

## Japanese Forests to make Japanese Houses

Dr. Shin Nagata

The University of Tokyo

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The Japanese archipelago stretches from north to south, and its forest cover changes from boreal to sub-tropical. In the most northern island of Hokkaido, there grows a boreal forest dominated by fir and spruce but which also has such broad-leaved trees like aspen and birch. In the northern half of the central island Honshu, grows cool temperate forest consisting mainly of deciduous broad-leaved trees like beech and deciduous oak. In the southern half of Honshu and Kyushu and Shikoku islands one will find warm temperate forests consisting of evergreen broad-leaved tree like oak and zelcova. Lastly, in the most southern islands, known as the Okinawa islands, there grows sub-tropical and mangrove forests.

In the Okinawa islands, wooden houses are very rare. The people don't like wooden houses because of severe termite problems. Of course wooden houses used to be very common here but now other longer-lived building products are more commonly used.

A cool temperate forest consisting mainly of deciduous broad-leaved trees like beech and deciduous oak can be found in northern Honshu Island. These cool and warm temperate forests were used to produce fuel wood. Natural regeneration was a usual way to manage these forests. Because of high human population density in Japan, naturally grown old growth type of these cool and warm temperate forests are rare to find. This beech species is also found in the cool temperate forest. The leaves of this species changes into beautiful colors in the fall. Although the tree is beautiful, the wood quality of beech is not so valued and this beech is considered to be a weed tree. These days it is becoming rare to see pure beech forest. Beech forest are becoming so rare that the example shown in this photograph is listed as a World Natural Heritage site.

Boreal forest fir, spruce, and broad-leaved trees like aspen and birch are from the island of Hokkaido. In this cool temperate forest and previous warm temperate forest, Japanese cedar and Japanese cypress grow very well. Both species are most commonly used for plantation forest.

On Yaku Island, Yaku cedar trees older than 1000 years old are named after Yaku Island. If cedar is younger than 1000 years old, then they are called young cedar. The forest with this peculiar cedar is also listed as a World Natural Heritage. There are also natural stands of Japanese cedar in the warm temperate zone on Shikoku Island. But these cedars are not as famous as the Yaku cedar.

Japanese cypress forests are found in the cool temperate zones of my country. Forests of this particular tree are managed for supplying building materials for one of the most important Shinto shrines in Japan. As you may know, "Shinto" is an indigenous Japanese religion. The Shinto shrine, I am talking about, is actually called the "Shrine". This temple has been rebuilt afresh every 20 years since the 7th century. So as you might suspect a large amount of Japanese cedar is required in quite a planned manner.

Now I would like to present you with some basic statistics pertaining to Japan. Specifically, the:

Total population: 120 million

Population increase: 0% per annum

Total land area: 38 million ha

Total forest land: 25 million ha

Plantation forest: 10 million ha

Total wood consumption: 110 million m<sup>3</sup>/yr

Foreign supply: 80%

Domestic supply: 20%

Sawn lumber: 40%

Pulp: 40%

There are two principal types of forest ownership and management. But before I discuss them let me tell you how the Japanese Forest ownership practice has developed.

(1) Just after the Meiji Restoration of 1868, modern land ownership was introduced from the west. The Meiji government issued titles to individuals to levy land tax. At the same

time, the government wanted to secure its own land ownership to establish national forest management opportunity. In the feudal period of Tokugawa shogunate, people gather fuel wood and other daily needs from near-by forest. Its ownership was, however, vague. Villagers shared the near-by forest and managed it in common. These forests became communally owned and "prefecture" owned forest. (A "Prefecture" refers to the governmental administrative entity. Next largest to Central government. Japan consists of 47 prefectures.)

(2) Private holdings with titles. This is where a private individual or companies may hold a title to a piece of land so that they can utilize the land in any way he or she wants it. In case of National forests, the prefecture forest, or municipality forest, they themselves carry the operation, including harvesting, or made contract in a yearly basis. There are no large forestry industry companies in Japan.

Forest management types; plantation, naturally regen and old growth

Systematic plantations in forest management can be trace back at least to the Tokugawashogunate era, 200 or 300 years ago. However, the majority of Japanese plantation forest was established after the second world war. Many houses were destroyed during the War. When the war ended the demand for house and building construction was enormous. Japanese people love wood houses hence house building demands directly affected wood demand and availability. Back then wood was the major energy source. Hence the price of wood soared. Another important fact was that labor was abundant and labor costs were minimal, especially in rural area. Thus tree planting to establish or re-establish plantations was a very lucrative enterprise at the time. In general, the need for wood was high, the future demand for wood looked strong, and labor and land rents were cheap.

However, as time progressed, the Japanese economy became very strong. The Yen became valuable and strong against other international currencies. As the economic engine of Japan progressed many rural people migrated to urban area. The wages in the cities were higher and the new life style appealed to many, especially the younger generation. This had the affect of significantly reducing the number of people available to work in the forest. The shortage of skilled forest workers (supply) plus the elevated wage rate, which was now common in Japan, had made it too expensive to harvest and ship wood from Japanese forests to urban Japanese markets. In general, now even without calculating replanting cost, harvesting a Japanese forest had become a "money loser". Also because the Japanese Yen was now so valuable, the cost of buying wood abroad had become very cheap. Hence wood imports into Japan increased. The end result of all of these factors was to make most of the Japanese plantations, which were planted during 1950's and 1960's, too expensive to harvest.

Lastly, the so-called energy revolution changed the domestic energy source from fuel wood to propane and kerosene. This energy revolution accelerated the conversion of naturally regenerated fuel wood producing forest to plantation forest with cedar or

cypress. As a result the wood volume in Japanese plantations has increased as indigenous use slowed and off shore demand was low.

### Forest operation in Japan

We have plenty of rainfall under our monsoon climate. Precipitation in Japan averages 1500-2000mm per year. With a predominately temperate climate, most of the land in Japan could be planted to forest. However, almost all of the flat lands are being used for agriculture (paddy field), residential lots, and urban development. Hence most of the forests in Japan are found in mountainous or hilly areas, which is about two thirds of land in this country. Thus, 25 million hectares of the 38 million ha of total land in Japan is forested. Further, of these 25 million hectares, 10 million hectares or about 40% has been converted to plantation forest, mostly after the Second World War. (*It may be interesting to know that in the Japanese language, Mountain also means forest, because mountain is most cases covered with forests.*)

To make plantation forests, of course, we first plant trees. However, because the forests in Japan are most commonly in hilly areas, most trees are planted by hand.

Because of monsoon climate, we have plenty of rainfall during summer time. This water benefits weeds as well as the trees. So weeding is very important, but a costly operation for plantation forest managers. Weeding machines are available but manual labor is the most common method of treatment.

Trees are normally planted of 2 x 2m spacing (2500 seedlings per hectare). The "rotation" of these forests was originally planned to be 40 to 50 years, and forest planted after the ware should be ready for harvest. However, currently it is not profitable to clearcut these 40- to 50-year-old trees so the people have adopted a longer rotation period, 80 to 100 years. Their goal is to reduce the harvesting costs per m<sup>3</sup>, which they believe will be lower because the larger diameter trees will command higher prices. Also in an attempt to reduce wood volume losses and to improve the quality of the wood in these forests, many of these stands of trees are being thinned and pruned. It should be noted that knotless, fine grain of lumber highly, which results from judicious pruning is highly valued in Japan. Pruning and thinning is typically carried out manually.

Probably most common felling operations are done manually with chainsaws. The forestry labor force is rather old and aging fast. Currently forest industry in Japan is stagnated and it cannot offer good wage rate and as a result it has failed to attract the younger generation. Old forest workers are accustomed to working in the forest industry and commonly stay until their retirement. Currently, the forestry labor force is shrinking at a rate greater than 5% per annum.

Small vehicles haul logs out of forest. These small vehicles are called "In-Forest Operator" in Japanese. The advantage of these smaller vehicles is that require smaller (narrower) roads. However, the major disadvantage is that their payload is small. In steep terrain, the high-lead Cable system is also used for yarding logs to landings. Feller-bunchers are used in Hokkaido and other places where terrain is less steep. Logs are shipped on small trucks. Small trucks are well suited for moving trees from 40 to 50 years old plantations owned small landholders. The rural public road system in Japan is not usually able to accommodate large trucks.

Logs are sold by Auctioning at lumber/log markets. As mentioned previously, the Japanese people highly value knotless, clear and fine grain wood. Also, logs of equal size and strength can command quite different prices because of their aesthetic characteristics. Therefore, buyers generally insist in personally inspecting all logs before purchasing. Posts, which are used extensively in traditional Japanese wooden house, are the products most valued. They are the basic product of most sawmills in Japan.

#### Protected forests and National Park System

The first Forest Law in Japan was enacted in 1897. The purpose of the law was to establish a method for protecting the forests of the country. Watershed protection, and soil erosion control were, and still are, major goals of the laws. Today, about one third of the total forested area in Japan is protected.

The National Park System in Japan was begun 1931. It is interesting to know that the Japanese National Parks are not nationally owned. Rather a "National Park Area" is only a designation, which can be assigned to any piece of land, regardless of ownership. Even private land can even be designated as a National Park Area. The restriction is applied in the National Park depending on the types of designation. There 2.00489 million ha, 5.42% of NPs 1.289 million ha QNPs 3.41% 2.01 million ha 5.4% of PNPs. In total they count 13% of total land.

#### Demand and Supply of Wood in Japan

The Japanese use about 110 million m<sup>3</sup> of wood annually. On a per-capita bases, each individual consumes about 0.9 m<sup>3</sup> of wood fiber per year. Most of the wood used (40 %) is in the form of sawn lumber. Another 40% is consumed in the form of chips and pulp for paper. The demand for paper follows the typical economic models. In general, the elasticity in the demand for paper is related to the GDP is about unity.

After the oil crisis, recycled paper usage increased. These days the percentage of recycled paper is a bit more than 50%. Although it is still increasing to know that the recycling rate has not change much in recent years because we are at the upper limit of our

capability. So the unitary elasticity can safely translated into chip and pulp demand elasticity with respect to GDP.

In case of sawn lumber and plywood, up to the first oil crisis, Japanese economy grew at about 10% per annum, which is reflected in a monotonic increase in these demand elements. After that, the level of economic activity stayed rather stable. As expected the growth rate in sawn lumber and plywood is determined the demand for these products, which highly influenced economic growth. In the prosperous time it increased, and in the depression time, it decreased.

Building construction accounts for about 70% of sawn lumber and most of the plywood used in Japan each year. About 60% of building construction is for residential housing. In general, a little bit more than half of housing in Japan is constructed with wood. The average Japanese house is about 100 m<sup>2</sup> in size. Using a conversion factor of 0.2 m<sup>3</sup> of wood per 1 m<sup>2</sup> would suggest the average house in Japan today uses about 20 m<sup>3</sup> of wood volume. This is more than what is used in house construction in many countries but much less that what is used in North America.

Japan imports a large amount of wood fiber. Actually 80% of Japan's wood consumption comes from sources abroad. In Japan, we make the joke "That in the past we got wood from mountains, but now it comes from the sea". In general, it comes from the United States, Canada, Australia, New Zealand, Indonesia, and Malaysia. In the past Japan imported foreign wood mostly in the form of logs but because many of the exporting countries are promoting their indigenous wood processing industries more processed wood is being received. As expected, this situation is impacting on Japanese sawmills, which are being forced to process the higher cost wood grown in Japan.

In 1950's, one third of Japanese wood consumption was used for fuel wood. Around 1970, Japanese energy usage changed to kerosene and propane, and fuel wood consumption became negligible in the total wood consumption.

### Japanese Housing

Basic wood construction in Japan is designed around beam and post architecture. Old houses, particularly farm houses used wood posts and beams with straw roofing. These materials are beautiful to look at and comfortable during our hot summers. However, it is becoming less common to see this type of construction. Other feature of old construction and something that is found even in some newer homes is the floor hearth in the center of the room. This is where the family gathers. It gives new meaning to central heating. Another standard feature of Japanese homes is the fact that commonly there is no wall between the rooms. Straw mats, otherwise known as Tatami mats, are a commonly used floor covering. As many are aware, Japan is a rice-growing nation, and we utilized rice straw for housing construction as well.