

Public Disclosure Authorized

Document of  
**The World Bank**

**FOR OFFICIAL USE ONLY**

**Report No. 8545-A31**

**MARKET PROSPECTS FOR FOREST**

**PRODUCTS FROM THE PACIFIC ISLANDS**

**VOLUME I - MAIN REPORT**

**MAY 25, 1990**

**Agriculture Operations Division  
Country Department V  
Asia Regional Office**

**This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.**

Public Disclosure Authorized

MARKET PROSPECTS FOR FOREST PRODUCTS  
FROM THE PACIFIC ISLANDS

Volume I--Main Report

Table of Contents

	<u>Page No.</u>
Preface . . . . .	i
Executive Summary . . . . .	ii
I. <u>INTRODUCTION</u> . . . . .	1
II. <u>THE MAJOR IMPORT MARKETS</u> . . . . .	2
World Wood Removals and the Place of Tropical Hardwoods . . . . .	2
Japan . . . . .	4
Europe . . . . .	8
The Pacific Northwest . . . . .	13
Other Markets . . . . .	14
III. <u>COMPETING SOURCES OF SUPPLY</u> . . . . .	16
The Pacific Rim . . . . .	16
The New Southern Resource . . . . .	18
South East Asia . . . . .	19
IV. <u>MARKET IMPLICATIONS FOR FOREST SECTOR STRATEGY IN THE</u> <u>PACIFIC ISLANDS</u> . . . . .	23
Major Market Factors . . . . .	23
Global Market Trends . . . . .	23
Freight Factors . . . . .	24
Environmental Considerations . . . . .	25
Implications for Pacific Island Production . . . . .	27
Resource Type and Quality . . . . .	27
Sector Evolution and Product Type . . . . .	29
Broader Sectoral Issues . . . . .	31
Command Processing . . . . .	31
Others Issues: Land Tenure . . . . .	33
Future Directions for the Pacific Islands Forestry Sectors . . . . .	34
Implications for Sector Development . . . . .	34
Implications for Donor Agencies . . . . .	35
Glossary	
Bibliography	

PREFACE

This report synthesizes the findings of a review of market prospects for forest products from the Pacific Islands which was carried out in 1989 with financial assistance from the Government of Australia. It also analyzes some generic market and industry policy issues, from which it suggests some conclusions on forest development strategies for the four principal producer countries covered in the report: Fiji, Papua New Guinea, the Solomon Islands, and Vanuatu.

The report is presented in three volumes. Volume I (The Main Report) provides the overall summary of findings of generic issues; Volume II provides a summary of the main market studies and sectoral issues in the Pacific Islands; and Volume III contains background statistical data.

## EXECUTIVE SUMMARY

### Major Market Findings

1. The review of major market prospects led to several general conclusions:

- The rate of growth of consumption of forest products (in terms of roundwood or log equivalents) in major markets has slowed appreciably, from rates in excess of 3% p.a. in the 1950s, to a little over 1% p.a. at present. This is due to structural changes in consumption such as the demographics of housing demand and the effect of technology on the longevity and efficiency of use of wood.
- There is no global shortage of wood developing in the foreseeable future. Tropical timber is becoming scarce, but its substitutes (temperate hardwood and, increasingly, softwoods) are not. Thus, while trade in tropical forest products has declined by some 25% since 1979, this has had no appreciable price effect.
- A scarcity premium does seem to attach to high value, decorative tropical rainforest species, for which prices are rising quite strongly. Other markets where demand seems somewhat more robust than the general trend, are: short fibered pulp furnish which can be produced from fast growing hardwoods suitable for plantation in the tropics; and some specialized products which can be made from the medium grade tropical species--certain types of joinery, carpentry and moldings. These products are more reliant on quality control and effective marketing than on capital and technology in processing.
- The Pacific Islands producers will need to closely monitor the potential market imports of some major supply changes around the Pacific rim. The output of softwood from Chile and Australia and efforts by Canada to find alternative markets to the US for its lumber, are two important developments in this respect.

### Environmental Factors

2. At present, some important importing countries are, or are considering, introducing bans on imports of tropical forest products obtained in environmentally destructive ways. It is likely that much of the Pacific Islands' output could be regarded as falling in this category. However, by altering their approach, Pacific Island nations may be able to turn growing environmental concern to their advantage. Plantation hardwoods, as long as they are grown on degraded or cleared areas, can be marketed as the environmentally sound alternative. Such plantations have been evaluated as economically viable in specific projects analyzed in the Pacific Islands region. Also, the Pacific Islands should be able to gain strong financial support from donors in efforts to reduce logging and generally to invest in forest conserving alternatives to current practices. These will, to a large extent, be consistent with site protection and tourism objectives.

## Forest Sector Strategy Implications

3. The review of international forest product market developments leads to some suggestions for sector strategy in the Pacific Island region:

### (a) Resource type and quality

4. The natural forests of the Pacific Islands region contain varying concentrations of high quality species. Given the already high premia which attach to these, and the likelihood that the differential between them and medium grade species will widen farther, the report draws two conclusions:

- There is probably underinvestment in monitoring and supervision in the marketing chain in the forestry sector of the Pacific Islands. Control over utilization standards, log measurement, classification and revenue collection are the means by which resource owners will maximize collection of rents for premium species.
- There may be merit in reversing the normal strategy of natural forest utilization, which is to proceed from exploitation of the better quality area to less valuable resources, to take advantage of the price effects of conserving premium species. Alternatively, the concept of low impact extraction of high value logs might be worthy of further exploration, from both environmental and economic viewpoints.

5. For plantations of species intended for structural or decorative end uses, the objectives must be to market into the highest premium categories possible. In the case of softwood plantations, this will require market promotion activities to differentiate the product from the rapidly growing softwood resources on the Pacific rim. In the case of the high quality hardwood plantations, there is little doubt these will sell into lucrative markets, so long as reliability of supply--which is important in this market--is maintained.

6. Where Pacific Island countries are considering investment in fast-growing hardwood plantations, the most logical strategy would be to ensure that species type and infrastructure investments are selected to permit the resource to be marketed as pulpwood, in addition to (or perhaps even as an alternative to) sawlogs, since the sawlog market must be seen as a risky market at this time.

### (b) Sector Evolution and Product Type

7. The standard progression of forest sector development, from log exporting through primary processing (basic sawn material and ply) to more sophisticated production, may not be optimal for the Pacific Islands. This is because:

- Competition in the primary processed markets from other Pacific rim suppliers is particularly intense.

- Small countries can market a significant proportion of their output as specialized components or household items; they do not need the high volume primary processed markets to absorb the volume they can produce.

8. Some specific processing suggestions are made in the report:

- Papua New Guinea may be better advised to abandon its current intention to develop a widespread basic sawmilling sector. Instead, it may be able to utilize its existing log exporting infrastructure to accumulate sufficient quantities of premium species logs at export points, for processing into precision sawn material.
- Fiji may need to re-design the large softwood sawmill it has recently commissioned, to produce appearance grade material, so as to take the resource beyond the highly competitive primary processed softwood market of the Pacific rim.
- The Solomon Islands should abandon the policy of requiring log exporters to build processing plants, because it results in low grade mills with little incentive to produce efficiently.
- In Vanuata, considerable work needs to be done on land tenure, and on a possible quality problem in a major planted species, before significant progress in the plantation sector can be made.

#### (c) Command Processing

9. The final point made above is a specific example of the more general phenomenon of command processing, whereby governments attempt to create or retain forest products industries via regulation. All four countries of the region have command processing policies, and in some cases (e.g., in PNG) are considering introducing more. A common form of command processing is a log export ban (or restriction), frequently supplemented by various forms of domestic protection such as tariffs, import quotas, local content rules in housing, furniture, and so on for the industries which arise as a result.

10. The report argues that these forms of industry assistance will normally produce inefficient and inappropriate industries, since they are insulated from international competitive pressure and therefore have little incentive to improve productivity and performance. The report suggests that if, for wider economic or political reasons, Pacific Islands governments are committed to domestic processing, then positive incentives, which can be focussed so as to reward attainment of specific productivity or efficiency goals, are superior instruments to command processing policies.

#### Implications for Assistance Agencies

11. Traditionally donor assistance to forestry in the Pacific Islands has been heavily concentrated in institutional development, technical assistance in field management and resource assessment, and plantation development. In addition to these areas, agencies should consider investment in improving the capacity of the Pacific Islands nations to properly

administer the marketing chain, and to evaluate and promote their forest products in specialized product markets.

12. Market intelligence in products and markets identified in the report as being of high potential interest to the Pacific Islands could more efficiently be collected, processed and disseminated in a single operation for the benefit of the region, and this may require external involvement to initiate.

13. The International Tropical Timber Organization might be approached, firstly to alter its classification system so that the Pacific Islands appears as a separate category in its promotional activities, and secondly to raise the profile of the region in its marketing work in Japan.

## I. INTRODUCTION

1.1 The objective of this study is to extract, from information available on supply characteristics within the Pacific Islands region, and market developments in major importing regions, indicators of worthwhile changes in policy or practice in forestry and forest products sector marketing and management in the region. Thus, while a great deal of information has been collected in this study, it is used in this report only where it has a bearing on what the governments and people of the Pacific Islands can do to implement effective change.

1.2 Pacific Islands producers of forest products will remain price takers in the major markets in which they sell their output. In this case, this means they are subject not only to trends in demand, but also to political factors related to environmentalism in those major market areas. In the case of competing suppliers, it will become clear in this report that tropical hardwoods are not only competing internationally with temperate hardwoods for markets, but increasingly also with temperate softwoods; the zone of substitution is growing. Temperate zone softwoods as a group of products--both from traditional European and North American sources and the new Southern Hemisphere suppliers--are a much larger presence in the market than hardwoods.

1.3 For this reason, attention in the demand analyses in this report is focussed on the major markets, even in cases where the Pacific Islands region does not sell a particular product it produces in a given market. It is argued here that world wood markets, while still differentiated by taste, location and a range of domestic factors, are now sufficiently integrated for major market developments to be reflected in all markets, at least to some extent.

1.4 Obviously, a report of this nature cannot lay out detailed sector development strategies for the four countries in the region. Nor, given the diversity and distances separating these countries, can it attempt a unified regional marketing strategy. What it can attempt to do is shed light on some of the major generic issues that confront these countries in their pursuit of forest sector development:

- What are the major trends in international supply and demand for forest products? Where may markets develop? Where will major competition arise?
- Are current forest resource development and use patterns in the region optimal, in view of these major international forest product supply and demand trends?
- Are major changes required in policy, to pursue objectives of product type and quality, and sector evolution
- In particular, how effective are command processing policies, as compared with other measures to maximize returns from forest production?
- How might environmental factors--both at home and abroad--affect markets and output of forest products?

II. THE MAJOR EXPORT MARKETS

World Wood Removals and the Place of Tropical Hardwoods

2.1 Table 1 below summarizes the usage pattern of wood in the world:

Table 1: WORLD USAGE OF WOOD, 1986  
(million m<sup>3</sup> RWE /a)

	Developed Countries	Developing Countries
Hardwood	407	1,415
Conifers	1,062	245
Charcoal	-	117
Total	1,469	1,777
Fuelwood	257	1,298
Industrial	1,212	362
Charcoal	-	117
Total	1,469	1,777

/a Roundwood equivalent.

Source: Nectoux and Kuroda.

2.2 Table 2 shows the destination of tropical hardwood export volume by product type. Values are shown in brackets.

Table 2: DESTINATIONS OF TROPICAL HARDWOOD EXPORTS, 1986,  
(MILLION M<sup>3</sup> RE /a AND US\$10<sup>6</sup>)

	Logs	Sawn Timber	Veneer	Flywood	Pulpwood
Japan	12.11 (1,693)	0.83	0.21 (278)	0.57	0.33 (78)
Europe	4.09 (1,624)	4.22	0.33 (651)	7.44	- <u>/a</u> (122)
Far East Asia			15.4		
Other			2.8		

/a Includes pulp and waste paper.

2.3 Worldwide, the rate of growth of consumption of wood has been slowing down; in 1950-60, the average was 3.5% p.a.; in the 1970-80 period the average was 1.1%, although the rate appears to have risen somewhat in the late 1980s. Variations in economic growth rates explain some, but not all of this phenomenon: according to Arnold (1990), market maturity (in important areas such as housing in Japan, Europe and the US), and technical improvements in wood which reduce initial volume requirements and lengthen product life are important factors. According to FAO (1989), the volume of industrial wood and wood products entering international trade is about a third of total production; increasing proportions of processed wood products are being traded.

2.4 For nations such as the Pacific Islands, with a strong interest in trade of forest products, these global trends are of particular interest. One cause of the increasing international level of trade in processed wood products may be the progressive bans on export of raw material from a number of tropical countries, but as can be seen by comparing the volumes in Tables 1 and 2, this will be a minor factor. It must therefore be related to factors such as increasing specialization; the development of more niche markets; and possibly changes in the structure of demand towards products with higher value-to-volume ratios--making them more likely to enter trade. Arnold (1990) in fact notes a trend towards declining proportions of sawn timber in trade, and higher proportions of highly processed products, such as paper.

2.5 Whilst the projection of demand and supply for forest products is notoriously difficult, especially over the period necessary to be of use in forestry decisions, attempts continue to be made. Arnold (op cit) has summarized the outcome of some recent projections, and concludes that, despite well-publicized declines in the tropical forest resource in recent decades, there is no imminent world shortage of wood and little prospect for appreciable price increases.

2.6 In global terms, forest products trade is increasingly a matter of export of processed goods, suggesting that technology, efficiency in production and marketing are becoming more important determinants of comparative advantage than resource abundance. This is nothing new in international forestry, but the combination of this trend with outlook of no scarcity of the resource, suggests that any nation seeking to enter trade in forest products will face strong competition at all levels of value added in the market. This is particularly the case for exporters of tropical hardwoods. Although, as will be discussed further in this report, a certain proportion of tropical hardwoods enters specialized markets, a larger proportion competes directly with temperate hardwoods and, increasingly, softwoods - and there are both a larger suppliers to the market.

2.7 Within this overall scenario, it is useful to examine trends in the individual major wood consuming markets of the world.

Japan

2.8 In 1986 Japan relied on imports for some 70% of its forest product needs which amounted to some 95 million m<sup>3</sup> (RWE) in that year. It is the largest purchaser of tropical hardwoods. Table 3 summarizes the pattern of imports of wood products from the "South Seas" (i.e., the nations of South East Asia, Australia and the Pacific) since 1973.

Table 3: JAPANESE WOOD PRODUCTS IMPORTS  
FROM THE SOUTH SEAS  
(MILLIONS M<sup>3</sup> RWE)

	1973	1981	1986	1987
Logs	27	16	13	14
Sawn	0.1	1.0	0.85	1.25
Ply	0.5	0.1	1.0	2.7
Total	28.5	17.1	14.85	17.95

Source: Nectoux and Kuroda.

2.9 Per capita usage of sawn timber (most of which is used in house construction) has declined from 0.43 m<sup>3</sup>/capita/annum in the early 1970s to about 0.25 m<sup>3</sup>/capita/annum now: due largely to shifts towards high rise dwelling construction and demographic shifts reducing new housing demand. In the past, a major source of raw material for Japanese sawmills was hardwood from SE Asia, but from a level of 7 million m<sup>3</sup> in 1970, by 1987 this figure was less than 1.5 million m<sup>3</sup>: the supply of logs (predominantly softwoods) from N. America has remained fairly stable in the range 13-15.5 million m<sup>3</sup> p.a. over the same period.

2.10 The decline in tropical log imports is particularly striking. Vincent et al (1990) have utilized econometric methods in a multi-output

its major sources: North America, the USSR and the South Seas. The results indicate that Japan is increasingly substituting softwoods for tropical hardwoods (a phenomenon missed in earlier models which constrain softwood-hardwood substitutability). The authors believe that the Japanese sawmilling industry has made a strategic decision to get out of the tropical sawnwood business altogether. Total log imports to Japan declined from around 40 million m<sup>3</sup> p.a. to 28 million in m<sup>3</sup> p.a. in the early 1980s, due mainly to log exporting bans in Indonesia. In broad terms, Japan has simply not sought to replace this volume with other tropical logs (albeit that from the perspective of some small Pacific supplies--notably Papua New Guinea--this may appear to be the case). Nor have sawn timber imports substituted heavily for tropical log volume.

2.11 Japanese sawmills are characterized by slow cutting speeds, and by production of significant levels of small sized and low graded material as well as higher valued output. It is these characteristics, presumably, which account for the very high recovery rates--65-70%--which typify the Japanese mills.

2.12 Virtually all Japanese plywood is manufactured from SE Asian hardwoods. Mill numbers have declined, but overall production of ply has been relatively static at around 1.7 million m<sup>3</sup> through the 1980s. As can be seen from Table 3, Japan has become a significant importer of processed plywood; 98% of it from Indonesia.

2.13 More recent (unpublished) data suggest that the plywood import figure has risen significantly beyond the 1987 level. However, given that plymills still exist in Japan, and that the economics of factor substitution are similar in ply and sawn manufacture, there may be an increasing tendency to substitute softwoods in ply manufacture in Japan, as has happened in sawmilling, with further implications for the market for tropical ply logs, and possibly for tropical ply as well. There is some anecdotal evidence contained in the consultancy reports which were done as background for this report that suggests that this is indeed occurring in Japan.

2.14 Projections of demand and supply of forest products for Japan are available from the Ministry of Agriculture, Forests and Fisheries (see Table 4). MAFF calculates that imports of forest products will be 58 million m<sup>3</sup> in 1994, and 56 million m<sup>3</sup> in 2004. Domestic supplies are expected to take up an increasing share of the market. The projections imply a considerable increase in domestic supply, and there are a number of factors involved in this (see para. 2.20).

Table 4: MAFF PROJECTION OF JAPANESE  
DEMAND FOR FOREST PRODUCTS  
(million m<sup>3</sup>)

	1994	2004
Ply & panels	17	19
Pulpwood	35	40
Sawn timber	45	45
Other	4	5
	101	109
of which, est imports	58	56

2.15 The Japan Pulp and Paper Association projects modest increases in paper consumption for Japan to the year 2000: 1% p.a. for newsprint; 3% p.a. for printing and writing; 2% for container board, and 0% for packaging materials. Japan's high usage of waste paper in paper manufacture is well known: 24% in paper; 82% in paperboard. These figures are believed to be at a technical maximum; also, the trend in Japan towards higher quality papers will require larger inputs of pulpwood furnish. Japanese production of paper rose from 14.2 million tonnes in 1975, to 23 million tonnes in 1987. Japan depends on imported pulpwood (mostly in wood chip form) for about half its total pulp requirements.

2.16 The basic market outlook for other major forest product groups in Japan is as follows:

- (a) Housing and commercial construction. Currently this group uses 81% of total lumber, 45% of ply and 15% of panels consumed in Japan. As noted earlier, overall housing starts have declined recently, and the proportion of wooden houses has declined. However, tropical hardwoods are used mostly for decorative work in dwellings, and this market may be more resilient than the overall construction lumber and ply markets.
- (b) Industrial packaging. This group use 9% of lumber and 5% of ply. It is highly price sensitive, and is not expected to grow rapidly.
- (c) Furniture. This group uses 5% of lumber; 35% of ply and 80% of panels. The sector has experienced 8-9% growth rates in recent years, but this is not expected to continue; slower growth is projected. The sector is, and will remain, a useful market for medium density hardwoods.

2.17 In general, Japan pays no more now, in nominal yen terms, for its imported wood products than it did in the early 1970s, due to the strong value of the currency.

2.18 Japan is clearly attempting to diversify its sources of supply of wood chips. Government projections for 1995 show a strong move in hardwood chip supplies away from Australia--believed to be a high-risk supplier (see para. 4.18) to Chile and others.

2.19 In the longer term, Japan will move away from a heavy dependence on resource imports, and ultimately this will include such items as wood chips. Japan is investing in some forest processing off-shore, in response to constraints on supply due to log export bans and/or diminishing supplies, but also for sale of the products in third markets. The investments are not moving strongly into countries which have imposed bans in pursuit of domestic value added, but elsewhere (the US, Brazil and Chile), largely on the basis of favorable investment parameters.

2.20 A number of observations relevant to Pacific Islands forest products market prospects arise from the foregoing information and supporting material in the consultant reports done for this project:

- (a) Overall Japanese consumption of forest product imports is likely to rise, albeit quite slowly.
- (b) This trend will be strongly influenced by developments in domestic supply. At present, Japanese wood is expensive and difficult to extract, and most analysts agree this resource will remain expensive: current extraction costs for logs in Japan are up to three times those for North American Douglas Fir. However, as discussed in para. 3.12 below, this does not mean the Japanese resource will not be used.
- (c) Japanese producers of plywood may already be gearing increasingly towards use of softwood material for some products.
- (d) According to Nectoux and Kuroda (op. cit.), Japanese planners assume a reasonable continuity of supply from the South Seas region for perhaps another two decades, after which the temperate zone will become a more important source of supply. No major dislocation of Japanese industry is expected from this trend.
- (e) Demand for paper will, as noted earlier, remain fairly strong in Japan. Tropical hardwoods are not a source of supply for this industry, but plantation grown hardwoods suitable for growth in the Pacific Islands are: it is expected that, in general, some 50% of Japan's pulpwood supply will continue to come from hardwood chips.
- (f) The Japanese imported ply market is filled by Indonesia: it would be extremely difficult for new producers to break into this area. Quality ply, or flitches supplied to Japanese mills for manufacture of high quality sliced veneer, have better prospects.
- (g) The most certain part of the market appears to be that for high quality lumber and veneer species, for which there is a strong demand in Japan. The Pacific Islands region has some examples (discussed in the supporting reports) of such species.

Europe

2.21 Europe is a large purchaser of forest products, taking about half of internationally traded output. However, of the 500 million m<sup>3</sup> of forest products consumed annually in Europe, in recent years only 12-15 million m<sup>3</sup> has been tropical hardwood in the product groups of interest to the Pacific Islands: logs, sawn timber, ply and veneers, and further processed sawn material. The composition of tropical hardwood imports has altered markedly, with logs moving down from 47% in 1976, to about 30% by 1986; the balance being taken up primarily by sawn wood imports, and to a lesser extent plywood.

2.22 Africa has remained the predominant supplier of logs to Europe, but Asia now supplies 70% of sawn tropical hardwood imports. Asia also now supplies 80% of tropical hardwood ply imports by Europe.

2.23 A major question which arises in Europe is the future of European domestic supplies of timber. Projections cited in the supporting material for this report show increases in European production of both conifers and hardwoods: increases between 40 million m<sup>3</sup> p.a. and 88 million m<sup>3</sup> p.a., depending on assumptions used. This projection of an increase in production is supported to some extent by current thinking in Europe that the existing standing resource is undercut, and that environmental concerns and agricultural rationalization in Europe may encourage reforestation. Some doubt is cast upon the projection by another imponderable, the extent to which the so-called "new forest decline" in Europe--largely a result of acid rain--is manifested in the future.

2.24 Table 5 below summarizes projection data cited in the documents supporting this report:

Table 5: EUROPEAN WOOD SUPPLY AND DEMAND PROJECTION

	1980	2000 (low)	2000 (high)
Coniferous removals (million m <sup>3</sup> )	228	391	438
Non coniferous removals (million m <sup>3</sup> )	122	134	149
Sawnwood (million m <sup>3</sup> )	102	119	141
Wood based panels (million m <sup>3</sup> )	36	50	58
Paper/paperboard million mt	49	67	92
Fuelwood (million m <sup>3</sup> )	72	86	109
Other industrial wood (million m <sup>3</sup> )	23		(---21---)

2.25 On this very broad basis, increases in European removals will more or less offset growth in forest product demand. Performance of specific imports in the European market will therefore be determined largely by species product quality and price, rather than by any major shifts in demand compared to domestic supply.

2.26 Logs. Forest utilization systems in Europe--in common with all temperate zone developed areas--has been geared to an homogenous resource base: essentially two coniferous and three hardwood groupings. Moreover, as implied in the earlier projection figure, supply of these traditional species is due to expand in Europe: it would be expected that these log supplies will be preferred, in traditional uses, to those from elsewhere.

2.27 A major problem in assessing the likely place of tropical logs in European supply is the paucity of detailed data on this matter. At present, only six species (all African) are recorded in overall European import statistics, and these account for about 30% of tropical log imports. The two most important of this group are Okoume and Obeche, which are both essentially plywood species. In one sense, the large size and lack of definition of the "others" category points to a possible opportunity for marketing out of the Pacific Islands, in that it is a result of the very wide range of species sought for sawing, veneers, and ply in Europe. The fact is that considerable internal substitution in the log market is already occurring in the tropical log market in Europe--a result of dwindling supplies of traditional species from Africa (emphasized by log export bans in some cases); cost factors (leading to changing preference); and a trend towards the use of these woods in specialized end uses, rather than general veneers or plywood.

2.28 Opportunities in the log market need to be seen in the context of the decline in overall tropical log sales in Europe. Ply production in Europe has declined appreciably in the face of intensified competition from ply manufacturers elsewhere in the world. Tropical sawn imports into Europe have also increased, and, moreover, there is evidence that temperate zone sawnwood has been achieving a greater market share in Europe: both of these trends impact upon the demand for tropical raw material.

2.29 Sawnwood. As with logs, tropical sawn timber import data for Europe lack detail. Few imports of this material are defined by species. Moreover, there appear to be some inconsistencies in the data: in Germany, for example, the general European data indicate (for 1987) only 1% of tropical sawn imports are shown as from the defined species, whereas newer data (for 1988) show 89% of imports are from the defined group.

2.30 There has been considerable substitution by Asian species, such as Meranti, Luaun, Keruing and Kampas, for African species in sawn imports. Overall growth in the tropical sawn timber market in Europe has recently been slow: the market grew 10.8% p.a. (in volume) between 1966-76, and by only 0.5% p.a. from 1976-86. The reasons for this appear to be:

- (a) continued depletion of the resource in the traditional supplier countries, coupled with the relatively slow pace of agents and importers (who control most tropical sawn imports) to explore new supplies. When supplies of a preferred tropical species from a given country run low, the tendency of importers is to attempt to find another country source supplying the same, or very similar, species. Major end users, on the other hand, are much more willing to change end product when they deal directly with suppliers--and this is predominantly the much larger volumes of temperate based material.

- (b) an increasing tendency by supplier countries to restrict exports of basic sawn products, in pursuit of higher value added conversion.
- (c) the trade effects of increased domestic demand in some supplier countries, and of export drives by temperate exporters (notably the USA).
- (d) the increasing domestic European supply effect noted earlier.
- (e) long-term slowdown in housing starts in Europe, from a peak of 2m p.a. or so in 1964-66, to 1.24m p.a. in the 1984-88 period.

2.31 The outlook for tropical sawn wood is not particularly encouraging, in general. While builders' woodworking--in the window and door market--seems sound, other important outlets are at risk. In the furniture market in Europe, production is increasingly based on assembly of pre-fabricated parts, and these are made in large volumes in temperate country plants, primarily from temperate wood materials. This makes the market increasingly difficult to penetrate: the role of the individual furniture manufacturer who might be expected to purchase tropical timber is increasingly marginal.

2.32 Substitution is already a factor in the sawnwood market--largely from another wood product: panels. Medium density fiberboard (MDF) is a more recent addition to the range of substitutes for sawn timber.

2.33 Plywood. Eighty percent of all tropical plywood is now made from just two species groups--Shorea and Parashorea, the Meranti and Luaun of South East Asia, mainly Indonesia. Ecuador has recently entered the European market, with light colored hardwood species.

2.34 European domestic production of plywood has been in decline for the last two decades or so: this is largely due to price competition from Asian suppliers. European imports of tropical ply are expected to remain above 1 million m<sup>3</sup> p.a. for the foreseeable future. The most serious threat to this scenario is the MDF industry, which is capable of substituting for plywood in areas such as furniture manufacture.

2.35 Veneer. Veneers are sold into a very price conscious market in Europe. The market for tropical veneer has actually narrowed slightly in recent years. The possibility of increased use of veneers in association with MDF exists.

2.36 Added Value Products. Almost every tropical forest producer supplying wood products has ambitions to increase the level of value added in processing of the raw material in the country.

2.37 Of the approximately 4 million m<sup>3</sup> of tropical sawn hardwood consumed in Europe, about 63% is used in general and industrial joinery and other construction; 27% is used in furniture; and the remainder in miscellaneous items; transport, toys, gifts, etc. However, Europe only imports some 188,000 mt of wooden added value products from developing countries: 57% as household goods; 39% as construction elements (beadings and moldings, doors, etc.) and the remainder as furniture (or furniture components).

2.38 Substitutability of Pacific Island Species. It is not possible to determine, on a species-by-species basis, which Pacific Island species could substitute for hardwoods currently marketed in Europe: timber tends to be sold in groupings of similar characteristics and qualities, rather than by individual species, except in the case of some quite valuable woods. Nevertheless, it is of interest in this context to explore--albeit in a highly approximate manner--where Pacific Island timber might substitute in end-use for well-known African and Asian timber on the market. This exercise is made more logical by the fact that Europe will, in any event, be forced to seek substitutes for these timbers, because of log exports bans and/or approaching diminutions of the natural resource base in important supplier countries.

2.39 Table 6 below provides a rough end-use comparison between tropical hardwoods currently imported into Europe, and those available from the Pacific Islands region. An estimate of potential volumes available in the Pacific are included for comparison with existing import levels in each grouping.

**Table 6: ROUGH END-USE COMPARISON BETWEEN SOME IMPORTED AND POTENTIAL PACIFIC ISLAND SPECIES IN EUROPE**  
(in '000 m<sup>3</sup> RWE)

#	Main species or group introduced in Europe	Import volume in 1987	%	Potential species from the region with roughly comparable end-use /a	Potent. volume /b
1	Meranti/Luaun	1,827	47	Calophyllum (10), Terminalia (1) Palaquium (4), Myristica (2) Pometia (22)	1,818
2	Ramin	652	17	Gonystylus (<1), (Gmelina)	6
3	Okoume	324	8	Octomeles (3), Camptosperma (1), Calophyllum (10), Canarium (3), Terminalia (5), Myristica (1)	960
4	Mahogany (Swiet.)	273	7	Calophyllum (10), Pometia (22), Canarium (3)	1,534
5	Keruing	230	6	Dillenia (3), Myristica (1), Syzygium (2)	291
6	Obeche	152	4	Pterocymbium (3), Endospermum (3), Octomeles (3), (Gmelina)	403
7	Sipo/Utile	128	3	Calophyllum (10), Pometia (22), Canarium (3)	1,534
8	Azobe	126	3	Homalium (5), Celtis (2)	352
9	Iroko	79	2	Intsia (2)	95
10	Limba	35	1	Terminalia (5), Gonystylus (<1)	221
11	Sapelli	30	1	Calphyllum (10), Pometia (22), Canarium (3)	1,534
12	Afr. Mahogany	26	1	Calophyllum (10), Pometia (22), Canarium (3)	1,534
13	Makore	12	-	Dilenia (3), Callophyllum (10), Canarium (3), Pometia (22), Palaquium (4)	1,839
14	Afrormosia	6	-	Intsia (2)	95
	<b>Total</b>	<b>3,900</b>	<b>100</b>		

/a Figures in (parentheses) = percentage of proposed harvest in the region.

/b Total species volume.

## The Pacific Northwest

2.40 The Pacific Northwest is not as important a market for tropical roundwoods as either Japan or Europe; nor is it expected to become so.

2.41 The US in general is not a major importer of logs (in fact is a major log exporter), and certainly Pacific Island species are virtually unknown in log terms in the US Market. Domestic production of forest products has recovered somewhat in the US, and while environmental and other constraints are posing questions for supply as a whole, supplies of domestic hardwoods (primarily oak and ash) are plentiful.

2.42 The sawnwood market in North America has lost ground to manufactured board and other products, and imports of sawn timbers have levelled off. South American countries--notably Brazil--have taken strong marketing initiatives in this market. Tropical hardwood comprises about 5% of the total consumption of sawn timber in the US: most of it is used in the furniture sector.

2.43 It is apparent that sawn high quality species from the Pacific, such as Tectona, Swietenia, Drancontomelum, and Pterocarpus, could be sold in any available volumes in the US--such material is strongly sought after. Many of the medium grade Pacific Island hardwoods would also find a market, at prices competitive with Luaun and Meranti from SE Asia. It is unlikely that lower grade sawn material--e.g., Eucalyptus, Planchonella,--would find any market in the US.

2.44 In the US plywood market, both negative and positive influences are apparent. On the negative side:

- (a) Imports of pre-finished ply are decreasing.
- (b) Specifications complexities make wall panelling a difficult market for importers to enter. Wood panelling for walls in general has lost popularity.
- (c) Hardboard is replacing plywood in door manufacture.
- (d) Neither ply raw material nor manufacturing capacity is in short supply.

On the positive side:

- (a) Meranti plywood from SE Asia has displaced Douglas Fir based ply in the West. However, the price competitiveness of Indonesian ply cannot be generalized to other suppliers.
- (b) Some traders in the US foresee a reversal of the trend away from pre-finished ply imports.
- (c) plywood corestock imports are better priced than the US alternative (yellow poplar), and may be able to obtain some of this market.

2.45 Both high quality face veneers and moldings appear to have good prospects in the US market. Imports of hardwood moldings increased from 40

million lineal meters in 1970 to 53 million l. m. by the mid-1980s. Production of the material in the US is expensive, because it is labor intensive. Presently, Malaysia is the largest supplier of moldings to the US. The Pacific Islands have species--e.g., Agathis, Podocarpus Terminalia, Nothofagus--which are suitable for molding production.

2.46 North America is an important importer of wood chips, as well as being an exporter (predominantly of softwood chips). Large companies in the US are currently making long term supply agreements for hardwood material with Southern American nations: Mexico, Brazil, Chile, and Argentina. The Pacific Islands are able to grow material well suited to providing the short fibered material needed for opacity in paper manufacture--e.g., Eucalyptus, Gmelina. It is believed that freight costs from, say, Fiji or the Solomon Islands, would not exceed those from Brazil or Australia, both of which presently supply the West Coast chip market.

2.47 The furniture market in the US is very large. The factors which appear to be important from an exporter's viewpoint are adaptability to frequent style changes, and an ability to utilize sophisticated knockdown packaging models. Considerable penetration of the US market has occurred-- by European exports at the higher end of the market, and the North East Asian suppliers at the lower end. In all cases, the availability of raw materials and cheap labor has been less important than the more technical marketing factors noted above.

#### Other Markets

2.48 The other regional markets studied in this review were the Indian Subcontinent, other North East Asian markets and the Middle East. China and countries of South East Asia have not been included in the market analysis (although their supply implications have been studied) for reasons of time and resource limitations. Australia has been excluded because it is already a well-known destination, so far as Pacific Island suppliers are concerned, and it has received attention in this regard in prior studies (as examples: the output from the Forestry Sector Development Study of Fiji (FAO, December 1988); and the Tropical Forestry Action Plan Review of the Papua New Guinea Forestry Sector (World Bank, February 1990) deal extensively with this subject).

2.49 While the other markets dealt with here are important (either actually, or potentially) to the Pacific Islands, they are dealt with briefly for the reasons advanced earlier: the major demand parameters in the international forest products market will be determined very largely by the three major consuming regions.

2.50 The Indian Subcontinent. Industrial roundwood production on the Indian Subcontinent is in the order of 27 million m<sup>3</sup> p.a.. The volume of roundwood used as fuel is many times larger than this, but is of no relevance in this discussion. The Subcontinent imported around 892,000 m<sup>3</sup> of roundwood in 1987, primarily for the sawmill and veneer sectors. Intraregional trade is an important element in this: for example, Nepal exported 126,000 m<sup>3</sup> of saw and veneer logs to India in 1987.

2.51 The output of the sawmilling sector is large (around 17.5 million m<sup>3</sup> in 1987); the region imported only 98,000 m<sup>3</sup> of this product in 1988--most of

this went to Pakistan. Plywood production in the region was only 529,000 m<sup>3</sup> in 1984, and a further 22,000 m<sup>3</sup> were imported.

2.52 FAO projects significant increases in consumption of forest products, in India in particular--rising from 250 million m<sup>3</sup> RWE p.a. in 1986 to 310 million m<sup>3</sup> p.a. by 2000. Given the reduction of harvests anticipated in the Subcontinent in the future, attainment of this level of consumption would imply significant extra-regional importation of forest products, by India and most of the other nations in the region, and significant increases in import demand for all major wood products are projected. The most relevant issue in this respect will be the willingness and ability of Subcontinent nations to pay for imports. So far, Malaysia has been the most active presence in the Subcontinent market, and has made some progress in shipment of sawn timber (to Sri Lanka and India) and logs (to India). Sales have been toward the lower end of the quality spectrum, and it is reasonable to suggest that, for the foreseeable future, this will remain the nature of the subcontinental market.

2.53 Other North East Asian Nations. Both South Korea and Taiwan are significant importers of wood fiber. Ninety percent of sawn timber produced in Korea is from imported logs, and both Korea and Taiwan have very large furniture manufacturing sectors (with a combined annual output value in excess of \$1,500 million). Taiwan imports fairly significant volumes of pulpwood in the form of logs and chips (some 2.7 million m<sup>3</sup> in 1988), whereas S. Korea relies entirely on manufactured pulp imports. Both S. Korean and the Taiwanese ply industries have been affected by the Indonesian plywood sector growth, but this has caused stabilization of output rather than overall declines.

2.54 Both countries will remain significant importers of saw logs and ply logs for some time: supplies to date have come from Malaysia, and the US. Given the size of the furniture sector, there would appear to be scope for exports of sawn wood to the region, probably on the basis of joint venturing with furniture manufacturers or their supplier mills. Pulpwood and wood chips will be a growing market in Taiwan.

2.55 The Middle East. Because of relatively high incomes and rebuilding programs in this region, emphasized at the present time by the strong motivation to rebuild in Iran and Iraq following cessation of hostilities there, the Middle East is generally thought of as a growth market. The total value of forest product imports in the region in 1987 was \$1,200 million: paper and paperboard accounted for 44% of this, wood based panels 24%, sawnwood 21%, roundwood 8% and pulpwood 3%. Sawn hardwood imports amounted to only 260,000 m<sup>3</sup> in 1984; plywood (in toto) 287,000 m<sup>3</sup> (this figure appears to have altered significantly since Saudi Arabia alone purchased 317,000 m<sup>3</sup> of tropical ply in 1987). The region has become a major purchaser of finished furniture.

2.56 It is difficult to project outcomes in this market: crude oil prices will be a significant determinant of what occurs. Clearly, the region will not become either a major grower or processor of forest products: finished building and construction timbers and manufactured boards, paper and paperboard, and high value added items--furniture, moldings and so on--will be the products of interest. Forest product specifications and end uses are not particularly well understood in the region as yet, and technical promotion of particular products could yield significant results.

## II COMPETING SOURCES OF SUPPLY

3.1 The Pacific Islands are in competition, directly or indirectly, with other suppliers of forest products for markets, and it is necessary to review supply trends in those other areas. This is done in some detail in the detailed volumes attached to this report: here, only the major supply issues are raised.

### The Pacific Rim

3.2 Given the most likely market destinations for Pacific Island products, Pacific Rim suppliers are of most direct interest in this context. For the purposes of this discussion Pacific Rim suppliers are: the boreal forests of the USSR and North America; the East Asia grouping (including China); South East Asia; and the "new Southern resource" (the plantation resources of Chile and Australasia).

3.3 The USSR. The USSR resource is immense; the Eastern USSR contains hardwoods and softwoods in extremely large volumes. This has two major implications for Pacific Islands suppliers: its proximity to Japan (and the possible evolution of its use by Japan from a stop-gap measure as now, to a more regular use); and the interest of China in labor investment in the resource--with implications for Chinese demand for wood from elsewhere

3.4 The USSR currently supplies about 19% of Japan's total imports of logs and sawn timber. So far, Japan has not signed extensive long term contracts with the USSR for supply of wood, but this may be in the offing. While there have been problems in the past in extraction (because of the Siberian climatic conditions, log size and shipment), these are all capable of resolution, and the expectation is that Japan will eventually want to avail itself of this resource in larger measure than at present.

3.5 Nevertheless, perspective must be retained here, and the forecasts referred to in the accompanying appendixes show log exports to the Pacific rim rising from 7.3 million m<sup>3</sup> (in 1983) to 8.7 million m<sup>3</sup> in 2000 and 10.2 million m<sup>3</sup> by 2020. There will be modest gains in export of hardwood wood chips to Japan, and the inherent quality of Larch in the USSR softwood resource is a potentially marketable factor.

3.6 Canada. Canada harvests about 5% of the world's roundwood but accounts for some 20% of value of trade in forest products. Its exports to the US comprise 35% of the total international trade in sawn products, and 60% of that in newsprint.

3.7 Canada has been making strenuous efforts to reduce its dependency on the US forest products market, and there have been programs to promote Canadian building material in Japan, lumber in Europe (and in East Coast US markets, where West Coast Canadian production has been a less significant presence). The question of Canada's capability to maintain raw material supplies is a complex one, depending as much on stumpage and management policy as on standing reserves. There appears to be a general decline in quality and commercial availability in the Canadian resource, but it would be unwise to conclude that significant declines in competitive forest products export

output will result from this in the medium term. Canada's capabilities to respond to competitive pressure in the large markets it serves--including the bulk lumber market which is a (theoretical) option for the Pacific Islands--are well known, and should serve as a caution for small producers attempting to enter these markets.

3.8 The United States. The US Forest Service projects very modest growth in softwood harvest, from 319 million m<sup>3</sup> in 1987, to 372 million m<sup>3</sup> by 2010. The bulk of this increase will come from the Southern Pine resource, while the Pacific Coast region (of most direct interest in this review) is seen as static. Even these modest projections may be optimistic, due to: the current pace of environmental reservation; high stumpages; and the expectation of continued high levels of log export implicit in the projections.

3.9 US temperate hardwoods are of direct interest to Pacific Island suppliers, even though they are a relatively small item in the US context: in 1986, the US exported 1.2 million m<sup>3</sup> of hardwood lumber, and 0.6 million m<sup>3</sup> of hardwood logs, compared to respective softwood exports of 4.4 million m<sup>3</sup> and 15.8 million m<sup>3</sup>. Strong increases in exports from the US of hardwood logs, lumber and ply have occurred in the 1970s and 1980s. Most of the material is red and white oak, going to Europe, and to furniture manufacture in Taiwan. There has been considerable foreign investment in US wood processing mills, and this is at least partly responsible for the growth in exports noted.

3.10 It is difficult to project the status of the hardwood resource at present. There are apparently some conversion pressures upon it--either to softwood plantations or other land uses. However, at present less than half the increment of these forests is actually harvested, so the physical potential for continued growth in supply from this resource would appear to be high.

3.11 Japan. Total forest area in Japan has remained at 25 million ha for the last two decades. Plantations comprise 9.9 million ha, and are expected to comprise 10.65 million ha by 1995. Major issues arise in considering Japan's capacity to supply itself with forestry raw material. The capability of the resource to produce projected levels of growing stock is unclear. Current Government plans project a growing stock of 3,308 million m<sup>3</sup> by 2026, up from the current level of about 2,500 million m<sup>3</sup>. This appears to be based on optimistic assumptions on the rate of planting, and of harvesting and conversion of natural areas.

3.12 The parameters governing the use of Japanese forests are complex. Cooperative ownership of much of the resource; environmental factors in the mountainous country where much of the resource occurs and labor availability problems in those same areas; and the comparative role of domestic supply policy, as opposed to price competitiveness in determining the choice between imports and domestic supply; all play some role in this matter. Thus, whilst Japanese supply costs are high, other domestic social and political factors--and a significant aversion to reliance on a few large foreign suppliers (as in the case for wood chips)--will play some part.

## The New Southern Resource

3.13 Along with the US South, the new plantations of the Southern Hemisphere are the significant new elements in the Pacific Rim supply equation. New Zealand and Chile are able to supply much of their own requirements and export 60-70% of their softwood plantation production, while the softwood plantations in Australia are altering price and demand relationships there.

3.14 A significant factor which requires mention in this context is the considerable integration of ownership and operation of forestry and forest products companies across the three countries which has occurred in recent years. This has increased the complexity of supply relationships, and reduced the value of standard individual country based comparative advantage analyses as predictors of supply from the region.

3.15 Australia. Australia is a net importer of forest products. Imports exceeded exports (predominantly hardwood chips to Japan) by some \$1,400 million in 1987/88, and the country is an important purchaser of Pacific Island wood products.

3.16 Several factors are important in considering Australia's role as both a customer for and a competitor with the Pacific Islands nations:

- (a) as noted earlier, Australia's position as a supplier of wood chips to Japan is uncertain, largely because of environmental pressures in Australia to preserve significant areas of hardwood forest hitherto destined for utilization under clearfelling regeneration woodchip regimes. Japan is aware of this matter and is actively seeking alternative supplies.
- (b) Australia is now a more important market for high grade rainforest timber, since its only significant commercial supply of this material, in North Queensland, has been closed for environmental reasons.
- (c) the Australian softwood plantation resource is significant, and potentially is capable on both quality and cost bases of replacing a significant part of currently imported lumber. Also important, from the viewpoint of Pacific Island suppliers is the developing relationship between Australia and New Zealand forest products companies, and the evolving free trade relationship between the two countries: factors which should lead to greater penetration of the Australian timber market by New Zealand.

3.17 Australia still retains special trading arrangements with Pacific Island nations under the SPARTECA agreement, and Australian companies are active investors in the forestry sector of these nations. Australia is, moreover, likely to remain a larger importer of forest products in general. It is, however, an increasingly open economy, and it will be no less inclined to avail itself of the most competitive supplies of its forest products needs than will other net importing nations.

3.18 New Zealand. The forest resource of New Zealand will be affected by far-reaching economic changes which have occurred there: privatization of the forestry resources; taxation changes affecting private growers; and corporate restructuring are important in this respect.

3.19 Although New Zealand has invested more than other growers of Pinus radiata in silvicultural systems to produce clear, high grade sawlog volume, yield forecasts indicate that even by 2020, the proportion of clear, finishing grades achieved will still be quite small. Therefore, New Zealand will be competing, for the most part, in basic utility markets: framing and the many applications of medium-density fiberboard.

3.20 It has also been suggested recently that previous forecasts of domestic consumption of forest products in New Zealand may have been optimistic: thus, more supply than previously estimated will be available for export.

3.21 Chile. Chile has 1.4 million hectares of plantation--predominantly Pinus radiata-- with a lower average maturity than New Zealand: two-thirds of the resource is less than 10 years old.

3.22 It uses very small amounts of this resource domestically, and reliance on the export market for disposition of the resource is, and will remain, very high. Chile markets logs, sawn timber and wood chips to a wide range of countries, and utilizes active price competition to enter markets. Although it has not to date sought quality markets, its sawn timber quality is potentially high, due to the superior quality and form of the logs available. Chile is also a seller of unbleached Kraft pulp, and the product is good quality. Chile has pursued the principle of producing mainly for pulpwood, with sawn products an opportunistic option while markets are good.

3.23 While recent yield projections are lower than some original figures, fertilizer technology (still largely not applied) and the advent of Atriplex plantations in arid regions suggest that Chile will become, and remain, a significant force in the Pacific Rim supply and trade.

3.24 Chile has a source of natural timber, including some premium species, and it is expected that this resource will be sustainable for some considerable time. It is also investing in plantations of Eucalyptus for wood chips.

#### South East Asia

3.25 The three countries of major interest or suppliers in this region are Malaysia, Indonesia and the Philippines. Together, these countries produced in 1985 some 13% of world non-coniferous industrial roundwood. The level of stress on this resource is more clearly indicated by the fact that it produced 13% of total roundwood output (i.e., inclusive of fuelwood) in the same year: a result related to the low resource:population ratios in the two large countries: 0.7 ha/capita and 0.17 ha/capita for Indonesian and the Philippines, respectively.

3.26 Malaysia. Asian Development Bank figures for Malaysia show a estimated growing stock of 3,735 million m<sup>3</sup> (volume underbark) of which 1,422

million m<sup>3</sup> was on the Peninsula; 1.512 million m<sup>3</sup> was in Sarawak; and 801 million m<sup>3</sup> was in Sabah. Dipterocarp forests comprise 87% of the resource, with the remainder peat and mangrove forest.

3.27 A recent study by the Malaysian Industrial Development Authority (MIDA 1989) estimated the total growing stock of mature commercial timber species at about 1,600 million m<sup>3</sup>, on 20 million ha of forest. Some 55% of this area is in Sarawak, 28% in Peninsular Malaysia, and 17% in Sabah.

3.28 Given that 700,000-800,000 ha are logged annually, at an average harvest volume of 45 m<sup>3</sup>/ha, the average harvest is 30-36 m m<sup>3</sup> p.a. Standard estimates show existing standing volume should be sufficient for 25 years, and also that such volume should be replaced by natural regeneration--at somewhere between 1.5-3.0 m<sup>3</sup>/ha/annum depending on species. However, it is now apparent that these estimates are optimistic:

- (a) there has been no systematic update of forest inventory since 1972/73. It is now recognized in Malaysia that the level of harvest estimated in the early inventories is rarely achieved, due to inaccessibility, low density and inventory error.
- (b) about half of the land which is logged does not return to forest, but is converted to agricultural crops.

3.29 Malaysia is now in the process of making substantial downward revisions of merchantable volume and annual allowable cut. In Sabah, for example, the annual allowable cut has already been reduced from some 12 million m<sup>3</sup> p.a. to about 8 million m<sup>3</sup>, and it is being suggested that the figure may eventually reduce to 3 million m<sup>3</sup> p.a..

3.30 Malaysia is the world's largest exporter of both tropical logs and tropical sawn timber: in 1988, it exported 20.6 million m<sup>3</sup> of logs; 4.1 million m<sup>3</sup> of sawn timber; and 1 million m<sup>3</sup> of ply and veneer. Malaysia has pioneered the use of rubberwood, and exports some 1 m m<sup>3</sup> of sawn rubberwood: some figures discussed in Volume II suggest this figure could be expanded slightly in the medium to long term.

3.31 Malaysia has had log export bans for the Peninsula in force for some years. The question of similar bans for Sabah and Sarawak is politically sensitive, given the heavy reliance of these states on log exports, but recent resource concerns have reopened the question of bans.

3.32 Although a large sawmilling country, secondary processing in Malaysia--furniture, doors and so on--remains a fairly small sector, although significant quantities of beadings and moldings are exported. There is now strong interest in Malaysia in investment in higher value added processing.

3.33 In general, limits to the Malaysian resource can now be seen, and log exports from the country will decline. Malaysia will attempt to become a larger exporter of sawn material and ply (probably ply of different quality and specification from the Indonesian material, for sale predominantly in Europe), and will also attempt to move downstream in processing output, into the area of furniture, doors, moldings and household items.

3.34 Indonesia. Indonesian forestry statistics are incomplete and occasionally unreliable. Official data record some 28 million ha of conversion forest; 30 million ha of protection forest; and 64 million ha of production forest--half of the latter being limited production forest. While there is considerable debate as to the actual growing stock commercially available in Indonesia, it is reasonable to suggest that the planned level of logging (31.7 million m<sup>3</sup> p.a.) in the Fifth Plan Period (Repelita V) would allow some 35 years of operation in the production forest even at the most conservative estimates of standing volume. The conversion forest might yield a further 15 years of operation.

3.35 In the case of Indonesia, the main issue for competitive suppliers such as the Pacific Islands is not the life of the resource, but the policies that the Government of Indonesia intends to apply for its use.

3.36 As discussed earlier Indonesia began reducing log exports early in the 1980s, and a complete ban on log exports now applies. The objective of this policy was to create a large plywood manufacturing sector within Indonesia, and this has been the result. Indonesia now exports some 66% of all tropical plywood traded in the world.

3.37 Recently, Indonesia announced bans on exports of rough sawn timber; ostensibly to force more sawn timber into higher value added manufacture (furniture making etc.). The immediate effect may actually be to force more logs into plywood production--a result which, from the point of view of the Government of Indonesia's concern with efficiency of utilization of the resource, would be advantageous.

3.38 This review is not the venue for a consideration of the merits of the value added policies of the Government of Indonesia. It can be assumed that Indonesia will not revert to log exports for some considerable time. It is the likely impact of such policies on purchasers of Indonesian products which is of interest. As already noted in this report, Japan (the major destination of Indonesian logs in the 1970s) did not replace that volume with tropical logs from elsewhere when the bans came into force. On the other hand; Japan is now a major purchaser of Indonesian plywood. The general view is that other producers, or potential producers, of medium grade structural ply of the type produced in Indonesia would encounter difficulties in attempting to compete with Indonesia on a price basis.

3.39 Indonesia has a large area of established plantation: 1.84 million ha in 1988. Most of this is teak plantation on Java. Private plantation is expected to grow significantly, as large scale pulp manufacturing projects are established. In the meantime, not much impact on wood supply can be expected from plantation sources in Indonesia in the medium-term: teak has a long rotation period.

3.40 Indonesia, like Malaysia, has a large rubber area, but is less advanced in its utilization of this material than Malaysia. Also, given the availability of natural forest, it may be that, despite the 3 million ha of rubber plantation in Indonesia, volumes produced by rubberwood may be fairly small.

3.41 The Philippines. The Philippines has about 1 million ha of unlogged forest remaining, and a total forest area of 4.6 million ha. On the basis of these figures, the Philippines represents the opposite end of the resource spectrum to Indonesia. The implication for the Pacific Islands is that the Philippines is now a much reduced export presence in the international wood market.

3.42 The Philippines also demonstrates a feature of potential interest to other tropical forest countries, in that it introduced log export bans in the 1970s. In general terms, it can be said that the domestic processing sector which has resulted has not become internationally competitive, and the costs in economic rent lost to the Philippines must be substantial. It is also apparent that considerable illegal logging has undermined the policy to a large extent.

3.43 The Philippines plans to re-enter the export market. Reforestation and agroforestry programs--much of their output aimed at pulp production--have been initiated (with varying success), and the Philippines has recently raised investment funds for plantation from the development Banks. The major industrial species being grown--Paraserianthes falcataria (previously genera Albizia) has been planted as a pulp furnish, but it has had some success as a sawn export to Japan and Taiwan, where it is used as a corewood in panelling.

3.44 Another potential source of supply is in the regrowth stands resulting from previous logging. There are no precise estimates of what may actually be available on these stands, many of which, obviously, will have been severely encroached upon after their original logging. One regrowth stand recently logged 33 years after the original operation in the Philippines registered a high growth volume (106 m<sup>3</sup>/ha in the 60 cm+ diameter class) and generated good revenues, especially from regrown mahogany on the site.

IV. MARKET IMPLICATIONS FOR FOREST SECTOR  
STRATEGY IN THE PACIFIC ISLANDS

4.1 The major market factors can be grouped into: global market trends; environmental considerations; and freight. Following discussion under these headings below, the report draws some generic production implications from them for the Pacific Islands. Some broader sectoral issues are then raised, and the report closes with some indicators of directions for Pacific Islands forest sector development.

Major Market Factors

(a) Global Market Trends

4.2 It is clear, from information gathered in this report and from recent projection studies reviewed earlier, that the world is not running short of wood. Regional shortages may apply, but these will be in areas and products (e.g., fuelwood) of no relevance to Pacific Island suppliers. The major markets are basically well supplied in their requirements, and have a number of options in species and product substitution.

4.3 Overall growth in global demand for forest products has slowed from the peak period of the 1950s, and is not expected to increase rapidly in the foreseeable future. The proportion of raw material in international forest products trade is declining, and this must be due primarily to technical and structural factors in the market, rather than to log export restrictions in various countries. The comparative advantage in trade appears to be moving further towards technical production and marketing factors, at the expense of resource abundance.

4.4 According to Arnold (1990), the future evolution of tropical forest product exports is particularly difficult to predict. Aggregate tropical forest products export trade is now about 25% lower than at its peak, in 1979: partly due to log export bans, but depressed demand for these products has also been a factor. Processed tropical forest products exports have faced relatively difficult market conditions. Tropical sawnwood is for the most part in direct competition for basic joinery in all markets with temperate sawn hardwoods and softwoods. The tropical hardwood plywood market may be peaking: it appears already to have done so in the US, and the Japanese market may shift to some extent to softwood substitutes.

4.5 In all of the major markets reviewed in this report, strong demand for quality tropical hardwood material is apparent, and seems likely to continue. To varying degrees across the different markets, this appears to be the case for logs, sawn timber, veneer flitches and finished veneers and plys.

4.6 In the higher volume, more basic grade markets, the Pacific Islands will be in competition with major suppliers of forest products for markets. Price competitiveness will remain an important factor, and some price information and comparisons are included for this reason in Volumes II and III. Some general points which emerge from the information collected on the supply situation are:

- (a) many tropical supplier countries have become increasingly reluctant to export raw material to major markets: log export bans are now common in Africa and Asia. However, there has been no urgent search for replacement tropical logs by the large markets: the trend appears to have accompanied a trend in those markets to purchase more processed forest products, largely from temperate suppliers in integrated, sophisticated operations.
- (b) in current usage, much tropical wood is substitutable, either by temperate equivalents (hardwood and, increasingly, softwood), or by other products--including wood fiber re-processed into board products (made in processes which are more dependent on capital and technology than on availability of particular types of wood).
- (c) major competition for Pacific Islands timber in standard, traditional uses will arise from Canada, which is presently diversifying its marketings of lumber away from the US, and from the New Southern Resource.

4.7 The major implications of the reviews of supply and demand in this report for the Pacific Islands, are:

- (a) Quality hardwood will continue to hold a strong position in all major markets, in log, sawn and veneer forms. This suggests that Pacific Islands producers must take care to maintain a clear differentiation between this class of material and bulk grades, in both processing and marketing. Throughput becomes less of an issue with this material than recovery, precision and flexibility in size and/or specification.
- (b) In product areas less reliant on high quality resource, the European and American markets show examples of items which appear resilient in the face of cyclical market trends: moldings, beadings, some joinery items and household items. These products require a certain amount of capital investment in technical development in processing, but rely primarily on quality control and effective marketing.
- (c) In general, the middle and lower end of the tropical forest products market seems likely to become increasingly competitive: South East Asian producers will continue to market processed output strongly; domestic processors in major markets will continue to adapt to new markets and resource bases; substitution--from temperate hardwoods, and increasingly from softwoods--will continue to place pressure on this market. An abundance of a medium quality resource--whether natural or plantation--is no longer a strong factor in development of profitable and reliable markets.

(b) Freight Factors

4.8 Freight is a vital consideration, especially in the case of low value added products, such as logs and wood chips, where freight can represent 45% or more of total c.i.f value. The key requirements for cost-effective freight of forest products are:

- (a) the use of larger volume charter vessels: charter rates are 30-50% lower than liner rates;
- (b) efficient loading/unloading facilities; and
- (c) deepwater port facilities.

4.9 At present, the four major forest producers of the Pacific Islands region suffer significant freight disadvantages in NE Asian markets, compared to their main competitors (Indonesia, Malaysia, New Zealand, Australia and the US).

4.10 In the case of Fiji there is some possibility that plantation volumes may eventually allow scale factors in freighting to be achieved, and internal sea freight in the country is reasonably efficient. Fiji is able to ship forest products to Australia and New Zealand competitively, and has reasonable shipping access to North America: and it is relevant in this context to note that Latin American freight rates to North America are high-- at least 50% higher than Asia-US rates. Fiji will probably be able to overcome problems of shipping sawn timber without resort to expensive containerization.

4.11 Papua New Guinea log freight rates to NE Asia have fluctuated widely. In 1988/89 they were \$18-35/m<sup>3</sup> on volume shipments to Korea and Japan: these are not prohibitive rates, but rates of \$45/m<sup>3</sup> and more to the Subcontinent and Europe would certainly place PNG logs at a strong disadvantage in those markets. Costs of bulk or container shipping to the US are very high out of PNG.

4.12 PNG has a coastal shipping service, although small ports are not well served. The cost of the service is high: costs of shipping from provincial ports to major exporting ports are in the order of \$40-50/m<sup>3</sup>. Until road links enable more efficient internal transport, PNG faces a severe freight logistical problem; particularly if the intention is to ship finished products by masterpack containers or in other forms out of PNG.

4.13 The Solomon Islands faces similar difficulties: the coastal freight service is expensive, and ports do not exist in many areas. The large scale plantations and processing project on Kolombangara will construct port facilities there. The Solomons is reasonably well served by overseas links to Australia, New Zealand and Asia, and log export rates seem more or less comparable to PNG.

4.14 Vanuatu has a serious inter-island shipping constraint. It is also confined to use of liner services: these provide rates comparable to those out of PNG, but unpredictable costs will continue to be a factor until Vanuatu can develop shipments of reasonable size.

(c) Environmental Considerations

4.15 There are a number of environmental factors which now exert a strong influence on tropical timber markets in consumer countries. In Europe, the current observation is that the "new forest decline" is significant. In the longer term, the most likely outcome is larger investment in forest creation

and preservation in Europe, and increased supplies of forestry raw material may result.

4.16 The other factor of importance in Europe is the influence of "green" parties on the tropical forest products trade. Potentially, there are both costs and benefits in this movement for Pacific Island suppliers. If moves in Europe to ban or restrict imports of tropical forest products which come from exploitive or destructive operations succeed, some Pacific Island operations would certainly be classified as such and would therefore be affected. On the other hand, European nations have shown a willingness to contribute financially to more environmentally acceptable management of tropical forest operations--to the point of funding such contributions via levies on tropical imports. Pacific Island nations may, because of their relatively small size, their island status and their relatively less severe population problems, be able to utilize such funding in easily observable ways. A more indirect implication of the current mood in Europe is that plantation grown tropical hardwood material may become more acceptable in the European market.

4.17 In Japan, there is some momentum building for measures similar to those being considered in Europe to pressure producer nations on the matter of environmental management. The Japanese forest products sector can be expected to resist such moves. However, observations made earlier in this report suggest that end-user trends and the substitutability of temperate and plantation grown material would make environmentally based import restrictions an adjustment problem, rather than a disaster for the sector. It is, therefore, a possible outcome.

4.18 In Australia the environmental lobby is vigorous and politically powerful. It has succeeded in closing down operations in Australia's only remaining large area of rainforest, and it has (at least for the present) blocked the construction of new large scale pulping facilities in Tasmania. It is also placing considerable pressure on the clearfelling operations of the hardwood woodchip industry, and this has led to the interest noted earlier in Japan for diversification of supply of hardwood wood chip supplies.

4.19 There is increasing concern, both from within the four Pacific Island nations, and internationally, about deforestation, and the need to preserve biodiversity and other ecological values in the unique flora of the region. Significant initiatives are either under way, or being considered, in PNG and Fiji, and to a lesser extent in the Solomon Islands and Vanuatu. From the perspective of this study, two generic concepts are of major interest:

- (a) The concept of reducing forest exploitation and clearing, in return for international support--either as direct financial compensation, or in project assistance aimed specifically at providing sustainable income opportunities while retaining forest cover.
- (b) The value of forested land and the biodiversity it supports, for the tourist sector, which, in Fiji and Vanuatu is already an important source of foreign exchange, and is potentially so in PNG and the Solomon Islands.

4.20 An example of the former concept may be developing in Papua New Guinea, as a result of an idea put forward in the recent TFAP review.

Although the great bulk of PNG's forested land remains intact, considerable localized damage from logging has occurred, and new public and government concern over this problem was an important factor in the request originating the TFAP review, and in the direction that review took. The feasibility of declaring large areas of forested land under World Heritage listing, and undertaking international treaties to manage the production forest areas sustainably, in exchange for significant inputs from international donors, is now being actively investigated in PNG.

4.21 In Fiji, it is apparent that at present considerable damage is being done to the natural forests in logging operations: there appear to be legal loopholes which allow protection forests to be logged for agricultural conversion; regulations on stream erosion control and reserve areas are routinely ignored; and removal of reservation orders is apparently fairly simple. Given the strong dependence of Fiji's rural population on the forest environment, the fragility of that environment; the necessity for Fiji to maintain a positive image in large markets as a forest products exporter; and the tourism value of its forested areas--and the other environmental values they protect--it may be that Fiji should consider the primary role of its remaining natural forests to be a protective one.

4.22 In the Solomon Islands, environmental values in forested areas are at some risk from logging, although it is clear that only 10% or so of the forested area of the Solomons could be considered commercially accessible for logging. The Solomon Islands currently has a high population growth rate, and the level of input and influence of technical expertise are timber rights decisions under customary land ownership is low. These factors make the retention of forest cover in the productive forest highly problematical: they relate strongly to the land tenure issue, which is taken up briefly in the next section.

4.23 In Vanuatu, at present there appears to be little intention to manage the natural forests: the resource is seen largely as a supply source for the local market, for which purpose it is expected to last to about the end of the century. As in the case of the Solomons, a primary reason for this is the current approach to land tenure in Vanuatu. Vanuatu does have an interesting case of environmental preservation in progress on the island of Erromango, where local landholders are in favor of preservation--especially of the remaining old growth Agathis stands. Significant tourist potential exists for this area--undoubtedly of greater value in the long run than the value of the residual timber on the island.

### Implications for Pacific Island Production

#### (a) Resource Type and Quality

4.24 The implications of the findings for the Pacific Islands producers will vary. In Papua New Guinea, about 10% of the available forest resource is of high quality. In the PNG TFAP report, serious problems were identified in the marketing chain, from supervision of utilization standards, through measurement, grading and classification of logs, to checking and revenue collection at the export point. Given the premiums that already attach to desired species, and the likelihood of these increasing, there will be a strong tendency to malfeasance in this area. As a corollary to that, the

payoff to resource owners and governments to tightening monitoring and supervision procedures in the marketing chain will be high. This is an area in which underinvestment by both governments and international agencies is probably significant.

4.25 In the PNG resource, the proportion of quality species varies significantly from one location to another. The normal procedure in forest utilization is to proceed from the better quality, better located resource, to less attractive sites. Given the market dynamics in this case, with increasing competition for medium and low grade material but an improving market for quality material, PNG may need to explore the practicability of reversing this strategy: utilizing medium quality areas early, and conserving better quality species in the expectation of future real price improvements. The success of this strategy will depend upon the level of movement of prices. An alternative approach may be to concentrate logging upon the high value species, utilizing logging methods designed to minimize damage from highly selective logging. This could produce environmental as well as economic benefits.

4.26 PNG has, according to the recently completed Tropical Forestry Action Plan review of that country, ample areas of degraded or cleared lowland areas for plantation development. There are some important institutional and political reasons (reviewed in the TFAP report) why the plantation sector in PNG has remained underdeveloped. The essential observation here is that there is considerable potential to develop productive and well-located plantations of marketable species in PNG.

4.27 In Fiji, the important question for resource management is the future of the plantation sector. There are some 80,000 hectares of Pinus caribaea in plantation, and about 20,000 hectares of high quality hardwood--principally mahogany. The potential for plantation development is high: according to FAO (1989), by early next century Fiji could have 120,000 ha of softwood, and a similar area of quality hardwood plantation.

4.28 The Government of Fiji is already committed to an increasing reliance on its plantation resource. At this stage, the major strategic issue is the disposal of the pine resource. The particular variety of Pinus caribaea growing in Fiji has certain advantages, both in the sawn timber/veneer markets, and as a pulp furnish, over Pinus radiata--the dominant species in the New Southern Resource. At present, however, no particular premium seems to attach to this species in international markets: considerable efforts may be required to establish the product in markets that will differentiate between it and the large volumes of pine due to come on stream in the Pacific rim market.

4.29 The major part of Fiji's pine resource grows in relatively large concentrations, under the management of the Fiji Pine Commission--and this should assist in large scale export oriented operations. A potentially more difficult problem arises with the pine which has been established under the extension plantation scheme. This resource is fragmented, and may be difficult to mobilize. Some efforts are being made in Fiji at present to bring the marketing of this resource under more unified management: these efforts need to be monitored closely.

4.30 The hardwood plantations of Fiji are well advanced, and this should give the country an opportunity to establish a place for this material in the quality market. An important factor in this market will be reliability of supply: in this context, FAO (1989) recommends that no regular supply of high quality material should be marketed out of Fiji prior to 1998, even though some volume will become mature before then.

4.31 The Solomon Islands has what is generally regarded as a better quality natural resource than PNG, and a similar strategy for its utilization as suggested for PNG might optimize returns to the Solomons, from a quality viewpoint. Most interest in the Solomon Islands, however, now focusses on development of a plantation resource. There has already been a shift in emphasis in plantation development from of indigenous species for local use, to exotic large species for scale export. This is the correct decision for the Solomons, provided the right species are grown. At present, Gmelina arborea is the major interest, on Kolombangara under a project supported by the Commonwealth Development Corporation. A consultancy report for this project suggests that Gmelina should be marketable internationally: it may be an effective competitor with Ramin, and Gmelina woodchips should sell in the relatively promising hardwood woodchip market.

4.32 In Vanuatu, major export interest has been focussed on the Industrial Forest Plantations, although these are still relatively small, and the program has not been expanded since 1986. Some doubts have been expressed over the location of plantations in Vanuatu, and also over the suitability of Cordia--the major species, after pine--for sawing or peeling. There is a possibility that fast grown trees would develop a wide sapwood band which would adversely affect the decorative use of the species. It is essential to have tests on this matter completed.

(b) Sector Evolution and Product Type

4.33 There is a natural sequence of production in the forestry sector, beginning with logging for local use, and progressing through: log exporting; basic primary processing (sawn or ply); secondary processing into components, moldings, specialty plys; the creation of larger integrated forest products plants; and eventually pulp, paper and wood panel manufacturing.

4.34 Whilst this sequence is the historical norm, it is not inevitable. In the case of the Pacific Islands, which are small, and suffer freight and other disadvantages it may be advisable to omit certain steps--particularly given the market trends in some of the more basic products. It has already been noted in this report that it would make little sense for the Pacific Islands to attempt to compete with large countries, such as Indonesia, in the hardwood medium ply market. But being small carries certain advantages, in addition to the well-known disadvantages. For example, it might be possible for the countries to market a large proportion of their production as specialized components and household items, whereas larger exporters will always need to rely on high volume markets to a significant extent. It is at least feasible to consider a direct move to single process manufacture of wooden articles in the Pacific Islands, utilizing imports of technology and high levels of training to achieve this.

4.35 In Papua New Guinea, export sawmilling has declined to very low levels, and such regional sawmills as exist frequently have problems in obtaining a reliable supply of reasonable quality material within commercial distance. The only plywood mill in the country produces a fairly low quality output which is sold under strong protection on the domestic market. There is one woodchip operation in PNG, but it remains based on tropical hardwoods, which provide an inferior furnish to fast grown plantation hardwoods.

4.36 Given the low level of forest industry development in PNG, the country has an opportunity to completely restructure its processing sector, without incurring large write-off costs. Industry prefeasibility and feasibility studies are urgently needed in conjunction with studies of the plantation potential.

4.37 The present Government of PNG has a strong interest in promoting domestic processing, to reduce the present heavy reliance on log exporting. However, in the medium term, PNG could develop its processing in a way that could, in fact, take of the log exporting infrastructure which has developed. This could be achieved by locating specialized high precision mills at major export points. This would generate a sufficient throughput of the high grade species to justify building these kinds of mills, and allow PNG processors to take advantage of the improving market for such products.

4.38 PNG also needs to explore the feasibility of developing plantations linked to woodchipping facilities along its coastal areas. As noted earlier, the technical parameters for fast-growing hardwood plantations in PNG are good, and given that the New Britain area, for example, will soon offer road linkage from such areas to a major port, the potential seems good.

4.39 Fiji is committed to reliance on processed rather than raw material exports from the forestry sector, and is already structured towards that objective. The large Tropik mill, for processing the pine resource, has recently been commissioned. This mill is modern, and appears to have an adequate resource base to justify its 215,000 m<sup>3</sup> p.a. log intake capacity. The major problem may be that its design is focussed on high throughput for the bulk grade timber market: a market which will come under major pressure from competing Pacific rim suppliers. It would be advisable, at this point, to explore the feasibility of moving at least some Pinus caribaea up-market, based on its appearance and performance advantages, and to assess the costs of either adjusting or augmenting the mill operation to produce higher grade material.

4.40 If Fiji is to gain the maximum advantage from sawing its valuable plantation hardwood resource, structural change will be necessary to upgrade existing mills to the high precision capability that will be needed to follow the quality components and related markets. The hardwood sawmilling sector in Fiji is now largely concentrated in two major firms, which should have an adequate investment base for restructuring the sector.

4.41 In the Solomon Islands, all but one of the 34 major sawmills in the natural forest area exist as part fulfillment of agreements by logging contractors to establish processing. As in most cases of command processing (see below) this is not an effective means to achieve an efficient processing

sector: log exporting is highly profitable in the Solomons, and contractors have this, not processing, as their primary interest.

4.42 According to initial project evaluations for the Kolombangara plantation project, the project will be profitable if based on woodchipping alone, or on a combination of woodchipping and sawmilling output. Provided the scale of operations justifies the construction of needed infrastructure on Kolombangara, this project should allow the Solomons flexibility for varying its product mix to follow market developments.

4.43 Little can be said on products or sector evolution in the case of Vanuatu, since only three sawmills currently operate. A valuable species--Black Bean--is sliced into veneer in Vanuatu, and currently this constitutes the major output of the sector. Some foreign investment interest has been shown in establishment of large scale pulpwood plantations on Vanuatu. Provided the major land tenure problems which presently constrain such developments can be overcome, such a project would seem to offer the only feasible route by which Vanuatu might enter the export sector in a major way.

### Broader Sectoral Issues

#### (a) Command Processing

4.44 The market information contained in this study suggests that countries with aspirations to enter the international forest products market will need to be efficient producers. An abundance of the natural resource is a less important determinant of competitiveness. Thus, the means by which a country develops its forest industries is important.

4.45 All four countries of the Pacific Islands region under review in this report have in place some version of command processing policies: measures introduced by governments to essentially "regulate into existence" (or preserve in existence) domestic forest processing. Such policies are introduced in the belief that value-added, and associated employment, from a natural resource endowment should be kept within the country.

4.46 The most common form of command processing is a ban, or a significant restriction, on the export of logs--which forces logs onto the domestic market for further processing. By definition such a measure isolates the local processing industry from world prices--and the first result of such policies is usually a loss of revenue to resource owners. Of itself, a log export ban creates no incentive for domestic processors to match the efficiency of overseas producers, since they receive what is in effect a broad-based subsidy on their major raw material input. The mere increase of the cost of a final product over its raw material equivalent should not be interpreted as increased value added. If the addition of labor and equipment results in losses of the efficiency of resource use (compared to foreign equivalents) then the private and social costs of that additional employment generation will be high. Such costs will, however, usually remain uncalculated, and will be hidden from policymakers and the public alike.

4.47 A reason frequently given in defence of log export bans is that the log exporting sector is highly profitable and that therefore there is no incentive for exporters to process. However, this suggests that the royalty

and taxation system being applied in forestry is inappropriate, and that attention should be given to reducing to correcting rent-seeking behavior, rather than the implementation of further regulation.

4.48 If a given country wishes, for larger political and economic reasons, to create an efficient and competitive forest processing sector, it is unlikely a log export ban will achieve this. A better alternative is to introduce incentives which are targeted specifically on the achievement of productivity, efficiency and profitability objectives by processors--so that there is an incentive for industries to perform, rather than merely establish themselves in the sector which, as argued above, might just as easily result in value lost as value added. This approach would also seem preferable to the third alternative--essentially "picking winners"--whereby a government attempts to pre-determine which sorts of processing sector are preferable.

4.49 Another form of command processing--also common in the forest products sectors of Asia and the Pacific--is protection of domestic markets for forest products. To be fair, these measures are most often introduced to save existing processing industries in which (frequently) considerable investment--often including government investment--has already been made. Nevertheless, the principle still applies: a tariff, or import quota, will provide indiscriminate assistance to all domestic industries involved in that particular market, and from the national welfare viewpoint, the above-normal profits or inefficiencies that result are equally undesirable. And, as in the log export ban case, the level of assistance will be invisible (and, for quotas, possibly incalculable). Again, as in the case of log export bans, if assistance is deemed necessary at all, in pursuit of some higher economic or political purpose, then it should at the least be of a form that can be directed towards producing efficiency responses.

4.50 Another method of promoting domestic processing, which is followed by both PNG and the Solomon Islands, is to use regulations to force log exporters to create a certain amount of processing capacity domestically. This rarely contributes to the creation of an efficient and competitive domestic processing sector. Variants of this measure have appeared in Australia, and South East Asia (notably the Philippines), and have been equally unsuccessful. As long as the price and market signals favor the export of logs, log exporters have no incentive to do anything more than the legal minimum in the processing area. Few of the sawmills which have been set up in PNG on this basis ever reach full capacity production and some simply do not operate at all. Moreover, these mills seldom receive the better log material from the exporter's shipments for processing. To achieve an efficient processing sector, the government of PNG needs to develop policies which will guarantee a potential investor a reliable supply of high quality logs at the export point (at the going f.o.b. price), and provide incentives attractive enough to initiate the investment structured so as to reward specific performance goals.

4.51 The two major countries of the region (PNG and Fiji) have in place local market protection policies for domestic processors. Papua New Guinea's sole plywood manufacturer survives because of restrictive quotas on imports of competing material, and as is detailed in the PNG TFAP Report, a range of industry protection measures is under consideration: restrictions on imports of sawn timber and molding; heavy duties on furniture; and local content

requirements for buildings. The Fijian domestic forest products market is also heavily protected by import controls: there is strong evidence that local suppliers do not compete vigorously in the local market.

4.52 Papua New Guinea is also considering a range of incentive policies for local processors: tax exemptions on equipment for downstream processing; income and export tax concessions. Amendments to merchant shipping legislation, to improve the efficiency of coastal shipping are also under consideration in PNG, and would benefit the forest processing sector. In the medium term, until major structural changes in forest management and the administration of the log market work through the system, concentration on these positive incentives would be more advisable than the use of command processing or industry protection measures in PNG, especially if they can be focussed so as to reward productivity and efficiency improvements. Eventually, broad industry policy reforms, and improvements in the management of both the natural and plantation resources will allow processing for export to operate with low levels of assistance in PNG. In the meantime it is essential that the rapid creation of a large, insulated and inefficient sector be avoided, so that the inevitable adjustment costs of such a development can be minimized.

4.53 Fiji is already committed to a large, export based processing sector. Provided this sector continues to be developed in a technologically advanced manner, with incentives for management and market development, the perceived necessity to protect domestically oriented processors should diminish, as the technical skills needed to manufacture efficiently become established in the country. Fiji's preferred strategy, therefore, should be to proceed with encouragement of investment in technically efficient processing for export, rather than relying on domestic processors serving a heavily protected local market to evolve towards efficient production.

4.54 More details on the command processing and domestic industry protection policies that currently apply in the four Pacific Island countries appear in Volume II, and also in the PNG TFAP report (World Bank (1990)), and the FAO Fiji sector review (FAO (1988)). For the purposes of this document, it is hoped that the foregoing generic treatment will be sufficient to encourage policymakers to carefully review their resource pricing and industry development policies.

(b) Other Issues: Land Tenure

4.55 As with forest sector development anywhere, there are issues of policy, planning, institutional development and field management which will be critical in achieving sectoral objectives and be preconditions to development of any long term market strategy. Some of the more important or urgent of these issues are raised in Chapter X and XI of Volume II of this report. Also, they have been the subject of much recent analysis of the sector, in reports referred to in the bibliography. Because of the breadth of these issues, no attempt can be made in this report to produce definitive solutions: most governments of the region are, or will shortly be, involved in comprehensive sectoral re-evaluations, as is presently occurring in Papua New Guinea, largely under the impetus of the Tropical Forestry Action Plan process there.

4.56 Perhaps the single most important forestry issue in the four countries is one which is also unique to the Pacific Region: the fact that almost all forested land is owned by individual groups or clans of landowners, not by the State acting as an agent for the people as whole. This situation implies both a problem (where technical forestry expertise cannot be applied to management, because of divergence between the State interest, and those of resource owners), and an opportunity (local populations with an unambiguous long term vested interest in the resource are potentially a powerful source of field management and control over utilization of the resource). In practice, the land tenure system has had different implications for forestry in different countries: in Papua New Guinea, the Solomon Islands and Vanuatu, it has resulted in significant environmental failures in both plantation and natural forest management. In Fiji, on the other hand, it has worked fairly well--largely through the successful incorporation of landholders interests into the Native Lands Trust, and the efficiency of that agency in dealing with other government agencies and the corporate sector. As is detailed in the PNG TFAP Report, various initiatives for resolving tenure disputes and issues, and involving landholders in land management and decision making are under way, and it is unlikely that a single solution will emerge for PNG, let alone for the region as a whole. All that can be said at this juncture is that a withdrawal from clan ownership of land in this region is basically not an option: whatever is done will need to involve landholders as effective owners of the resource.

#### Future Directions for the Pacific Islands Forestry Sectors

##### (a) Implications for Sector Development

4.57 The questions posed in paragraph 1.5 in the Introduction to this report call for analyses and information on market trends, resource and environmental factors, and some major policy issues. As noted above, some major issues of policy, management and institutional development--particularly in relation to incorporating landholders effectively into the system--are important, but are essentially beyond the scope of this report. However, in addition to market analyses focussed on products presently or potentially available from the region, this report has raised some important sectoral issues: resource quality; sector evolution and product type; the role of command processing and protection as means to develop efficient processing capacity; and environmental factors.

4.58 The general forest sector implications which emerge from the foregoing information and analyses are:

- (a) None of the four countries should rely heavily on traditional markets. Nor should they assume market demand for tropical timber will improve. A major implication of this finding is that new entrants into forest products markets will need to make significant investments in both market evaluation, and marketing of their forest products.
- (b) The market studies indicate that even in the medium grade markets, some niches may be exploitable, and that some product areas are resilient in the face of market cycles. These areas will require strong, focussed marketing to exploit.

- (c) The quality markets seem more secure, and the Pacific Island nations should do whatever is necessary in resource management and marketing to harbor and to create quality resources, and to market as much output into these grades as possible. In some cases, this may involve reversing the traditional pattern of resource usage (moving from best to worst) so as to take maximum advantage of evolving market trends. Issues of reliability of supply, quality and flexibility of processing--rather than throughput--become important.
- (d) From a technical point of view, there is a logical evolution towards processing in the forestry sector, but the sequence may be impractical in view of major market trends facing the Pacific Islands. Basic sawn material; and medium, structural grades of plywood are relatively low in the sector evolution scale, and reasonably efficient production can be achieved with relatively low levels of technical input and investment. But these products sell into intensely competitive international markets, and all indications are this will continue to be so. Pacific islands producers may need to explore ways to bypass this stage of development. Some suggestions made in this report to achieve this include: utilizing existing log exporting infrastructure as a means to accumulate sufficient quantities of quality resource in central locations for specialized processing; exploring the potential for specific purpose plantation and processing (for example, for woodchip export of desirable hardwood material in plantation); utilizing marketing techniques to place products with some characteristics better than average in higher grade use; and generally exploring niche markets for specialized componentry, moldings and other value added products.
- (e) All four Pacific Island nations--but especially Fiji and PNG need to reconsider their industry assistance policies: command processing and industry protection policies of the type presently in place or under consideration are unlikely to lead to efficient and competitive processing sectors. A combination of removal of unnecessarily restrictive regulations, and focussed subsidies or incentives, is more likely to produce the desired result. Given that competition for markets for tropical forest exports is likely to remain strong--or more probably, to intensify--selection of the appropriate policies for industry development becomes especially important.

(b) Implications for Donor Agencies

4.59 Finally, there are some implications for multilateral or bilateral agencies which are, or are about to be, involved in development of the forestry sectors of the four Pacific Island nations:

- (a) In addition to inputs in the more traditional forestry development assistance areas (such as institutional development, policy reform and technical assistance in management and resource analysis) agencies need to evaluate whether sufficient capacity exists in

these countries in the area of market evaluation, marketing and promotion.

- (b) Although, as noted earlier, the four countries cannot be expected to operate regionally in a marketing sense, some monitoring information could be collected in a central point and disseminated amongst the countries, for greater efficiency. It would, for example, be useful for every country to receive up to date and comprehensive information on markets for: hardwood chips, tropical logs, sawn timber and quality veneers in Japan; chips, sawn timber and moldings in the Pacific North West; sawn timber, moldings, componentry, builders woodworking and veneers in Europe; and all products traditionally sold under special trade arrangements to Australia.
- (c) The International Tropical Timber Organization might be approached to make the Pacific Islands a separate category, in its promotional dialogue with Japanese importers. In general, ITTO should be requested to raise the profile of the Pacific Islands as a supply zone in its market work.

## GLOSSARY

N.B. This glossary deals largely with abbreviations and acronyms commonly used in the text or tables. It omits abbreviations which are immediately accompanied by a synonym or an explanation in the text, and also those which are widely understood e.g. EEC, FAO, etc.

- AAC:** Annual Allowable Cut; a forest management concept indicating the permissible annual harvest under a traditional sustained yield system.
- ABARE:** Australian Bureau of Agricultural & Resource Economics, formerly the Bureau of Agricultural Economics (BAE).
- AD:** Air-dried (of sawn timber).
- ADAB:** Australian Development Assistance Bureau.
- ADB:** Asian Development Bank.
- ANM:** Australian Newsprint Mills, now part of the FCL\* group.
- APKINDO:** Indonesian Plywood Manufacturers' Association.
- a.s.l.:** Above sea level.
- ATLANTA/IMPROMA:** Major study on the Indonesian forestry sector conducted by the German firm and the Indonesian Government.
- BAM:** Baikal Amur Magistral, the second trans-Siberian railway.
- BB:** Break-bulk (of shipping cargoes).
- BC:** British Columbia.
- BDU:** Bone Dry Unit, mensurational standard for shipping woodchips derived from air-dry density of the chips.
- BERL:** Business and Economic Research Ltd., influential New Zealand research group often active in the forestry sector.
- Bison Board:** Very thin (3mm.) New Zealand-made particle board.
- bd.ft.:** Board feet (1000 = 2.36 m<sup>3</sup>), a U.S. unit.
- BPS:** Biro Pusat Statistik, the Indonesian Statistics Office.
- BULOG:** Indonesian parastatal responsible for rice distribution.
- C.a.i.:** Current annual increment, a marginal parameter in forest biometry.
- c.&f.:** Cost and freight (insurance found by purchaser).
- CDC:** Commonwealth Development Corporation.
- CER:** (ANZCERTA), an Australia-New Zealand common market agreement with similar intent to Europe 1992, but less deleterious to third country traders such as the Pacific Islands.
- CHH:** Carter Holt Harvey, New Zealand forestry/fishing company with large Chilean interests.
- "Chippu shokku":** Japanese colloquial transliteration describing unilateral U.S. softwood chip price rises ca. 1980-1.
- c.i.f.:** Cost, insurance, freight (conventional import pricing standard)
- CINTRAFOR:** Centre for International Trade in Forest Products at the University of Washington, author of one of the original reports.
- "Command processing":** (In this study) negative policy instrument prohibiting export of less- or unprocessed products; cf. positive export encouragement instruments which are broad-based and do not select industries.
- CONAF:** Corporacion Nacional Forestal, Chilean Government agency responsible for conservation of natural forests, and administration of forest laws, including D.L. 701\* grants.
- CSIRO:** (Australian) Commonwealth Scientific & Industrial Research Organisation.

CTMP: Chemi-Thermo-Mechanical Pulp.  
 CWC: Chipwood Working Circle (Kolombangara Project).  
 DBB,DAB, ###, etc.: Grading codes for the quality of the face, core,  
 and back veneers of  
 plywood.  
 d.b.h.: Diameter at breast height, conventional mensurational location  
 for standing trees.  
 DIY: "Do-it-yourself" market for wood-based manufactures.  
 DJK: Direktorat Jenderal Kehutanan, the Indonesian Forestry Service.  
 D.L.701: Decree Law 701, the Chilean legislation granting partial cost  
 recovery to forest growers.  
 DNER: Department of Natural & Environmental Resources.  
 DRM: Dark Red Meranti (group of species).  
 ETTS IV: Scenarios from the ECE/FAO study of the European Timber  
 market.  
 F#: Australasian sawn timber grades.  
 "Falcata" ("Albizzia"): Trade names for Paraserianthes falcataria.  
 f.a.s.: free alongside ship.  
 FCL: Full Container Load (shipping).  
 FFD: Fiji Forestry Department.  
 FIC: Forest Industries Corporation (PNG).  
 FMA: Forest Management Agreement (B.C.).  
 F.o.b.: "Free on board (shipping).  
 Formply: Plywood used for concrete shuttering.  
 FPC: Fiji Pine Commission.  
 FPRDI: Forest Products Research & Development Institute (Philippines).  
 FRI: Forest Research Institute (New Zealand).  
 FRIM: Forest Research Institute of Malaysia.  
 "furumono": (Japanese) second-hand goods.  
 "Gastarbeiter": Foreign immigrant workers with limited sojourn rights.  
 GATT: General Agreement on Tariffs and Trade.  
 GDP: Gross Domestic Product, total value added in an economy.  
 GNP: Gross National Product, GDP plus net value of traded goods.  
 GOF: Government of Fiji.  
 GOPNG: Government of Papua New Guinea.  
 GOS: Green-of-saw.  
 GOV: Government of Vanuatu.  
 GP: Georgia Pacific (U.S. firm).  
 GSP: General System of Preferences.  
 GTZ: Gesellschaft fur Technische Zusammenarbeit, aid agency of the  
 F.R. Germany.  
 "hashira": (Japanese) square column in traditional building.  
 Hinoki: Chaemaecyparis obtusa, valuable Japanese indigenous species.  
 HP: Hutan Produksi, Indonesian production forest classification.  
 HPT: Hutan Produksi Terbatas, Indonesian limited production forest.  
 ICSI: Investment Corporation Solomon Islands, a financial parastatal  
 in the Kolombangara project.  
 IFP: Industrial Forest Plantation (Vanuatu).  
 IGGI: Inter-Governmental Group on Indonesia, a joint aid agency of  
 some OECD Governments for aid to Indonesia.  
 IMP: Industrial Master Plan (Malaysia).  
 INFOR: Instituto Forestal, the Chilean Forest Research Institute.  
 INFOS: New Zealand Government computer database open for lease.

IRR: Internal Rate of Return, roots of the higher order equation of future streams of benefits and costs in discounted cash flow analysis.

ITTO: International Tropical Timber Organisation.

Kaingineros: Filipino shifting cultivators in the uplands.

KD: 1) Kiln-dried (of sawn timber).  
2) "Knocked-down" (of furniture).

KFPL: Kolombangara Forest Products Company.

kN: Kilonewton, S.I. unit for measurement of hardness in wood.

LANCO's: Land-owning companies (PNG\*).

Lao PDR: Lao People's Democratic Republic.

LCL: Less than container-load (shipping).

LDP: (Japanese) Liberal Democratic Party, in power over forty years.

LRM: Light Red Meranti group of species.

LSP: Local Supply Plantations (Vanuatu).

LVL: Laminated Veneer Lumber.

MAFF: (Japanese) Ministry of Agriculture, Forestry, and Fisheries, of which the Forestry Agency is a part.

M.a.i.: Mean annual increment, an average growth measure in forest biometry.

Matsutake: A lucrative Japanese fungal food, grown on hardwood logs stacked beneath coniferous forest canopies for shade and humidity.

m.c.: Moisture content (of sawn timber).

MDF: Medium Density Fibreboard.

MITI: (Japanese) Ministry of Trade & Industry.

MLH: Mixed Light Hardwoods (trade term).

MoE: Modulus of Elasticity (wood testing).

MoR: Modulus of Rupture (wood testing).

MOF: Ministry of Forestry e.g. P.R. China, New Zealand, etc.

MPa: Megapascal, S.I. Unit used to quantify moduli of rupture and elasticity when testing wood properties.

MPI: (Malaysian) Ministry of Primary Industry.

MSF: 103 square feet (U.S. plywood measure).

MTIB: Malaysian Timber Industry Board.

MUS: Malaysian Uniform System ("sustained yield" mangement type).

NCD: National Capital District (Port Moresby, PNG).

N.F.: Natural Forest.

NICS: Newly Industrialising Countries e.g. S. Korea, Singapore etc.

ni-Vanuatu: Indigenous people of Vanuatu.

NLTB: (Fijian) Native Lands Trust Board, intermediary in lease of customary lands by forestry interests.

NSW: New South Wales.

NZFP: New Zealand Forest Products, forestry company now Australian-owned (Elders NZFP).

NZFS: Former N.Z. Forest Service, disestablished 31.03.'87.

N.e.s.: Not elsewhere specified (in tables).

o.b.: Over-bark (measurement).

OCC: Old Corrugated Containers, a N. American waste paper export to Japan.

ODA: (U.K.) Overseas Development Administration.

OECD: Organisation for Economic Co-operation & Development.

OSB: Oriented Strand Board.

P & P: Pulp & Paper.

PFE: (Malaysian) "Permanent" Forest Estate.

PI: Pacific Islands.  
PICOP: Paper Industries Corporation of the Philippines  
PNG: Papua New Guinea.  
PNGFD: PNG Forestry Department.  
PNW: Pacific North West (coastal States & Provinces of U.S. & Canada)  
Perum Perhutani: Indonesian parastatal primarily responsible for teak plantations and milling on Java.  
REPELITA #: Series of Indonesian national plans.  
R/S: Rough-sawn.  
RTA: Ready-to-assemble (of furniture).  
RWE: Round Wood Equivalent (of processed products). Note choice of conversion factors always leads to non-comparability of data.  
SAFODA: Sabah Forest Development Authority, a parastatal.  
"Scrimber": CSIRO\*-developed product made by crushing pine thinnings between steel rollers and re-assembling with glues in a sawable form.  
s.e.d.: Small end diameter (of logs).  
Sel & Btr.: Select & Better (sawn timber grades).  
"Setto nai-kai": Japanese Inland Sea.  
SFI: Sabah Forest Industries, a papermill/plantation complex.  
Shiitake: A lucrative Japanese fungal food, grown on hardwood logs stacked beneath coniferous forest canopies for shade and humidity.  
SI: Solomon Islands.  
SIFD: Solomon Islands Forestry Department.  
SIG: Solomon Islands Government.  
SMA: State Marketing Authority (PNG).  
SMS: (Malaysian) Selective Management System, another "sustained yield" management type with a shorter cycle than MUS\*.  
SNASP: System of Protected Natural Areas, a Chilean conservation classification.  
SPARTECA: South Pacific Regional Trade and Economic Co-operation Agreement liberalising trade among Australia, New Zealand, and the PI\* economies.  
SPO: State Purchase Order of SMA\* in PNG.  
SSSB: Sabah Softwoods Sdn. Bhd., a State/private plantation-growing joint venture.  
SWC: Sawlog Working Circle (Kolombangara project).  
SWPI: South-west Pacific Islands (objects of this study).  
Sogo shosha: Japanese conglomerates (very large and very few) functioning as hybrids of high volume traders and merchant banks.  
"South Seas": Japanese term (nan'yo), for products of S.E. Asia and Pacific Islands, especially tropical hardwoods.  
Stumpage: Strictly, the price of any standing tree, however determined.  
Sugi: Cryptomeria japonica, preferred indigenous plantation species and major building component.  
Sustained Yield: Traditional forest management concept rather similar to entail in law, when a trustee may use only interest and never capital. Universal usage has now clouded any modern meaning.  
TFAP: Tropical Forestry Action Plan (FAO\*).  
TLA: Timber Logging Agreement (Philippines).  
TRDI: Tropical Research and Development Institute (London).  
Triboard: New Zealand thick panel using fibreboard and waferboard technology and plywood principle.  
TROPIK: Sawmill 51Z owned by FPC\* designed to process their pines.

## BIBLIOGRAPHY

- Adams, D.M. Haynes, R.W. & D. Darr (1977): "A Welfare Analysis of Long-term Forest Products Price Stabilization" Amer. Jnl. Agric. Econ.
- Aggrey, J.E.K. (1989): "ITTO & the Timber Trade" in Woodmacasia 89 Int'l Conf. Sept., Singapore.
- Akhaven, Ahmad (1988): "Middle East and India: Expanding Markets for logs and Other Forest Products." -in "Marketing Logs, Timber and Chips of the Pacific Rim--Some Emphasis on the Middle East" Proceedings of the Fifth Annual Seattle Conference, Jay Gruenfeld Associates, Inc., Seattle Washington, November p.44-46.  
(1987): "Middle East: Surprise Log and Lumber Market of 1987," in "Marketing Logs, Timber, Lumber, and Chips to the Pacific Rim", Proceedings of the Fourth Annual Seattle Conference, 7-8 December Jay Gruenfeld Associates, p. 65, 91.
- Alston, A.S. (1982): "Timbers of Fiji Properties and Potential uses."
- Amjad, Mohammad and Nalar Khan (1984): "The State of Forestry in Pakistan" Forest Economics ranch, Pakistan Forest Institute, Peshawar.
- Anonymous (1988): "AMP - Bilanz, Forst- und Holzprodukte, Zentrale Markt- und Preisberichtsstelle fur Erzeugnisse der Land-, Forst- und Ernährungswirtschaft" GmbH, Bonn, 1988.  
- (1986) " Singapore Trade Development Board."  
- (1988) "Statistical Year Book of the Republic of China Directorate General of Accounting and Statistics."
- APINDO (1989): Pers. comm. (export of plywood 1988 figures).
- Arnold, J.E.M. (1990): "The Long Term Global Demand For and Supply of Wood" Ch. 8 in forthcoming study under preparation for UK Forestry Commission by the Oxford Forestry Institute.
- Asian Development Bank (1987): "A Review of Forestry and Forest Industries in the Asia-Pacific Region" Agriculture Department, ADB, Manila.
- ATIBT (1982): "Nomenclature Generale des Bois Tropicaux" Association Technique Internationale des Bois Tropicaux, Nogent-Sur-Marne, France.
- Australian Development Assistance Bureau (ADAB) (1986): "Market Prospects for Timbers in the Kolombangara Forest Plantation Project." Solomon Islands Department of Foreign Affairs.  
- (1988): "A report on the potential of the Allardyce project"
- Australian Government Department of Primary Industry (1987): "Australian Forest Resources," Canberra.
- Australian Gov./Fiji Gov. (1986): "A review of the hardwood plantation reforestation subsector in Fiji."

- Baharuddin Haji Ghazal & Tong Kok Hung (1987): "Supply of and Demand for Timber and Wood-based Products of Malaysia" Proc. Seminar "Future Role of Forest Plantations in the National Economy and Incentives Required to Encourage Investment in Forest Plantation Development", Kota Kinabalu.
- Bank of Papua New Guinea (1988): "Quarterly Economic Bulletin Dec. - "Report and Financial Statements 31 Dec. 1987."
- Bilek, E.M. (1989): "A Critique of "Valuation Prices for Wood in New Zealand Exotic Forests" (Report by Business & Economic Research Ltd.)" N.Z. Forestry 34 (1).
- Blandon, P. (1983): "Forest Economy of the U.S.S. R."
- Bourke, I. A. (Ed.) (1988): "India." in "A Preliminary Assessment of Export Market Opportunities for Solidwood Products" Report for New Zealand Market Development Board by Forest Research Institute, Rotorua, New Zealand, May pp. 24-28.
- Brooks, D.J. and A.K. Gandapar Vincent, J.R. (1990) "Tropical-Temperate Sawlog Substitution in Japan" Mimco report, Michigan State University.
- Buhler, C. & G. Briggs (1988): "The Role of Northwest Hardwoods in International Trade" CINTRAFOR, University of Washington.
- Burrows, G.D., H. H. Levack, and J.B. Novis (1986): "A National Forestry Planning Model for New Zealand" ANZAAS Conf. Proc., Palmerston North.
- Byron, R.N., & J.J. Douglas (1981): "Log Pricing in Australia: Policies, Practices, and Consequences" BFE Press, Canberra.
- Calhoon M. (1988): "Domestic market forecast, Forestry sector Development study FAO/UNDP/Fij/88/006.
- Calhoon M. and Baba J. (1988): "Forest Valuation and Forestry Accounting Methodology", FPC Tech Report #30 May.
- Cameron, John I. & Ian W. Penna (1988): "The Wood and the Trees: A Preliminary Economic Analysis of a Conservation-Oriented Forest Industry Strategy" Australian Conservation Foundation.
- Canadian Forestry Service (1988): "Selected Forestry Statistics Canada 1987" Economics Branch, Ottawa (Statistics Canada).
- Central Bank of the Solomon Islands (1989): "Annual Report," Honiara.
- Chai, F.Y.C. (1989): Pers. comm.
- Chai, Francis Y.C. & Joseph J. Kendawang (1984): "Nursery Practice, Site Evaluation, and Silvicultural Management of Plantations in Sarawak" Proc. Seminar "Forest Plantation in Malaysia," Kota Kinabalu.
- Chung Hwa Pulp Corp. (1988): "Annual Report."

- Commonwealth Development Corporation (1987): "Kolombangara Reforestation Project SI, Industrial Options."
- Council for Economic Planning & Development (1987): "Industry of Free China." Executive Yuan.
- Dahms, K.G. (1982): "Asiatische, ozeanische und australische Exportholzer" ISBN 3-87181-305-2, DR-Verlag Weinbrenner KG, Stuttgart.
- Dahms, K.G. (1979): "Afrikanische Exportholzer, 2, erweiterte Auflage" ISBN 3-87181-044-4, DRW-Verlag Weinbrenner KG, Stuttgart.
- Davey, T.L. (1984): "Land Administration Fiji, Lessons for Papua New Guinea" INA.
- Dep't of Forestry, Council of Agriculture (1988): "Taiwan Timber Production, Timber Prices and Forest Products." International Trade Statistics (1972-88).
- Dep't of Statistics, Singapore (1989): "Imports, Exports and Re-exports." Singapore Government.
- Directorate General of Budgeting, Taiwan (1988): "Statistical Year Book" Production of Timber and Firewood.
- Direktorat Tertib Peredaran Hasil Hutan (1988): "Data dan Informasi Pemasaran Kayu di Dalam Negeri," Jakarta.
- Dongsuh Furniture Co. (1988): Pers. comm.
- Drysdale, P. (1988): "Rain forest management and conservation in Fiji A prescription for action" Proc. Conservation Conference, Suva.
- ECE/FAO (1989): "Study of the Trade and Markets for Tropical Hardwoods in Europe." undertaken for the International Tropical Timber Organization (ITTO) by the ECE/FAO Agriculture and Timber Division, Geneva, April 1989 (not published as yet).
- ECE/FAO (1989): The ECE Timber Committee Yearbook 1988, United Nations, Economic Commission for Europe (ECE), Food and Agriculture Organization of the United Nations, Timber bulletin, Volume XLII, No. 1, Geneva.
- ECE/FAO (1986): "Europe Timber Trends and Prospects to the Year 2000 and Beyond" (ETTS IV) United Nations Economic Commission for Europe (ECE), Food and Agricultural Organization of the United Nations (FAO), Vols. I & II, New York, 1986.
- ECE/FAO (1978): "Study on the Trade and Utilization of Tropical Hardwoods" Supplement 10 to Volume XXX of the "Timber bulletin for Europe" (EC), Food and Agricultural Organization of the United Nations (FAO), Geneva.
- Economist Intelligence Unit (1988): "World Outlook - 1988".

Eddowes, P.J. (1977): "Commercial Timbers of Papua New Guinea, Their Properties and Uses" The Director, Office of Forests, Department of Primary Industry, Port Moresby.

Erfurth, T. (1976): "The Marketing of Tropical Wood" in Rusche, H.A. "Wood Species from African Tropical Moist Forests" also B. Wood "Species from American Tropical Moist Forests" Forestry Department, Food and Agriculture Organization of the United Nations, Rome.

Far Eastern Economic Review (1988): Asia Yearbook 1989, Hong Kong.

FAO (1989): "Yearbook of Forest Products", Rome.

- (1988): "Monthly Bulletin, Tropical Forest Products in World Timber Trade" FO: MISC/89/3, Rome, Jan.-June.

- (1987): "Forest Products Prices 1967-86."

- (1980): "Concepts and Guidelines for the Utilization and Marketing of Tropical Timber in a Changing Supply and Demand Situation" Committee on Forest Development in the Tropics, Fifth Session, Rome.

- (1988): "Forest Products: World Outlook Projections, FAO Forestry Paper 84, Rome, 350 pp.

- (1988): "Pulp and Paper Capacities - 1987-1992 Survey."

FAO/UNDP (1988): "Forestry Sector Development Study, Project findings and recommendations" FIJ/88/004.

Fenton, R.T. (1988): "The Japan Pulp & Paper Industry, and Market."  
"The Japanese Sawn Timber Market."  
"The Japanese Wood Chip Industry and its Markets"  
F.R.I. Project Records Nos. 1897, 1943, 1870.  
(1986) pers. comm.

Fenton, R.T. & F. Maplesden (1987): "The Eastern U.S.S.R.: Forest Resources and Forest Products Exports to Japan" F.R.I. Bulletin On. 123, Rotorua.

Fiji Forestry Department 1987: Report to National Timber Marketing conference, Suva.  
- (1986): Annual Report 1985.

Fiji Pine Commission (1988): "Annual Report".

Finch, A.C. (1985): "Pacific Island and South East Asian Forestry" CDC, London.

Flynn, F.A. (1987): "Tropical Hardwood Supplies in the South Pacific." in "Forest Products Trade: Market Trends and Technical Developments" (J. Johnson & W. Smith, Eds.), Proc. of the 3rd Int't'l Symp'm on World Trade in Forest Products. Coll. of Forest Resources & CINTRAFOR, 18-20 March Univ. of Washington Press, Seattle p. 210-216.

Ford, B. (1988): "The market potential for Fijian hardwoods in North America" FAO/UNDP FIJ/88/006/A/01/12.

- Forest Products Association of the R.O.C. (1988): "Forest Products Industries."
- Forestry Administration, Korea (1899) "Forestry Statistic", Seoul.  
- (1988) "Summary of Forest Resources Development Plan", Korea.
- Forestry Research Institute (1988): "Illustration of Wood Demand/Supply and Forest Products."
- Golokin, Stan L. & Patrick K. Cassels (1987): "An Appraisal of Sabah Softwoods Sdn. Bhd. 12 Years After Establishment" Proc. Seminar "Future Role of Forest Plantations in the National Economy and Incentives Required to Encourage Investment in Forest Plantation Development," Kota Kinabalu.
- Gottschalt, Marie (1984): "Mushrooming Civilization Killing India's Forests." The Denver Post, 9 Sept. p. 19A.
- Government of Papua New Guinea (1983): "Report of the Task Force on Customary Land issues."  
- (1985) "1980 National Population Census, summary of final figures" Nat. Stats. Office Port Moresby.
- Government of Vanuatu (1982): "National Development Plan"  
- (1985) "Mid term review of the first National Development Plan."  
- (1988) "Santo Industrial Forest Plantation, five year pilot project."  
- (1988) "Statistical Indicators Q2 1988 Statistics Bureau, Nov. 1988.
- Gresham, G.E.: "A Short Guide to Substitute Selling of Papua Guinea Timber" Forest Industries Council, Port Moresby, PNG.  
- (1989) "Indochina - What Timber Future?" in Woodmacasia 89 Int'l Conf. Sept., Singapore.
- Haslett, A.N. (1989): "Interim Report on Tests of Samples of Gmelina arborea from Kolombangara, Solomon Islands" F.R.I. Rotorua.
- Holm, Bob (1988): "India." in "Marketing Logs, Timber and Chips of the Pacific Rim--Some Emphasis on the Middle East" Proceedings of the Fifth Annual Seattle Conference, Jay Gruenfeld Associates, Inc., Seattle, Washington, 28-29 November p.47-49, 73.  
- "Outlook for 1989 and Later: Pacific Rim Markets for Lumber and Other Forest Products" (Panel Discussion). in "Marketing Lumber and Plywood To and From the Pacific Rim" Jay Gruenfeld Associates, Nov. 30, Seattle, Washington, p.47-48.
- Hong Kong Trade Development Board (1988): "Import, Export and Re-export Statistics."
- Hsu Jen Shiu (1989): "Tall Trees Make Island Beautiful." Taiwan Public Information.
- Huang, Y.S. (1988): "Challenges and Opportunities for the Timber Industry in the Republic of China."

Hogbin I. & Lawrence P. (1967): "Studies in New Guinea Land Tenure" Sydney University Press.

Hossain, M., et al. (1989): "Consumption Projections for Forest Products: Implications for Trade and Sector Developments" Aust. Bur of Agric. & Res. Econ. (ABARE) Disc. Paper 89.6, AGPS, Canberra.

Hunter, Lachlan (1984): "Tropical Forest Plantations and Natural Stand Management: A National Lesson from East Kalimantan?" Bull. Indon. Econ. Study. 20 (1) A.N.U., Canberra.

- "The Chilean Forestry Sector: N.Z. Forestry Council Information Paper No. 2 (1987) Wellington.
- (1988) "Fijian Pine Pacific Rim Market Prospects" FAO/UNDP Fij/88/066/A/01/12.

IFSC (1979): "Marketing SI wood and wood products", by McConchie J.D., Groome and Associates.

- (1980) " Fiscal Aspects of the Timber Industry" Final Report to SIG.
- (1982) " Project identification survey, Forestry and Wood Based Industries SI".

Inchcape Timber Group: (1989) Miscellaneous.

INFOR/CORFO (1987): "Estadisticas Forestales" Santiago.

International Tropical Timber Organisation (1989): "Economic Information and Market Intelligence."

- "Tropical Timber Markets in 1988 and Prospects for 1989."

International Development Assoc. of the Furniture Industry of Japan (1989):

- "International Furniture Fair, Tokyo 1989."
- "Import and Export Statistics of Furniture by Items."
- "General Situation of the Household Furniture Market in Japan."

International Monetary Fund (1988): "International Financial Statistics."

Japan Lumber Journal (1988): - "American Timber Demand for 1989."

(1989): - Imports of Forests Products

- Imports of Forest Products
- Southsea Timber Markets
- CIF of Russian Logs
- "White Pater."
- "Southsea Timber Markets, February.
- "Forecast of Housing Starts, 1989."
- "Timber Demand/Supply."
- "Plywood Imports for 1988." 20 April.
- "Softwood Markets for April."
- "CIF of Russian Logs."
- "Southsea Timber Markets."
- "American Timber Markets."
- "Hardwood Imports."

- Japan Paper Assoc. (1988): "Pulp and Paper Statistics, 1988."
- Jayasuriya, Sisira & C. Manning (1988): "Survey of Recent Developments" Bull.Indon. Econ. Stud. 24 (2).
- JICA (1985)" "Report on the forestry development in Cromwell area PNG."
- Jones, N. (1986): "Kolombangara Reforestation Project Feasibility study, Tree Breeding Report."
- Kallio, Markku et al. (eds.) (1988): "The Global Forest Sector: An Analytical Perspective" International Institute for Applied Systems Analysis (IIASA), Vienna (Forestry Sector Project) John Wiley.
- Kehr, K. H. (1985): "Papua New Guinea, A Review of the Sawmilling Industry" FAO, Working Paper No. 43-FO-RAS/78/010.
- Kinajil, Rudy T. (1988): Letter to Comm. For. Rev. 67(3).
- Kir, Adnan (1989): "Wood Products: Domestic Consumption and Marketing" FAO Field Doc. V-1 UTF/INA/065/INS, Rome.
- Kolombangara Forest Products Ltd. (1989): Unpub. feasibility study.
- Korea Business World (1989): "Economic Indicators."
- Korea Federation of Furniture Industry Co-operatives (1988): "International Furniture Fair Reprints."
- Korea Paper Manufacturers Assoc. (1989): "Monthly Statistics on Pulp, Paper & Paperboard in Korea.:"  
- "Korean Pulp and Paper Industries, 1988."
- Korean Plywood Assoc. (1988): :Plywood Statistics, 1988."
- Krefting, Paul (1988):India." in "Marketing Logs, Timber and Chips of the Pacific Rim--Some Emphasis on the Middle East: (op.cit.) Seattle, Washington, 28-29 Nov., p. 50-52, 74-75.
- Kura, Dieter (1989): "Furniture & Construction Mouldings - the Way Ahead" in Woodmacasia 89 Int'l Conf. Sept., Singapore.
- Levack, H.H. (1979): "Future National Wood Supply" N.Z. Jnl. For.24 (2).
- Leslie, A. J. (1986): "A Review of Pulpwood Royalty Policy" Aus. Pulp & Paper Assoc.  
- (1987): "A Second Look at the Economics of Natural Management Systems in Tropical Mixed Forests". Unasyuva 155, Vol. 39.
- Luppold, William G. & Philip A. Araman (1988): "Hardwood Trade Trends" U.S. Exports" USDAFS Res. Pap. NE-611.

- McGuane, Harry (1988): "Marketing Veneers for the South Seas." In Marketing Lumber and Plywood To and From the Pacific Rim, Jay Gruenfeld Associates, Inc., Seattle, Washington, 30 No. p. 45-46.
- Management Analysis Centre Asia Ltd. (1989): "Maskayu" (various issues) Kuala Lumpur.
- Maner, James W. (1989): "Furniture Management & Marketing - the Taiwan Model" in Woodmascasia 89 Internat. Conf. - "Asias's Timber Future: Realities and Opportunities" Singapore, September.
- Marsden, J. D. (1989): "A proposal that will ensure the long term supply of logs from the Bulolo plantation for the existing wood processing complex of PNG Forest Products" Anderson and Marsden.
- Maugham, C.W. & M. Clough (1986): "Future Domestic Solid Wood Market" Massey University Occ. Paper.
- Maxwell, J. & d. Baines (1985): "Developments the New Zealand Forestry Sector: implications for australia" B.A.E., Canberra.
- Miller, R. (1989) pers. comm.
- Miller, W. (1989): "Timber Drying Requirements and Appropriate Technology for the Timber Industry of Vanuatu" FRI Rotorua NZ, for Ministry of External Relations & Trade.
- Ministry of Forestry (N.Z.) (1989): "A National Exotic Forest Description " MOF, Wellington (authors Novis, J., J. Turland, and J. Collins).
- Ministry of Primary Industries, Malaysia (1988): "Forestry in Malaysia," Kuala Lumpur.
- Ministry of Forests, Fiji (1985): "Proceedings, National Timber Marketing Conference, Oct.
- Ministry of Finance, Indonesia (1989): "Assessment of Tariffs and Payment Procedures of Export Duties and/or Additional Export Duties."
- MITI (Ministry of International Trade and Industry) (1980): "Current State of Supply and Demand of Soviet Lumber Imports." (1980) & (1986): "Basic Plans for Forest Resources and Long-term Forecast of Supply and Demand of Major Forest Products."
- Moretti, Frank J. (1989): "The Australian Market: Imports & Exports" in Woodmascasia 89 Int'l Conf. Sept., Singapore.
- Morris, P. & J. Maxwell (1985): "Export Potential of Pulp and Pulpwood to S. Korea" Proc. For. Econ. Conf., Brisbane.
- Mou-Hsiung Tsou (1989): "Country Profile Taiwan, Furniture Industry Facing Tough Fight." Asia Pacific Forest Industries.

- National Forest Products Association (1986): "India--The Great Subcontinent and A New U.S. Market." Economics Monthly Vol. II, No. 11, Nov., p. 1-2.
- "India Reneges on Tariffs, but Market Still Looks Good." International Trade Report, Nov.-Dec., p. 1-2.
  - "India: The Subcontinent and American Wood." International Trade Report, p. 8.
  - "Pakistan May Become a Forest Products Importer." International Trade Report, March, 1989, p. 12.
- Nectoux, Francois & Voichi Kuroda (1989): "Timber from the South Seas - An Analysis of Japan's Tropical Timber Trade and its Environmental Impact" World Wildlife Fund International.
- N.Z. Forestry Council (1987): "Utilisation and Marketing Prospects for Special Purpose Species" NZFC Working Paper No. 8.
- N.Z. Government (1987): "Evaluation of Plantation grown hardwoods for veneer slicing." Ministry of Foreign Affairs/Ministry of Forestry.
- Nam-Joo Huh (1985): "Forest Resources in World and Counter Measure Against Securing Raw Material for Domestic Wood Industry." Joo Hae Forest Products Co.
- "The Current Status and Problems of Wood Industries in Korea." Reprinted from Wood Science & Technology.
- Nomura, I. (1982): "Forest Sector Model in Japan and Some Observations" in "The Current State of Japanese Forestry (II)" IUFRO/Japanese Forest Economics Society, Tokyo.
- Organisation for Economic Co-operation & Development (OECD) (1984): "Future Trends in Waste Paper."
- Office of Forestry Republic of Korea (1984): "Forestry Statistics 1983," Seoul.
- Overseas Development Administration (ODA) (1982): "An evaluation of British aid to assist forest development in SI 1965-1980" - Wood P. S. & Watt G. R.
- Pacific Rim Intelligence Report (1986): "Indian Market for Imported Wood Proving More Difficult Than Expected" (Nov.).
- Pacific Rim Log Market Report (1987): "Turkey and India to be Featured," April, p. 4.
- Palmer, J. R. (1988): "Jari, lessons for land managers in the tropics" Bois et Forests des Tropiques 212 (2): 16-26.
- Paper Business Review (1989): "Import Wood Chips from Various Countries." April.
- Papua New Guinea Ministry of Forests (1979): "White paper - revised National Forest Policy" Port Moresby.

- (1986): "White paper - Consolidated National Forest Policy, October Draft."
  - (1980): "Compendium of Statistics 1979."
  - (1986): "Facts and Figures, 1985."
  - (1986): "Compendium of Statistics 1985."
  - (1988): "Five Year Forest Working Plan Model," Feb.
  - (1988): "The Forestry Sector in the Medium Term Development Strategy 1989-1993."
  - (1988): "Annual Report Statistics 1987."
  - (1989): "Management Programme and Performance Indicators 1989."
- Pack, T. J. (1988): "European, Soviet, and North American Trade Patterns in Forest Products with Middle Eastern and North African Countries." in Forest Products Trade: Market Trends and Technical Developments, (J. Johnson & W. Smith, Eds.), Proc. 3rd Int't'l Symp'm on World Trade in Forest Products, Coll. of Forest Resources & CINTRAFOR, 18-20 March Univ. of Washington Press, Seattle, p. 53-76.
- Percy, M.B. (1986): "Forest Management and Economic Growth in British Columbia" Economic Council of Canada.
- Ping, Domingo C. N., & Yahya Awang (1988): "Current Forest Resource Scenario in Sabah" Proc. MTIB Marketing Seminar, Kuala Lumpur.
- Preston R. (1986): "Methodology Used in the 1985 Review of the North Queensland Rainforest Allocations and Recommendations for Future Research and Development". Queensland Forestry Department.
- Pulp & Paper International (1988): "International Paper Takes the Lead." September.
- "Top 100 Listing. Pulp & Paper Converting Operations Only." September
  - "Hainans Eucalyptus Awaits Investors. January.
  - "Europe: Optimism still Prevails in the West, Problems Confront the East."
  - "Far East's big three expect more stable, but slower, growth rates."
- Queensland Department of Forestry (1983): "Rainforest Research in North Queensland
- (1984): "Forest Management in Queensland" Part II.
- Random Lengths Export (1989): Miscellaneous.
- Republic of Korea Forestry Administration (1987): "Forestry in Korea." August.
- Resch, H. & J. J. Morrell (1986): "India." in "The Wood Housing Market in Selected Pacific Basin Countries" A Report of Studies of Housing Supply and Demand and the Potential for U.S. wood Housing Products - The Pacific Basin Housing Conference, 9-12 Nov., Portland OR/Vancouver WA, Columbia Institute (Coords and Editors), Washington, D.C. p. 9-23.
- Resource Information Systems Inc. (1987): "Forsim Review - Lumber and Panel Markets through 2010." May.

- Richardson, D. S. (1986): "The Cotchell Report" Cotchell Pacific Ltd., Hong Kong.
- Sar, L. & J. Maxwell (1985): "Plantation Sawlog and Pulplog Availability" Australian Bureau of Agricultural and Resource Economics (ABARE, formerly BAE).
- Siddiqui, K. M., M. Ayaz & I. Mahmood (1986): "Properties and Uses of Pakistani Timbers, Forest Products Research Division, Pakistan Forest Institute, Peshawar 78 pp.
- Silviconsult (1988): "Vanuatu Forestry Development Project," Sweden.
- Singapore Department of Trade (1989): "Import and Export Statistics."
- Singapore Trade Development Board (1987): "Timber Newsletter, March."  
- "Statistics of Timber Import & Export in 1986."  
- "Singapore Timber Directory, Timber Newsletter."
- Smith, D.W. (1985): "Exporting Roundwood (Logs)" Unpub. M.Sc. thesis, University of Canterbury, Christchurch.
- Solomon Islands Government (1984): "A National Forest and Timber Policy" May Honiara.  
- Statistical Office (1989): "Statistical Bulletin."  
- (1987) "SI population census report 1. supplement."  
- (1988) "Statistics Bulletin 18/88, National Accounts of SI 1984-86."  
- (1988) (MNR Forest Div.): "Kolombabgara JV forestry project, Review of CDC feasibility study."  
- (1989) (MNR Forest Div.) "Annual Plan of Operations, Reforestation Projects 1989."
- Sutton, W.R.J. (1975): "The Forest Resources of the U.S.S.R.: their exploitation and potential." Comm For. Rev. (160): 110-38.
- Taiwan Forestry Bureau (1984): "Forestry in Taiwan."
- Taiwan Furniture Manufacturers Assoc. (1988): "The Export Value of Furniture in Taiwan."  
- (1987): "The Furniture Industry of Taiwan."
- Taiwan Paper Industry Assoc. (1989): "The Statistics of Taiwan Paper Industry, 1989)."  
- "Production and Shipment in 1988, Korea vs. Taiwan."
- Taiwan Plywood Manufacturers & Exporters Assoc. (1989): "Plywood Industry in Taiwan."
- Takeuchi, Kenji (1983): "Market Prospects for Tropical Hardwoods from Southeast Asia." in "World Trade in Forest Products, Proceedings of an International Symposium on World Trade in Forest Products, College of

- Forest Resources & CINTRAFOR, Univ. of Washington, 22-25 March, University of Washington Press, p. 432-446.
- Timber Association of Sabah (1989): "Facts & Figures," Kota Kinabalu.
- Timber Trades Journal (1989): "Indian Imports."
- Tokyo Business Today (1989): Miscellaneous.
- TRADA (1977): "Cross reference tables for 28 Commercial Timbers from Papua New Guinea.
- UN (ECE/FAO) (1989): "Timber Bulletin, Monthly Prices for Forest Products, Vol. XLII No. 3, United Nations, New York, 1989.
- UNIDO (1987): "Assistance to the Wood using industry of Solomon Islands" UNIDO SI/SOI/86/803.
- United Nations Development Programme (UNDP) (1986): "Economic and Social Survey of Asia and the Pacific."
- U.S. Department of Agriculture, FAS (1987): "India." Market Profiles (Foreign Agricultural Service, (U.S.D.A.) National Forest Products Association, Washington, D.C. (not paged), N.D. Spp.
- "India." Wood Products: International Trade and Foreign Markets, Circular Series WP 1-87, FAS, February, -. 16.
  - (Forest Service): "The Middle East." in "Analysis of the Timber Situation in the United States 1989-2040 Draft Report, Part 1. USDA, Forest Service, Washington, D.C. 1988. pp. 271-272.
- Vancly, J. K. (1987): "A stand growth model for yield regulation in North Queensland Rainforests.
- Vorobiev, H. E. et al. (1982): " Forestry of the U.S.S. R.", Moscow (Tr. Japanese by Takao Hosokawa in "Ringyo Keizai" 1983 et. seq., Tokyo).
- Waggener, T. & E. Medema (1986): "Sri Lanka." in "The Wood Housing Marketing in Selected Pacific Basin Countries" A Report of Studies of Housing Supply and Demand and the Potential for U.S. Wood Housing The Pacific Basin Housing Conference, 9-12 Nov., Portland OR/Vancouver WA. Columbia Institute (Coords. and Editors), Washington, D.C., p. 57-76.
- World Bank (1989): "Price Prospects for Major Primary Commodities" (& pers. comm. Commodity Prices Division.
- (1989) - World Development Report.
  - "Staff Appraisal Report, Indonesia, Forestry Institutions and Conservation Project."
- World Bank (1990): Papua New Guinea. The Forestry Sector: A Tropical Forestry Action Plan Review.
- World of Information (1989): "Asia and Pacific Review."

- World Wood (1989): Miscellaneous & Tropical Forestry Plan May Save Asia's Forests, Oct. 1987, pp. 39-47.
- Wormald, T. J. (1986): "Kolombanagara Reforestation Study Mensuration Report for CDC."
- Yabaki, K. (1985): "Projected Native Sawlog Harvest" Fiji Forestry Department.  
- (1986): "A Preliminary Appraisal of the South Pacific Forest Resources and Marketing Developments" FAO SSA No. RAPA 186/11/85.
- Yong, Chai Ting (1984): "Compensatory plantations in Peninsular Malaysia" Proc. Seminar "Forest Plantation in Malaysia," Kota Kinabalu.
- Yukutake, K. (1982)" "Economic Analysis of Timber Markets with Market Adjustment Mechanisms" in "The Current State of Japanese Forestry (II)" IUFRO/Japanese Economics Society, Tokyo.