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日本の将来の木材供給についての検討(生物生産学科)

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Future Wood Supply in Japan : A Discussion Paper

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Summary

Japan relies on wood imports for 70 percent of the total wood consumed. However, wood supply from traditional sources (North America, Southeast Asia) is declining rapidly. Japan has a substantial domestic forest resource, but its competitive position is weak. The reasons for this are examined. The paper discusses prospects for revitalizing Japan's domestic wood production, and for increasing imports of plantation softwood. Australia could become a substantial exporter of plantation softwood, but there are uncertainties to be resolved before this country can commit resources to a large export - orientated softwood program. The paper calls for greater dialogue between countries of the region on future wood requirements and trading relationships.

1. Introduction

Since 1960 Japan has been a very substantial importer of wood, meeting 70 percent of total wood demand in this way. Most of the wood import is in the form of unprocessed logs, derived mainly from the tropical forests of Southeast Asia and the temperate coniferous forests of the Pacific coast of North America. Because the availability of wood from these forests is declining rapidly, Japan faces a potentially serious problem in developing and maintaining a stable timber economy. It follows that Japan must either 'reactivate' and strengthen its domestic sector forestry and forest industries or seek new sources of wood imports, or pursue both of these options.

This paper explores these topics. It analyses world wood production and trading relationships, examines the status of domestic forestry in Japan, and looks at prospects for importing wood from southern hemisphere countries with substantial softwood plantation programs (focusing on New Zealand and Australia).

2. World Trading Relationships

Nomura (1991) presents a convenient world perspective of production and trading relationships by focusing on the three main areas of wood consumption: Europe, North America and Japan. Production and trading relationships are likely to be fairly stable in Europe and North America, but not in Japan.

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Europe. There is a large domestic trade in forest products between the countries of Europe. For example, Sweden exports a volume of timber equivalent to 8 percent of the world's export volume and, together with Finland, are the principal suppliers of sawnwood (with some unprocessed sawlogs) to other European countries. Additional sawnwood and sawlogs are imported from Canada, the USA and the USSR, and these sources of supply should be relatively stable.

Europe also imports tropical hardwood logs from Africa and constitutes the main importing block from Southeast Asian countries. While this trade is unlikely to be maintained at present levels, Europe does not appear to face any great problems in meeting its essential timber needs. Indeed, as the supply of tropical hardwood declines, Europe could even become a small but important market for 'value-added' Australian hardwood.

North America. The USA and Canada together produce some 33 percent of the world's sawnwood. Yet despite its pre-eminent position in sawnwood production (21% of world output), the USA is a major sawnwood importer-accounting for 38% of the world's total import of sawnwood, mainly from Canada. Similarly, the USA is the world's largest producer of plywood (40% of world output), yet is also a major importing country, principally tropical hardwood from Indonesia, Singapore and Malaysia.

Despite the level of sawnwood imports, the USA exports coniferous sawnwood and sawlogs, mainly from the Pacific Northwest. While this represents only a small part of total USA production, it has been an important source of supply for other countries, notably Japan and, in recent years, China. Given the levels of domestic production in North America, timber supply is expected to be fairly stable, that is, the region is unlikely to be unduly affected by changes in availability of timber elsewhere in the world, or in its own capacity to maintain present levels of exports.

Japan. The timber supply position for Japan and future trading relationships are much less certain. Japan is highly dependent on wood imports. In 1989, there was a total import of 83,411 million m³ -including sawlogs, sawnwood, plywood, particle and fibreboards and pulp and paper equivalents. This represents 72 percent of Japan's total wood consumption.

The pattern of wood supply and demand in Japan is often described in a number of stages. The period 1945 to 1960 was characterized by a gradual growth in demand centering on domestic wood supply. There was a rapidly rising demand from 1960 to 1973, with expanding importation of wood. Demand was relatively stable from 1973 to 1986, but now centering on imported wood. And under a policy of expansion of the domestic economy, there was a rising demand trend 1986 to 1988.

Japan is the world's top importing country, accounting in 1987 for 24 percent (41 million m³) of the world's total trade in sawnwood, pulpwood and saw and veneer logs. This was derived from the USA (45%), Southeast Asia (35%), USSR (13%) and other countries (7%). Japan is the world's largest importer of unprocessed logs. It takes close to half the total world trade in logs (still a massive 68 million m³), mainly from Southeast Asia.

The problem for Japan is that present trading patterns cannot be maintained; that is, neither North

America nor Southeast Asia can sustain present levels of timber export. The Philippines has harvested most of its tropical hardwood resource. Nomura (1991) refers to the 'near exhaustion of large diameter logs during the next 10 years in Sabah', and suggests Indonesia's relatively rich resources may not last much beyond the next 10 to 20 years. The effect of a run-down in supply will be exacerbated by increasing restrictions on log exports, the growth of processing industries in exporting countries, and the increasing domestic demand for timber as their economies develop. Indonesia, for example, phased out log exports between 1980 and 1985 in order to base a domestic plywood industry on the remaining forest resource and, from 1990 banned export of unprocessed sawnwood as well. Log exports from East Malaysia (Sabah, Sarawak) will be reduced by 54 percent by 1995, with a final export ban by 2000 (Donnelly 1991).

Similarly, there will be a rapid decline in the availability of large dimension ('old-growth') logs from the Pacific coast of North America, requiring a switch to smaller diameter (regrowth) logs. This may in itself affect the attractiveness of the products to Japanese industries designed to process old-growth logs, and to consumers accustomed to wide clear boards. However, legislative and environmental constraints are likely to have the greatest impacts on export volumes (Donnelly 1991). USA legislation has limited the volume of sawnwood available for export, and has stopped log exports from federal and state forests. Log exports from Canada were virtually eliminated by a prohibitive tax imposed in 1990.

The environmental constraints are those associated with a social trend towards greater preservation of forests. This applies to both the USA and Canada. Within the Pacific Northwest of the USA, conservation of habitat for the spotted owl may greatly restrict industry access to remaining old-growth forest on public land; and in British Columbia current indications support a 20 percent reduction in annual harvest on environmental grounds.

Because these legislative and environmental actions will focus on public lands, increased cutting on private lands might be anticipated for the short term. Hence a significant reduction in exports from North America may not become apparent until the mid to late 1990s', but beyond this, export volume could decline rapidly.

Against this background Japan recognizes there must be rapid expansion in the number of countries from which timber is imported. This means, essentially, those countries of the southern hemisphere with substantial plantation resources, including Chile, New Zealand, and Australia (Nomura 1991). To these might be added South Africa and Brazil. Nomura sees the Japanese timber trade undergoing '... relatively dramatic expansion and dispersion' and recognizes New Zealand specifically as an emerging source of supply.

Thus it appears that Japan could be facing an imminent and possibly severe shortage of timber, and this could generate the vigorous pursuit of imports from countries beyond the traditional sources of supply. However, the longer term position is unclear. Japan has 25 million ha of forest (including both natural and man-made forests), and longer term trading relationships may depend on the extent to which this resource will be utilized in the future. Therefore, in any evaluation of future trading relationships, it is essential to consider the status of Japan's forests and prospects for the domestic sector industries.

3. The Status of Forestry and the Domestic-sector Industries

Japan has 25 million ha of forest land (Table 1). This can be divided into 'National Forest' administered by Japan's Forestry Agency (31% of total forest area) and 'non-national' forest (69%). The non-national forest is either publicly owned (by prefectures, cities, towns, villages) accounting for 11 percent of the total forest area; or privately owned (58%). The forest in private ownership is a major source of wood in Japan.

Table 1 Japan's forest areas (March 1986)
(Ministry of Agriculture, Forestry and Fisheries 1990)

	Area ¹	Man-made forest	Natural forest	Other ²
National forest	7,877	2,466	4,736	685
Public forest	2,684	1,152	1,424	108
Private forest	14,684	6,601	7,506	576
TOTAL	25,255	10,219	13,666	1,369

1 1000 ha

2 Cutover lands, bamboo forest, etc.

Japan's natural forests had been heavily cutover and much degraded during a period of economic growth between World Wars I and II and during World War II itself. An overview of post-war forest policy in Japan is given by Handa (1988). A period of post-war reconstruction sought to stabilize and regulate the use and management of the forests. A large planting program was initiated to rehabilitate degraded forest land in all ownerships, and to meet as much of the wood demand as possible from domestic sources. There are now more than 10 million ha of man-made forest in Japan, with 6 million ha of this in private ownership. The plantations are almost totally coniferous - mainly Japanese cedar (*Cryptomeria japonica*) and Japanese cypress (*Chamaecyparis obtusa*). The scale of the national effort directed to the plantation program is indicated by the 3.75 million ha planted between 1951 and 1960, and a peak annual planting of 430,000 ha during this period.

The orderly expression of post-war forest policy was overtaken by the exceptional rate of growth of the economy during the 1950s and 1960s. The gap between domestic supply and demand widened and timber prices rose (e.g. as shown in Kumazaki 1988). The government responded at first by increasing the rate of cutting on the National Forest and, for a time, National Forest districts became prosperous lumber producing centres (Kawamura 1984). In this way output of the domestic forest matched growth in consumption until 1960 (Kumazaki 1988). However, there was a price to pay. Old-growth forests which were formerly economically and physically inaccessible were now exploited, and sometimes devastated. Attempts to develop 'natural' forests on a large scale in mountainous areas failed, and costs of rehabilitation became unacceptably high (Nagumo 1988). In order to reduce pressures on the National Forests and to slow down the rate at which timber prices were increasing, the government now had little option other than to permit unrestricted log imports. This was done in 1960.

Japan restricts the import of primary products such as beef, rice and sugar in order to shield from competition some 4 million farm households - 70 percent of which depend for their livelihood on holdings less than 1.0 ha in area (Ministry of Agriculture, Forestry and Fisheries 1990). However, given the serious timber deficit and the condition of the forests, it was impossible to treat the 'forestry households' in the same way without jeopardizing wider economic development. When freed of controls, timber imports grew rapidly and, as the Japanese currency appreciated against that of the trading partners, the price of imported timber fell. The increasing costs of domestic wood production, and the declining price of imported timber, were to have serious consequences for Japanese forestry.

This was not the first time this had happened. Following the 'Great Earthquake' of 1923, the government increased the volume harvested from the national forests, and increased timber purchases from the USA. This resulted in a severe depression within the timber producing districts (Murashima 1988). However, in this case, increases in timber tariffs, the reduced demand for timber during the Great Depression of the 1930s, and relief employment in the mountain villages, helped restore the status of the domestic industry.

The weak competitive position of Japanese forestry

The weak competitive position of Japan's domestic forestry is caused by four main factors (i) pattern of small and dispersed ownership of forest land (ii) the high costs of producing wood (relative to the market price of timber) (iii) the structure of the processing industries drawing wood from the domestic forests, and (iv) the shortage of labour in the wood producing districts.

Forest land ownership. Statistics on private ownership of forest land in Japan highlight a basic problem in improving the efficiency and competitiveness of domestic wood production. There are 2.5 million 'forestry households', and this excludes ownership by companies, shrines and temples, cooperatives, municipalities, and so on (Ministry of Agriculture, Forestry and Fisheries 1990; Komaki 1991). The typical forest ownership is small: 57 percent own less than 1 ha, 31 percent between 1 and 5 ha, 9 percent between 5 and 20 ha, and 2 percent over 20 ha. The average size of the forest area owned by individuals is 2.6 ha. The fact that 88 percent of the 2.5 million forest owners have holding of less than 5 ha creates a highly dispersed pattern of small forest ownership, and hence difficult circumstances for efficient management and utilization of the resource. The more active promotion of 'Forest Cooperatives' from about 1970 was designed to improve private forestry, and their contribution to afforestation has been highly significant (Handa 1988). However, the Cooperatives are subject to the same economic stresses as the individual owner, and their present financial situation has been deteriorating rapidly (Morita 1988).

Production costs and timber prices. The cost of a typical plantation program for Japanese cedar is described by Komaki (1991). Essential details are given in Table 2. By New Zealand and Australian standards this cost is outstandingly high (see the second of our papers in this Bulletin). The costs related to silviculture (1.9 million yen per ha) are direct costs, that is, they do not include any land rent or interest component. The seedling cost alone is around 200,000 yen per ha; and, under conditions of high rainfall and good soil fertility, weeding expenses account for 40 percent of all silvicultural costs.

Most of the silvicultural operations are based on manual labour. Machine use is limited by steep topography, unstable soils, high rainfall and the small forest ownerships. Workers compensation and other insurance charges are expensive in Japan, contributing to the high 'social cost' of plantation programs.

Table 2 Cost of typical forest operations in establishing, maintaining and harvesting a Japanese cedar (*Cryptomeria japonica*) plantation (Komaki 1991)

		Cost ¹ per ha (1000 yen)	
Harvesting ²		3,598	
Regeneration ³)	825)
Cleaning/ Pruning ⁴) silvicultural	291)
Forest Improvement ⁵) Costs	12) 1,879
Protection/ Administration)	89)
Social and other costs ⁶)	661)
TOTAL		5,476	

1 All costs presented without subtracting subsidies.

2 Includes costs of materials, social costs, depreciation, control of operations, owners own work

3 Soil preparation, cleaning, plants, planting, replanting, brushing and weeding, initial fertilization

4 Vine cutting, pre-commercial thinning, pruning

5 Drainage, continuing fertilization

6 Social costs (workers compensation and other insurances, control of operations, miscellaneous costs)

Timber prices in Japan (at roadside, at log markets and as sawnwood) are shown in Table 3. The price of Japanese cedar at roadside (1989-1991) was 14,361 yen per m³, and the price of Japanese cypress more than double this. The consumer is obviously prepared to pay premium prices for timber with particular attributes. Under import competition the prices of Japanese cedar and an imported softwood (western hemlock) at the log market are more or less similar. However, the price of Japanese cedar sawnwood is 12 percent greater than that of the imported product.

Despite what appears to be a favourable price structure for small dimension logs, these prices represent a market price of timber which has fallen appreciably under import competition. For example, the price of Japanese cedar fell as much as 31 percent between 1980 (when the price was at a peak) and 1986. During the past 10 years, costs of production have risen 12 percent relative to the market price of logs, and stumpage has fallen 34 to 56 percent - depending on species and the time span for which information was available (Komaki 1991). Nagumo (1988) puts the changing economic position another way: in 1965 the revenue from 1m³ of Japanese cedar would pay for a worker for 11 days; this decreased to 3.3 days in 1977 and to 2 days in 1984.

An estimate of the internal rate of return for Japanese cedar shows it falling from 8.1 percent in 1961 to below 2.0 percent in 1986. This is without consideration of subsidies; a rise in the internal rate of return of about 1 to 2 percent can be obtained by including the subsidies (Komaki 1991). Thus it is

apparent there is now little incentive for active forestry households. Some have ceased investment by withdrawing substantially from forest management, others have entered into proceeds-sharing afforestation with the Forest Development Corporation of their prefecture.

Table 3. Log and Timber Prices in Japan from Annual Report on the Trend of Forestry in Japan (Japan Forestry Agency)
Prices are average prices (1989-91) per m³ (yen)

	Domestic Timber		Imported (USA)	Imported (SE Asia)	Imported (Russia)
	Japanese Cedar	Japanese Cypress	Western Hemlock	Tropical Wood	Spruce
Price of log at roadside	14,361	33,048	—	—	—
Price of log market	26,166 ¹	66,267 ¹	25,433 ²	27,300 ³	25,367 ⁴
Price of sawn timber ⁵	61,733	117,466	54,733	Mainly converted to plywood	

1 Price for logs 14-22cm diam and 3.6 to 4.0m length

2 Price for logs 30cm diam and 6m length

3 Price for logs 60cm diam, 6 m length

4 Price for logs 20-28cm diam, 3.8m length.

5 Price based on a post 10.5 x 10.5cm end dimensions, and 3.0m length.

The structure of the domestic-sector forest industries. In 1981 there were about 20,000 sawmills in Japan. These are scattered throughout the country and are found in every area. They are divided broadly into 3 types (i) the inland types located in the vicinity of forestry districts and handling primarily domestic timber (ii) coastal types working mainly with imported timber and (iii) intermediate types adjacent to consumption centres. The mill size is generally small with an average 8.9 employees per sawmill. In the domestic sector of the sawmilling industry especially, the overwhelming majority of sawmills are small enterprises (Forestry Agency 1981). Iwai (1986) cites the case of a prefecture where there are 150 to 190 sawmills with an average production of only 3000 to 4000m³ per year - though with a high degree of product specialization. Some restructuring of the domestic industry could be a crucial factor in reducing costs and revitalizing forestry in Japan.

Labour Shortages. As forestry in Japan lost its economic power, a large part of the workforce left for the cities. For example, the available workforce declined from around 440,000 in 1960 to less than 200,000 in 1975, and 140,000 in 1985. There has been a decline in the forestry and industry workforce elsewhere in the world during the past several decades, for example, in Australia. However, this has resulted mainly from mechanization and improving operational efficiency rather than a decline in the industry itself.

It is not only the workforce which has declined, it is becoming older as well. In 1985, of the 140,000 forest workers in Japan 60 percent were over 50 years of age, and only 16 percent were under 40 years.

This hardly creates confidence for the future.

The departure of people for the cities, and the weak economic position of the timber industry have had a profound effect on rural communities, particularly the 'mountain villages' of Japan. A comprehensive analysis of mountain village policy is given by Yamada (1988). These villages had depended on a mix of agriculture and forestry, creating a stable way of life, with people living in cooperation and harmony (Okada 1991). The importation and declining price of timber caused drastic changes to that way of life. Many of the villages have been totally deserted. The redevelopment of forestry in Japan presupposes the repopulation of many mountain villages and the re-creation of a stable and skilled workforce.

4. Revitalization of Forestry in Japan - Will it be Possible?

Nagumo (1988) believes serious problems with the domestic forests might have been avoided had there been greater control of timber imports and prices. However, it is difficult to envisage what else governments might have done under the circumstances of the times. It was undoubtedly a well-conceived move to free up international trade in forest products in 1960; it might not have been possible at that time to predict the long-term problems this would create.

Whatever the debate about the past, the important questions relate to the future. As Japan loses access to the traditional imports, the most pressing questions appear to be these:

- (i) will there be, in fact, a continuing high demand for timber in the future;
- (ii) will it be possible for Japan to develop to full potential the domestic forestry sector so that it takes over, once again, the primary role in wood supply; and
- (iii) what compensatory sources of imported timber might be available, at least for the short term (e.g. the next 20 to 30 years).

The first two questions will be considered here, and the second in section 5.

The long term demand for wood

It is pertinent to ask at this stage whether there will be, in fact, a continuing high demand for wood. Wood demand in Japan increased consistently until, in 1970, it reached 100 million m³. It has not subsequently declined below this level. Yet many of the products which used to be made of wood have been replaced progressively by other materials. Reasons for the continuing high demand for wood include (i) the vastly increased use of paper and paper products (increasing by a factor of 15 in the 25 years 1950-1975) (ii) increased use of plywood and particle and fibre boards in construction (iii) an exceptional demand for housing as incomes increased and people sought larger homes - with fewer residents per home. The Forestry Agency and the Japan Forest Technical Association (1983) suggest in the following terms why the demand for wood will not decline:

'It is a fact that today wood is disappearing from the various scenes of our daily life except the house. It is true also that there are an increasing number of people who are attracted to the natural warmth found only in wood and who care for wooden things or

place artistic value on handicrafts. Although proceeding slowly there are signs of a resurgence of wood culture'

The production potential of the domestic forests

The production potential of the Japanese forest is enormous, and this can be illustrated by reference to the man-made forests alone. These forests are presently accruing wood increment at the rate of 76 million m³ per year. Given the present rate of harvest of only 33 million m³ per year, Nagumo (1988) sees the day when the total annual wood increment will reach 100 million m³. This would be sufficient to meet Japan's total demand for wood. However, it will be some time yet before it is possible to realize that potential through the production of commercially acceptable sawlogs.

Both Japanese cedar and Japanese cypress are among the more 'tolerant' of plantation species. They do not have the rapid early growth rate of *radiata* and Caribbean pines, or as early a peak in current annual volume production. Alternatively, they can maintain a greater stand volume production at later ages and higher stand densities than the pines. Because of this, Japanese cedar and cypress were grown traditionally at high stockings in long (100 year) rotations. While this is no longer possible on any scale, the minimum rotation needed to produce a commercially acceptable sawlog would be 45 to 60 years. Where the management objective is the production of higher quality wood, the rotation might be greater than this.

The age structure of Japan's man-made forests (Fig 1) suggests that if age 60 were to be accepted as a rotation age, large volumes of sawlog trees could begin to come available around 20 years from now (that is, around 2010), and there could be a peak in production around 30 years from now. If 50 years were to be adopted as a rotation age for Japanese cedar and Japanese cypress (as advocated in the national forest plan), large scale production might begin 10-20 years from now. But will it be economically feasible to harvest and replant the man-made forests on a large scale?



Fig 1. Age class distribution of man-made forests in Japan (all species)

Prospects for the domestic sector industry

The redevelopment or revitalization of domestic forestry and the forest industries will not be easy. The more pessimistic view would hold that it will be near-impossible; forest is being harvested and not replaced and this will ultimately affect the long term viability of forestry and lumber centres in Japan. There are some who believe that the domestic forestry sector might supply around, say, 50 percent of the timber demand, but this will require an increase in timber prices. Yet others simply recognize the seriousness of the problems, and want them addressed on a number of fronts. Nagumo (1988) believes it is essential that forest policies be tailored to creating stability for the domestic sector. Some examples of initiatives suggested in the literature follow.

(i) The most basic requirement, perhaps, is that of stabilizing harvesting and silvicultural costs. A large investment may be needed just to contain cost increases; a reduction in costs may be virtually impossible where the cost of labour continues to increase. While there may be cogent reasons for the continuing use of manual labour, effective cost containment might not be achieved unless modern plantation establishment technologies are used (e.g. weedicides), more profitable stand management regimes are developed, and appropriate machines are designed and used to the greatest possible extent. These topics are discussed further in the second of our papers in next Bulletin.

(ii) As long as Japan's economy remains generally strong, the labour shortage may be difficult to overcome. While consideration might be given to the use of foreign labour, it is difficult to accept this as the most appropriate resolution of the problem for the long term. Alternatively, it might be possible to look to ways in which the trend to depopulation of mountain villages might be reversed. For example, Okada (1991) suggests the mountain villages could become a significant recreational and cultural resource as increasingly affluent urban populations develop a stronger sense of nature and environmental values. It would be an important part of any such development that the traditional agricultural and forestry pursuits of the villages be maintained and protected, and village living stabilized in this way.

(iii) It will be essential to address the inefficiencies in the current industry structure. As one step Sakai (1986) recognizes the need to reorganize log distribution by enhancing the role of log markets in classifying and sorting logs to meet the needs of different mills. Iwai (1986) describes the way one forestry district (Yoshina) has been able to maintain both timber quality and a recognized market niche. Yoshina district had been famous for the production of high quality boles at high stockings on a 100 year rotation. When it was no longer possible to do so, Yoshina district formed a cooperative 'Timber Centre' by drawing on resources from surrounding areas, improving log collection facilities, allocating logs to appropriate mills (sometimes with specialized facilities), marketing the output of high quality products in this way, and improving the marketing process for them. While this is certainly an important step, it may not be enough. Sakai (1992), for example, recognized the importance of economies of scale, that is, taking advantage of mass production techniques in order to handle increased volume. A comprehensive restructuring of industry and an integration of management and industrial planning might be needed in order to ensure the availability of markets for the wood produced under more profitable stand management regimes. This is discussed in the second of our papers in next Bulletin.

(iv) The use of locally produced timber might be encouraged in a number of ways. Iwai (1986) cites the case of a prefectural government which subsidizes the price of a newly built wooden house on condition it is built with timber produced in the prefecture. A typical subsidy is 510,000 yen.

(v) As part of any restructuring and revitalizing of forestry, it will be necessary to determine at the outset just what part of the present resource will contribute to wood production in the future. As in many other countries, Nagumo (1988) sees the most important problem facing Japan to be that of realizing the co-existence of timber production and environmental conservation. There has been a marked shift in public attitudes to the forests. Japan's economy as a whole does not appear to be overly concerned about the declining supply of home-grown timber. Japan is becoming more and more a processing nation, importing fuel, minerals, foodstuffs and timber, and exporting manufactured goods to pay for them (Kumazaki 1988). Moreover, the impact of post-war rapid economic growth has tended to bring environmental values of the forest into sharper focus, and to assign them higher priority in setting policies and defining objectives. Kakizawa (1989) argues that Japan might adopt the USA processes of environmental impact assessment to conserve important environmental values, and public participation processes in order to achieve multiple-purpose objectives. Whatever the planning procedures used, Japan could have an outstanding opportunity to achieve a socially acceptable balance between production and conservation early in the process of restructuring or revitalizing the forest industry.

Against all this background, it is difficult to envisage that Japan will not make a serious attempt to restore the economic strength of the domestic forest industries. However, the extent to which it can do so must remain, for the present, uncertain. If the efficiency of plantation production, log distribution and processing can be improved, then Japan could have a domestic resource which can have a major effect of regional and world timber trade (Nomura 1991).

5. Prospects for Exporting Countries

An impending change in Japan's pattern of trade in forest products may be particularly advantageous to countries which already have a large export surplus of plantation-grown sawlogs and processed timber. New Zealand is an example of one such country. Alternatively, there are countries, like Australia, where plantation policy has not been export-oriented, though this could change as appropriate export markets emerge.

A New Zealand perspective

There are few uncertainties about the direction and strength of New Zealand's plantation policy. The Proceedings of the recent ANZIF Conference (Allen and Whyte 1991) contain seven papers concerned with New Zealand's plantation resources and export prospects. The New Zealand forest sector is embarking on an era of unprecedented growth, generated in large measure by an appreciation of changes in trading relationships within the Pacific Basin. New Zealand now sees its radiata pine resource as a particularly valuable asset-able to make a major contribution to export earnings and the vigour of the national economy.

Softwood production in New Zealand will double over the next 15 years, and the output of premium grade sawlogs increase fivefold (Ffowcs-Williams 1991). There could be an export surplus of around 10

million m³ roundwood equivalent by 2000 (Ogle 1991), and an export earning of \$4 billion could be generated by 2010 (Ffowcs-Williams 1991). Further processing could lift these earnings by over 50 per cent.

Competition for export markets can be expected, principally from the Soviet Far East and Chile. Coniferous log exports from the Soviet Far East already have a big share in the plywood, construction and packaging markets in Japan, and could make significant inroads into the South Korean market in the near future (Larsen 1991). However, Larsen argues that New Zealand-grown radiata pine has the competitive advantage of reliability of supply and uniformity of quality, and that significant investment in infrastructure and technical and operational activities are needed before the Soviet Far East will be competitive in quality and supply terms.

Chile has a similar capability to New Zealand both in terms of products and harvest volumes. The current harvest in Chile is 12 million m³ and this is expected to increase to 20 million by 2000. While the focus of plantation development in Chile has been on the pulp and paper industry (Donnelly 1991), radiata pine has been exported to Japan since 1980, peaking in 1986 at 421,000m³ (Kawata 1992). Because major pruning and thinning regimes in Chile were introduced only in 1960, product quality will differ from that of the New Zealand pine. The logs will be smaller and more knotty, though their slower growth, narrower rings and greater strength may appeal to some users.

New Zealand export of radiata pine to Japan was relatively low from the mid 1970s to the mid 1980s, but has expanded rapidly since then. The total volume export to Japan in 1990 was 1.5 million m³ - four times greater than that in 1986 (Kawata 1992). A large part of the New Zealand export has been in log form rather than as processed products. However, this should change progressively. Japanese companies purchased portions of the State plantation resource when that resource was 'privatised' in 1989, and manufacturing plants are being established to produce flooring, plywood and laminated veneer lumber (Kawata 1992). Other Japanese companies have established a sawmill in New Zealand, and there is continuing interest in establishing joint-venture industries.

An Australian perspective

There is greater uncertainty in Australia about the direction of plantation policy. However, it is recognized that the prospects for developing an export industry will have great bearing on that policy. Dargavel (1991) aptly puts it this way ... Planning and policy setting procedures for forestry need to be designed specifically to cope with the dynamic yet uncertain context of the forestry sector in the Pacific Basin.

Australia currently has only around 1 million ha of plantation, predominantly softwood. This is probably adequate for domestic needs and may provide a small sawlog surplus beyond 2000. There is already a surplus of softwood pulpwood for export, but only because of inadequate processing capacity for small dimension plantation thinnings. Ironically, Australia exports softwood pulpwood while importing softwood-based pulp and paper products.

The policy dilemma for Australia is this: should the plantation estate be maintained at about its current size, or should it be expanded to perhaps 1.5 million ha or even 2.0 million ha in order to service an export industry - as advocated by FAFPIC 1987. Shepherd (1991) explores this question in terms of Australian plantation productivity, availability of land, environmental concerns, the competitiveness of Australian industries, economies of scale, availability of markets and other matters.

Australia's competitive position for softwood exports will be affected more by the cost structures facing all Australian industries, than by any notable inefficiencies in the plantation and forest industry sectors. Australian softwood processing industries are technologically modern, systems for plantation establishment and management are well developed, and there are prospects for increasing unit area production in second and later rotations. Alternatively, the forest industries are sensitive to a wide range of costs - the cost of capital, labour and wood costs, and the costs of power, shipping and transport (Jaacko Poyry 1986, FAFPIC 1990). Transport costs are regarded as one of the main limitations to export growth in New Zealand (14 to 32% of the forest exporter's total cost). These costs will be even more limiting in Australia where, for example, wharf charges may be double those of New Zealand (Clarke 1991).

The achievement of greater economies of scale in softwood production will be a vital consideration in increasing the price-competitiveness of Australian softwood. Indeed, greater economies of scale may be needed simply to remain competitive in the domestic market. Shepherd (1991) asks whether Australia can afford not to expand the plantation resource, an expansion which would, in turn, generate an export surplus. Greater economies of scale can come both from an expansion of the present plantation area, and an increase in the productivity of existing plantations through more effective site preparation, weed control, fertilizer regimes and tree breeding. It will be appropriate to pursue both pathways.

Economies of scale also apply to the forest industries. Jaacko Poyry (1986) showed that, for most product sectors, Australian producers with world-sized mills could be highly competitive in domestic markets, and that in many product sectors Australian producers could be competitive in export markets. It follows that competitiveness may be greatly enhanced where any expansion of the planting program focuses on a limited number of current plantation programs capable of supporting a balanced mix of world-size industries.

Should there be sufficient confidence in the long-term competitive position of Australian softwood, attention might focus on overseas markets and the timing of access to those markets. For example, it could be around 10 years before the Australian softwood program produces a domestic surplus-though this depends on the rate of import replacement, the continuing availability of hardwood sawlogs at the predicted level, and other factors. This is getting close to the time when Japan's domestic production of coniferous sawlogs might begin to increase appreciably, possibly restricting Australian access to a market now dominated by New Zealand, Chile and, perhaps, other countries beyond the Pacific Basin.

It follows that if Australian plantation policy is to become export-oriented, it may be in the national interest to establish a market niche in Japan and other North Asian countries as soon as possible. This might be done as Australian softwood production increases rapidly through the 1990s. Exporters might

project the particular attributes of Australian softwood which could give it a competitive advantage in some markets - including wood with narrower growth rings than that produced in New Zealand, and good strength properties and grades. The consequences for the Australian domestic market might not be serious. The process of import replacement can be prolonged, and the hardwood sawlog industry would undoubtedly welcome the opportunity to maintain a market share that is greater than predicted. Establishment of a softwood market niche could be facilitated where Australia is also able to supply small volumes of 'value added' fine hardwood timbers - but that's another question.

6. Conclusion

The declining availability of exports from the natural forests of North America and Southeast Asia represent the end of an era. The emergence of trading relationships based on plantation forests represents the beginning of another. Countries with plantation-based forest economies must determine whether their plantation resources are designed to service only domestic needs, or whether that resource should be expanded to service export markets in a significant way.

It is impossible to base any firm conclusions on the information provided in this paper. It addresses the timber economy of, and trading prospects with only one country, Japan. There are other North and Southeast Asian countries with expanding economies and limited forest resources. There could be, for example, a large potential market in China as its economy develops and the living standards of the people increase. Despite these general perceptions, it may be difficult for countries, like Australia, to develop a strongly export-oriented plantation policy without some firmer appreciation of Australia's potential contribution to the future Pacific Basin market.

It follows that there is a case for greater dialogue between countries of the Pacific Basin on trends in timber consumption and future sources of timber supply. There are uncertainties (both external and internal) which Australia might wish to resolve before governments and industries are willing to commit themselves fully to a greatly expanded softwood plantation program. Given the 30 to 40 years between tree planting and sawlog harvesting, it is becoming urgent that governments and industries within the Pacific Basin countries develop a dialogue on these matters and initiate, perhaps, cooperative policy and management studies.

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日本の将来の木材供給についての検討

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要 約

日本は総木材消費量の70%を輸入に頼っている。しかしながら、これまでの産出地域（北アメリカ、東南アジア）からの木材供給は急速に減少しつつある。日本は相当な森林資源を有しているが、しかしその競争的立場は弱い。この理由は調査されている。この論文では日本の国産材生産の回復と針葉樹人工林材の輸入の増大についての展望を検討している。

オーストラリアは針葉樹人工林材の重要な輸出国になることができるだろう。しかし、この国が木材資源を多量に輸出することができる前に、すなわち輸出向けの針葉樹計画を立てる以前に解決すべきいろいろな問題がある。この論文は将来における木材の必要性や貿易関係について関係地域の国々の間で一層の話し合いを求めている。