to

improve the soil and increase growth. After 10 years the response was notable and now, after 40 years, the height of pine has been almost trebled and the diameter doubled. Even so, after 100 years these malformed trees are but 40 ft. in height and 12 in. D.B.H. As this forest is for protection and scenic purposes the results can be regarded as successful.

(d) **Wakayama Province: Honshu.**

The forests of Mt. Koya (3,000 ft.) are of particular interest as the natural habitat of *Sciadopitys verticillata*, the Umbrella Pine. It occurs in pine stands or in association with Hinoki, Momi and Tsuga—see note elsewhere in this issue.

About half the forest has been clear felled and replanted in Hinoki (70%) and Sugi (30%) managed on a rotation of 80 years. Sugi has been planted in the gullies and other moist well drained sites. The remainder of the forest is being managed on a shelterwood system to obtain natural regeneration. Sample plots are being maintained to obtain further information on regeneration and increment. Being a tolerant species, Umbrella Pine regenerates well where there are sufficient parent trees.

The heaviest stand of timber seen during the tour was in a temple cemetery on Mt. Koya. On an area of about 100 acres, there was a dense stocking of large Sugi. The biggest tree was 8 ft. D.B.H., 120 ft. total height and about 500 years old; many of the others were not much smaller.

4. Summary.

Japan is a small country with extensive tracts of forested land, the stands being both artificially and naturally established. Forestry is just as intensively practised as agriculture, on which Japan's life blood depends. The large tracts of forests can be attributed to two main reasons: (a) absolute necessity for soil conservation in a loose sandy loam overlying a granitic base and (b) the insatiable demands for timber on the home market. By reason of the large population and lack of iron, the need for timber in building and industry is very great. All private houses are wooden, as are most household fittings. Add to this the big demand for fuel to meet the cold of winter and it is not surprising that every bit of slash is utilized.

Japan's forests vary in type from almost tropical in the south to cold temperate in the north, and montane on the higher altitudes. Conifers supply the greatest quantity of timber and pulp, but hardwoods are also important. Evergreen oaks everywhere are most important from the points of view of charcoal and fuel production. Of the conifers, *Chamaecyparis obtusa* (Hinoki) and *Cryptomeria japonica* (Sugi) are the most important and widely used. Where planting is done after clear felling, these two species are used almost exclusively, particularly in the areas visited.

Methods of management vary widely due to the diversity of types and ownerships, but one Forest Act (1907) covers all forests. Wherever possible the ground is kept covered with some sort of vegetation and clear felling is never carried out over large areas, but in patches only. These patches are planted up almost immediately or are left to regenerate naturally. At the present time all forest activities are hindered by labour and supply shortages. As standard practices depend on abundant cheap labour and have not been mechanised to any extent, antiquated methods prevail and at present vitally needed production cannot be accelerated. Silvicultural treatments such as pruning and thinning appear to be generally lacking.

Japan's timber needs are such that her own supplies must be augmented by imports.

References.

- (1) Wilson, H. E. The Conifers and Taxads of Japan. Oxford, 1916.
- (2) Bulletins of the Natural Resources Section, SCAP, Tokyo.
- (3) Translated Data from the Japanese National Forest Bureau.