Professional Articles/ Articles professionnels

Forestry in Japan

by

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Abstract

Japan has a total productive forest area of 25 million ha of which 31% is owned by the state and 69% is owned by municipalities and the private sector. The total volume of growing stock is 2 484 million m³, of which plantations account for 42% and natural forest 58%. The average volume of growing stock is about 100 m³ ha. The average annual growth and removal are estimated to be 70 million and 40 million m³, respectively. There are three main forest zones: subfrigid in the north, temperate in the centre and warm temperate in the south. Regeneration was recognized as vital to the country's wood supply and environmental reconstruction after the destruction during the Second World War. The average annual planting area is about 200 000 ha with the largest area ever planted, in 1954, accounting for 432 700 ha. Skyline harvesting systems are common except in the northern area of Hokkaido. The Japanese Forestry Agency is the central forestry organization which has the leading role in providing management guidance for private forest owners. Forestry research is conducted by the Forestry and Forest Products Research Institute, and by prefectural (equivalent to provincial) and university forest experiment stations. The pulp and paper manufacturing technology is quite advanced. Almost the entire quantity of paper and paperboard needed in Japan is produced domestically, but more than 60% of the raw timber requirement is supplied by imports.

Résumé

Le Japon a une forêt productive d'une superficie totale de 25 millions d'hectares, dont 31% appartient à l'État, et 69%, aux municipalités et au secteur privé. Le matériel sur pied représente un volume total de 2 484 millions de mètres cubes; les plantations en comptent 42%, et les forêts naturelles, 58%. La densité moyenne est d'environ 100 m³/ha. L'accroissement annuel moyen a été estimé à 70 millions de mètres cubes, et la récolte annuelle moyenne, à 40 millions. On trouve au Japon trois grandes zones forestières: une zone subglaciale au nord, une zone tempérée au centre et une zone tempérée chaude au sud. Le pays a reconnu la régénération forestière comme étant essentielle pour assurer son approvisionnement en bois et sa reconstruction après la Seconde Guerre mondiale. La superficie annuelle moyenne couverte par les activités de plantation s'élève à environ 200 000 ha; la plus forte étendue plantée en une année a été de 432 700 ha en 1954. Les systèmes de récolte par câble aérien sont répandus, sauf dans le nord d'Hokkaido. Le service forestier du Japon a la responsabilité de conseiller les propriétaires de forêts privées en matière d'aménagement. Le Japon possède un institut de recherches sur la forêt et les produits forestiers; de la recherche forestière est également effectuée par les stations expérimentales des préfectures (correspondant à nos provinces) et des universités. Les usines japonaises de pâtes et papiers sont assez modernes. Le pays produit la presque totalité des papiers et des cartons dont il a besoin, mais il importe plus de 60% du bois non traité qu'il utilise.

Land Base for Forestry

Japan lies in the northwestern sector of the Pacific Rim, off the coast of eastern Asia: east of the USSR, the Korean Peninsula and China. The country, situated in the north Pacific Ocean, basically consists of four large islands: from north to south, Hokkaido, Honshu, Shikoku and Kyushu, stretching about 3 000 km from the northeast to the southwest. Its territory extends approximately between latitudes 20° N and 45° N and between longitudes 122° E and 154° E.

The total area of Japan, 377 000 km², is slightly larger than one-third the area of Ontario (1 068 583 km²) or slightly smaller than the State of California (411 000 km²). The population is about 120 million. Tokyo, the capital city, has a metropolitan population of 12 million, which is one-tenth of the country's total or one-half the number in all of Canada.

Generally, Japan is mountainous, with nearly 74% of its area featuring mountains and volcanic cones. The mountains are steep, ranging in elevation from 2 500 m to 3 000 m; Mount Fuji is the highest peak at 3 775 m. Rivers are short and the currents are rapid. During the rainy or typhoon season, flooding is frequent. Mean annual precipitation is 1 740 mm in

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Honshu Island except on the Pacific side of southern Japan where it is 2 000 mm to 3 000 mm.

Forest Resource

The forests of Japan cover about 25 million ha, or 68% of the total land area, whereas the world's forests cover about 22% of the total land area. Because of its small size and high population, the Japanese forest area per capita is only 0.2 ha, which is one-fifth of the world's average.

There are three types of forest ownership; national forests, 7.9 million ha (31%); municipally owned forests, 2.6 million ha (10%); and private individually owned forests, 14.7 million ha (59%) (Table 1). Most of the national forests are administered by the Forestry Agency of the Ministry of Agriculture, Forestry, and Fisheries (Figure 1). Municipally owned forests are under the jurisdiction of the prefectures, cities, communities, villages and corporations (prefectures are equivalent to Canadian provinces).

Figure 1. Productive forest area (stocked and unstocked), by ownership, in thousands of hectares.

Based on origin, the forested area can be divided into plantation of 9.9 million ha (39% of total forest area), natural forest of 14.0 million ha and other forests, such as bamboo stands of 1.3 million ha (Table 2).

The total growing stock amounts to 2 484 million m^3 , with that of plantations 1 054 million m^3 (42%) and natural forests 1 430 million m^3 (58%). The volume per ha in plantations is 106 m^3 and in natural forests 102 m^3 , while the average for both is about 100 m^3 , taking into consideration some unstocked productive forest land. Softwood species account for 1 482 million m^3 (60%) and the hardwoods for 1 000 million m^3 (40%) of the total volume of growing stock.

Table 2. Distribution of forest area and growing stock by origin

Origin of forest	Area (million ha)	(%)	Growing stock		Unit volume (m^3 /ha)
			(million ha)	(%)	
Plantation	9.9	39	1 054	42	106
Natural	14.0	56	1 430	58	102
Other	1.3	5			
Total	25.2	100	2 484	100	99

SOURCE: Summary of Japanese Forestry Statistics 1983 (Ringo Takei Moriya 1983)

Ownership Class and Item	T O T A L										S T O C K E D L A N D										U N S T O C K E D L A N D										Bamboo (1 000 ha)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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Mean annual increment up to the standard felling age is estimated as 7 m³/ha for Japanese Cedar (*Cryptomeria japonica*) and 6 m³/ha for other planting species. Annual removals from growing stock fluctuated around 70 million m³ in the 1970s but the trend has been downward, to 40 million m³, in recent years. The average annual growth is estimated to be 74 million m³.

Forests of Japan are distributed mainly according to the variations of temperature. There are three main forest zones, described as follows (Figure 2):

1) **Subfrigid forest zone:** The subfrigid forest is also called subalpine forest where its occurrence is governed by height above sea level. This forest zone is located in the mountains of central Honshu from 1 400 m to 2 500 m, and in central Hokkaido from 700 m to 1 400 m. In northeast Hokkaido it occurs even near sea level. The mean annual temperature is below 6°C. The dominant species are:

In Hokkaido
 White fir (*Abies mayriana*)
 Yezo spruce (*Picea jezoensis*)
 Glehn's spruce (*Picea glehnii*)

In Honshu
 Veitch fir (*Abies veitchii*)
 Northern Japanese hemlock (*Tsuga diversifolia*)
 Hondo spruce (*Picea jezoensis* var. *hondoensis*)

2) **Temperate forest zone:** The temperate forest zone consists of deciduous forest in which beech dominates; it is therefore called the "buna belt" (Buna means beech in Japanese). This type of forest occurs at elevations higher than 1 000 m above sea level in Kyushu, at 600 m around the Kanto district, and at sea level from the central part of Honshu north to western Hokkaido. The mean annual temperature in this zone ranges from 6°C to 13°C. The main representative species is Siebold's beech (*Fagus crenata*). Others are:

Japanese linden (*Tilia japonica*)
 Japanese horse chestnut (*Aesculus turbinata*)
 Katsura tree (*Cercidiphyllum japonicum*)
 Japanese walnut (*Juglans ailanthifolia*)

3) **Warm temperate forest zone:** This evergreen hardwood forest zone occurs on Kyushu, Shikoku, and the southern half of Honshu. The annual mean temperature is 13–21°C. The dominant species are:

Laurel (*Machilus thunbergii*)
 Live oak (*Quercus phylliraeoides*)
 Camphor tree (*Cinnamomum camphora*)

Although the forests of Japan can be divided into three main zones, a subtropical forest zone also occurs in Okinawa and southwest of Kyushu Island. Near the boundaries of zones the composition is complex with a transition belt in which no representative species can be attributed to either zone.

Forest Operations

Regeneration

After the destruction of World War II, it was recognized that wood supply and environmental reconstruction were vital to the national economy of Japan. In 1954, 432 700 ha were planted — the highest annual total since the war. Due to the limitations of suitable land, the availability of cheaper timber abroad and modified management methods, the planting rate has since been declining and by 1977 it had dropped to less than half of its all-time high.

Japanese cedar and Japanese cypress are the most important and common planting species in Japan. They are widely distributed from the warm temperate zone to the lower half of the temperate forest zone. Japanese larch (*Larix leptolepis*), Japanese red pine (*Pinus densiflora*) and Japanese black pine (*Pinus thunbergii*) are the next most important planting softwood species (Figure 3), and keyaki (*Zelkova serrata*) and kunugi (*Quercus acutissima*) are the most common hardwood species planted.

Figure 2. Distribution of forest area in Japan.

Figure 3. Plantation forest by species.

The typical regeneration process involves site preparation, planting, weeding and removal of vines. Site preparation includes windrowing of logging residues and shrubby vegetation along a contour line. Manual spot scarification is often carried out to create a favorable site for seedling growth. Planting is done by hand-hoe, a method that requires great care and is labor intensive. Because of the steepness of most forest land (except in Hokkaido) mechanical planting has not been practiced.

Weeding to eliminate competing vegetation is usually done once or twice within three or four years after planting. Because of the labor shortage in recent years, weeding machines and chemical sprays have been employed, particularly the latter with the use of helicopters. Weeding operations are carried out on an estimated 2-2.5 million ha each year.

Protection

Forests in Japan suffer from disasters such as fire, inclement weather, disease, insects and damage caused by wild animals. Forest fires usually occur in the dry season of spring, and most are caused by unextinguished cigarette butts and camp-fires. Typhoons often strike Japan several times a year leaving in their wake a great number of windfalls especially in old and overmature stands. Heavy snow and frost cause some damage to the trees, particularly in young stands in the warm regions. The trees can barely withstand the frequent heavy wet snowfalls in southwestern Japan. The pine bark beetle (*Hylastes parallelus* and *Hylastes plumbeus*) is the most common insect that poses serious problems to the forest.

Logging

Because of Japan's steep topography, yarding operations employing various skyline systems are common. Three of the most popular employed are the Tyler, Endless Tyler and Falling Block systems. Generally, operations are carried out with yarders equipped with winches which may have from two to four drums. The skyline spans may often reach distances of 1 200-1 300 m and with lateral skidding distances of 50 m-100 m. In Hokkaido, truck-hauling and tractor-hauling systems are more commonly used because of the gentler slopes. In general, there are three harvesting systems: shortwood, tree-length and full-tree systems. Because of the labor shortage in rural areas, the full-tree operation has been considered the most efficient and productive.

Forest Management

There are 7.9 million ha of national forests of which 7.7 million ha are under the jurisdiction of the Japanese Forestry Agency. The growing stock under the Forestry Agency totals 164 million m³ in plantations and 617 million m³ in natural forests. There are 369 million m³ of softwood species and 424 million m³ of hardwood species.

The forest management plan of the national forests consists of basic and long-range plans, which are implemented by government employees. Both plans are established every 5 years for a term of 15 years by the Director-General of the Forestry Agency.

All management plans take into consideration basic resource planning and operational planning, such as forest

inventory, land classification, cutting age, annual allowable cut, forest roads and conservation. All these strategies aim at achieving the long-term goals of stabilizing the timber supply, protecting the environment and wildlife, developing industries, creating employment, furnishing recreation and enriching the quality of life.

Forest management plans for private forests are closely related to agriculture. Ninety percent of individual tree farmers possess on the average less than 5 ha of forest. Because ownership is on such a small scale, both minor forest products (fuelwood) and agroforest products (mushrooms) are being produced to supplement the farmers' income.

Producing forest products requires a long period of time and financial commitment. The government provides special financial assistance as an incentive to individual forest owners. Loans with low interest or no interest are granted through the Japanese Forestry Agency. In addition, various other funds, such as the Forestry Improvement Fund and the Forest Credit Fund, are available. Also, tax incentives are granted to reduce the financial burden on forest owners.

Forest Industry and Forest Products

In 1970, wood demand in Japan exceeded 100 million m³ for the first time, and since then this level of consumption has been more or less maintained. More than 60% of the timber consumed was imported from the tropical countries of Malaysia, Indonesia and Philippines and the remainder from Canada, the USA, the USSR and other countries. Domestic supply accounts for less than 40% of total consumption.

In 1984, Japan's imports and exports of forest products amounted to C\$7 900 million and C\$927 million, accounting for 4.5% and 0.4% of the total trade value of imports and exports of the country, respectively. (In 1984, Japan's total trade values were C\$176.7 billion for imports and C\$220.3 billion for exports.) Basically, Japan is a net importer of forest products. Table 3 shows the country's production, imports and exports of major forest products in 1984. In the same year, the value of imported roundwood amounted to C\$4 872 million of 61% of the total value of Japan's imported forest products. Lumber was the next most important imported commodity, which was worth more than C\$1 billion.

Total imports of roundwood and lumber combined reached 46 million m³, worth C\$6 billion. The exporters of these commodities were tropical Asian countries (Malaysia, Indonesia, Philippines and Papua New Guinea) accounting for 44%, USA and Canada 35%, and USSR 19% of the total in 1984 (Figure 4).

Figure 4. Main sources of Japan's imported logs and lumber in 1984 (Base: 46 million m³ of imported logs and lumber).

Table 3. Production, imports, exports and value of major forest products in Japan 1984 and its rank of the production in the world

Commodity	Unit	Production	(World Rank)	Imports	Exports
Roundwood	1 000 m ³ C\$1,000	32 819	(15)	41 116 4 871 844	43 10 966
Lumber (Sawnwood and sleepers)	1 000 m ³ C\$1,000	28 667	(4)	4 552 1 072 838	28 26 114
Total wood pulp	1 000 t C\$1,000	9 110	(5)	2 149 1 267 760	39 21 436
Wood-based panels	1 000 m ³ C\$1,000	9 374	(3)	436 91 445	207 90 655
Paper and paperboard	1 000 t C\$1,000	19 344	(2)	815 635 253	737 777 374
Total forest products value	C\$1,000			7 939 140	926 545

Japan produced roundwood amounting to 33 million m³ and lumber 29 million m³ in 1984. In the same year, Canada exported 1.8 million m³ of roundwood to Japan, which accounted for 33% of the total Canadian roundwood exports of 4.4 million m³. The value of Canadian roundwood exported to Japan was C\$137 million, 40% of the total value of Canadian roundwood exports of C\$347 million. Lumber exported from Canada to Japan fluctuated around 2 million m³ with a value of C\$350 million. Japan produced a lumber volume of about 29 million m³ and ranked fourth in the world after the USSR, USA and Canada.

Wood Industry

There are two types of sawmills in Japan. One, small in scale, is used to process domestic timber, which is small and not uniform in shape and quality. The other type of sawmill is large and situated near harbor areas to process imported timber by using large production facilities and automated systems. In 1984 there were about 20 000 sawmills employing 156 000 workers, with an average 8 people per mill and an average processing capacity of 9 000 m³ per mill annually.

The plywood industry was very prosperous during the 1950s and to the mid 1960s because of exports to the United States. However, international competition, rapidly rising oil prices, and substitution of waferboard has weakened the industry. As of 1984, the actual number of plywood mills had dropped to 600 employing some 45 000 workers.

Pulp and Paper Industry

The pulp and paper industry is the most capital intensive of all the wood-related industries. It has become second to saw milling for wood consumption. Almost all paper and paperboard consumed in Japan is produced domestically, but most of the raw material is imported in increasing amounts every year.

In 1984, Japan produced 9 million t of wood pulp and ranked fifth in the world. It also imported 2.2 million t of wood pulp that year. Canada was its largest pulp supplier with 807 000 t, which accounted for 12% of total Canadian wood pulp exports and 37% of Japanese imports of this commodity.

The consumption of paper is said to be a barometer of civilization. Paper products such as newspapers, magazines, books and journals are strongly related to culture as well as to the progress of the community. In 1984, Japanese paper and paperboard output amounted to 19.3 million t and ranked

second in the world next to the USA. Imports from Canada of paper and paperboard have been steadily increasing and reached 142 626 t in 1984. Although accounting for only 1% of Canadian exports of these commodities, this share amounted to 18% of the total Japanese imports of paper and paperboard. In 1984 there were 593 paper and paperboard mills and 65 pulp mills in Japan. Per capita consumption of paper and paperboard was 169 kg. The average production of paper and paperboard is about 32 000 t per mill annually.

Japan's timber demand is likely to remain high despite the recent recession in the world economy and steadily changing tastes in the construction sector. The traditional Japanese house is based on wooden structures because of the preference of the Japanese for the unique beauty of wood. Furthermore, the apparent growth of the Japanese economy and the rising standard of living will cause demand for wood to remain high.

Forestry Organization

The central forestry administration is the Japanese Forestry Agency, which is a branch of the Ministry of Agriculture, Forestry and Fisheries.

The Forestry Agency provides guidance and assistance to private forestry through the forestry department of prefectural governments. Both the Administration Department and Private Forest Department of the Forestry Agency are in charge of private forest administration. The Forestry Agency also controls and manages all national forests through the regional forest offices and district offices. The National Forest Department and Personnel Department look after the management of the national forest.

There are 10 regional and 342 district forest offices, as well as many ranger offices and logging stations within the Japanese Forestry Agency. These offices are responsible for managing and controlling the national forests.

Forestry Education and Research

Forestry education in Japan is provided at universities and technical vocational schools, both of which are administered by the Ministry of Education. Approximately 28 universities have forestry departments under the Faculty of Agriculture and seven of them also have forest products departments. Among the universities, 22 have a master's and five have a doctoral program. There are about 1 200 forestry students registered at universities and 3 200 students graduate annually from the technical and vocational schools.

Research in forestry and forest products is conducted by the Forestry and Forest Products Research Institute (FFPRI), and prefectural and university forest experiment stations. The FFPRI is located at Tsukuba, the academic town in Ibaraki Prefecture near Tokyo, and is the main organization responsible to the Japanese (National) Forestry Agency for its research. Basic and applied research prevails at the national and university forest experiment stations. Indigenous research is conducted by local forest experiment stations across the country. Fields studied by the research organizations are silviculture, forest productivity, management, mechanization, protection, soils, wood utilization and wood technology.

Comments

Japan's territory is only 1/26th that of Canada. With 120 million inhabitants its population density is high, 318/km², compared with 14/km² in Finland and 2.5/km² in Canada. Moreover, two-thirds of its area is rather mountainous. Japan is therefore not well endowed with forest resources compared with either Finland or Canada on a per capita basis.

Most forest plantations were established after 1945 and are not quite mature enough yet for complete utilization. Furthermore, considerations of soil conservation and the concern of environmental protection groups in Japan have tended to limit harvesting operations to small areas of clear or selective cutting. As a result, the domestic roundwood production has been restricted to about 33 million m³ over the past decade.

Because of the cultural background of the people, the preference for unique wooden houses, the general

improvement of the standard of living and the high economic growth of recent years, the demand for forest products has been steadily increasing. Wood consumption in Japan fluctuates around 100 million m³ annually. Japan is one of Canada's largest trading partners in forest products, importing C\$815 million worth of major forest products from Canada in 1984. That year, Japan's real gross national product (GNP) was C\$1.6 trillion, equivalent to C\$13,333 per capita, for Canada in the same year the GNP was C\$420 billion, equivalent to C\$16,735 per capita. In view of its strong economic performance, Japan is likely to remain a major international economic force and continue to import a great deal of raw wood material for many years to come.

References

- Canadian Forestry Service. 1986.** Canada's Forests 1985. Government of Canada, Ottawa. 10 pp.
- Food and Agriculture Organization of the United Nations. 1983.** 1982 FAO Production Yearbook. Rome. 321 pp.
- Food and Agriculture Organization of the United Nations. 1986.** 1984 Yearbook of Forest Products. Rome. 400 pp.
- Matsui, M. 1980.** Forest resources in Japan. Jour. For. 78: 96-99.
- Persson R. 1974.** World Forest Resources — Review of the World's Forest Resources in the Early 1970's. Royal College of Forestry, Stockholm. 261 pp.
- Pulp and Paper International. 1985.** Pulp and Paper International Annual Review 1985. Brussels. 177 pp.
- Rinya Kosaikai. 1983.** Ringyo Thokey Yhoran 1983 (Summary of Japanese Forestry Statistics 1983) Tokyo. 205 pp.
- Statistics Bureau, Prime Minister's Office. 1982.** Japan Statistical Yearbook. Tokyo. 1982. 771 pp.
- Tsay, T.B. 1985.** Forestry Report: Japan. International Forestry Branch, Canadian Forestry Service, Ottawa. Information Report DPC-X-17. 61 pp.

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- 1987 — August 3-6, St. John's, Nfld.
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— Les communications: un lien essentiel en foresterie
- 1988 — September 19-22, Prince Albert, Sask.
Theme: Forest Management:
A Shared Responsibility
— Aménagement forestier:
une responsabilité partagée
- 1989 — October 16-20, Kananaskis Country, Alta.