THE PUBLIC POLICY IMPLICATIONS OF EUCLYPPT PLANTATION ESTABLISHMENT IN AUSTRALIA: AN INTRODUCTORY SURVEY.

Peter Cochrane and Rolf Gerritsen

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Abstract

Currently the issue of the future of Australia's native hardwood forests is central to Australian politics. One proposal to reduce the exploitation of these forests is for the creation of hardwood plantations as an alternative source of material.

This paper outlines the major factors involved in the establishment of eucalypt plantations in Australia, identifies those that appear important, explores the potential for government involvement in the issue, and discusses the ensuing public policy implications.

The issue of eucalypt plantations must be approached from many perspectives. But the question of the management of Australia's largely publicly-owned forests places a substantial emphasis on the role of the state. This both reflects the pre-eminent historical role of the Australian state - as initiator, facilitator, regulator and arbiter of the "public interest" - and contemporary political "agendas".

This paper does not attempt to "solve" this policy problem. It merely assembles the data and issues of which an understanding is required before future policy costs and benefits can be calculated.
1. Introduction

Public policy analysis therefore requires us to 'puzzle out' ... the processes and limits of the state and to assess the relative influence on outcomes of politicians, bureaucrats, interest groups, organisational structures and economic forces....policy is above all about politics" (Davis et al 1988: 8)

There are four major public policy foci to arguments for eucalypt plantation establishment - employment; the trade and economic forces arising from the demand for and the supply of wood and wood products; the land management/conservation issues; and the nature of and extent of governmental assistance to or involvement in plantation development.

The forestry and wood-based industries employ around 85,000 people, or 1.2 per cent of the workforce. Australia is a net importer of forest products, with a $A1.3 billion deficit on that trade. In addition Australia's most pressing environmental problems, land degradation and conservation, centre on improving land management. The consequent demand for increased plantation production involves considerations of governmental involvement, either through regulatory assistance or direct state production. In particular the weight of demands is upon the Commonwealth government.

In 1990 the Commonwealth government had before it two major submissions regarding the domestic forest industry - one by the Australian Conservation Foundation (ACF 1988) and the other by the Forestry and Forests Products Industry Council (FAFPIC 1987). These submissions differ in philosophy and objectives - with the FAFPIC proposal looking to supplement wood supply from native forests through plantation establishment, and the ACF proposing to substitute wood supply from forests through plantation establishment. Both propose increasing the area of hardwood plantations, FAFPIC by 3,800 hectares per annum (ha. p.a.) to a total of 76,000 ha. by AD 2008, and the ACF by 10,000 ha. p.a. to a total of some 105,000 ha by AD 2005. The Commonwealth government has referred these proposals to its recently-established Resources Assessment Commission (RAC) as part of an inquiry to identify and evaluate options for the use of Australia's forest and timber resources (RAC 1990).
With the establishment of the RAC and its first reference to inquire into Australia's forest and timber resources, the Commonwealth has placed itself in a potentially commanding position to increase its powers with respect to the management of forest resources, and the markets that depend on them. This has obvious implications for future Commonwealth-State relations.

In addition the advent of active conservationist movements over the last decade has recast the parameters of policy debate about the plantations issue. In comparison with hitherto econocentric orthodoxy conservationists weight non-economic values more heavily than economic ones (Gerritsen 1990: 58). This has profound effects on the estimation of social costs and benefits equations with regards to foregoing native forest exploitation in favour either of direct public investment or indirect regulatory and fiscal encouragement of plantations. This new matrix of values has the potential to affect the means whereby the price of governmental assistance to the plantations sector is evaluated.

While short-term microeconomic feasibility may play a central role with respect to the unassisted involvement of the private sector in plantation forestry, governments are also impelled by these other, broader, "social" issues. Given the extent of public concern about environmental questions, and the fact that many such issues, including forest management and land degradation, do not stop at State borders, suggests that the Commonwealth may adopt a higher profile, and increase its influence over land use policies. Whether or not this happens depends, in part at least, on the outcomes of the current Commonwealth-State negotiations over Australia's federal compact initiated by Prime Minister Hawke.

2 Forestry and the Role of the State

The state, throughout Australia's history, has provided and maintained infrastructure to facilitate private sector growth (Butlin et al 1982). The state has dominated, and continues strongly to influence, the Australian economy, the forestry and wood-processing sectors being no exception.

Generally, the State governments are monopolist suppliers in this industry, dominating the actual and potential wood supply both directly and indirectly (Leslie 1986:124). This situation is an historical consequence of European occupation and subsequent industrial development under the aegis of the state. The first century following white settlement was marked by plentiful wood
supply and manual production that required little state organisation to facilitate production or trade. Over the next fifty years public forests were reserved and the forest services established to protect the forest resource and oversee development of the industry.

Rapid expansion of the industry during the long post-World War II boom saw extensive private investment in pulp and paper mills, particle board and woodchip plants, together with the increased concentration and sophistication of the sawmilling sector. These developments greatly increased the capital cost of exploiting wood resources, intensified the demand for wood, and placed higher infrastructural and informational demands on the state owners. Fears of a timber shortage, and moves to replace imports, led to a massive pine planting programme to which the Commonwealth government was a major financial contributor. These trends attracted considerable public concern over public forest management, and resulted in the Commonwealth government gradually assuming a more significant and more interventionist role.

The Commonwealth government issues export woodchip licences and sets guidelines for the operations of the export industry. In addition it has greatly increased its powers to influence land-use options, for instance through its administration of World Heritage properties and the Register of the National Estate.

2.1 The Present

The present position of the state in forestry is as majority supplier and regulator of the industry. Its role is defined by a number of major attributes: ownership; control of prices; regulation and supervision of forest practices; arbiter of disputes regarding forest management; determination of land-use; and provider and/or protector of "social" benefits. In addition, the state has a substantial indirect influence on forestry activities through fiscal, trade and tax policies, research and development funding, and environmental policies.

The role of the state can only be understood within a historical context that includes industry stabilisation, supply of marketed and non-marketed goods, and intervention in cases of market failure or imperfection. These roles are by no means unrelated. The relationship between the state and forest industries now revolves around three main issues: resource allocation; prices; and security of access to resources (Dargavel 1988: 263).
The State governments own around 73 per cent of all native forests, 84 per cent of which may experience wood harvesting. The state also owns 69 per cent of all plantations (ABARE 1988:2-3). Through its dominant ownership the state virtually controls wood supply, ensuring that it acts as price leader, particularly through the negotiated price system (see Section 3 below). Perhaps as a consequence, prices for forest products are generally below those the market potentially could bear (Byron & Douglas 1981). Public expenditures on forestry have exceeded revenues by an increasing margin since the 1930s (Dargavel 1984:133). From this it is obvious that the state subsidises wood production.

It is generally argued that forests produce many values other than wood (eg Leslie 1986; Unwin 1976). Some of these values, including most environmental benefits, exhibit "public goods" criteria of non-rivalness and non-excludability. Allocation of price values to these according to social preferences can only be made through political rather than market processes (Kellow 1984; Gerritsen 1990: 58).

Leslie (1986) argues that the general "public interest" case for the role of the state in forestry is that the outputs are largely non-marketable and take so long to produce that the private sector cannot be relied upon to provide them in the quantities and locations consistent with that public interest. In other words, the case for state intervention rests on a "market failure" argument. The debate on valuation of non-marketed goods and services (eg Sinden 1984; Walker 1984; McKenney & Fox 1989) is relevant to the issue of optimal exploitation of forest resources, though ultimately the decisions will be political rather than economic. Final judgements about this question are beyond the scope of this paper.

The Commonwealth has limited direct but extensive indirect powers to intervene in issues of land use policy. In certain cases, Commonwealth-State administrative or regulatory bodies are created to deal with specific issues, the Murray Darling Basin Commission being one example. The Commonwealth's direct powers under the Constitution include the power to regulate external trade - the issue of export licences and conditions it may place thereon under the Export Control (Unprocessed Wood) Regulations Act being one example. In addition the Commonwealth can tie budget allocations to the States to specific goals or projects, and make specific purpose grants for particular activities, such as the Softwood Forestry Agreement Acts and the National Afforestation Program. The Commonwealth also controls National Estate and World Heritage listings and consequent supporting legislation. The Commonwealth cannot directly regulate forestry activities at present, other than on Commonwealth land, though it may acquire land from the States.
The Commonwealth has power indirectly to influence land use through the Income Tax Assessment Act. For taxation purposes, forestry, including plantations, is classified as primary production, enabling indefinite carry-forward of losses, income tax averaging, rebate of fuel excise, and deductibility of certain capital expenditures (IAC 1989: 4). Table 2.1 below lists key changes in the Income Tax Assessment Act that reflect policy changes towards tree production. It is clear that the state can exert an enormous impact on the direction of forestry activities through taxation policy. Most of these concessions are also available for competing land uses, provide only marginal incentives for private investment, and do not influence State government policies (IAC 1989: 4).

Table 2.1: Trees and Taxation

<table>
<thead>
<tr>
<th>Date</th>
<th>Taxation policy change (Income Tax Assessment Act)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before August 1973:</td>
<td>Outright deduction allowed for expenditure incurred in the destruction and removal of timber, scrub or undergrowth indigenous to the land.</td>
</tr>
<tr>
<td>August 1973 - August 1983:</td>
<td>Deductions as above, but deductible over ten years, to discourage massive clearing primarily for tax avoidance purposes.</td>
</tr>
<tr>
<td>From August 1983:</td>
<td>The one tenth deduction provisions for clearing timber were repealed.</td>
</tr>
<tr>
<td>October 1980 - September 1985:</td>
<td>Deductions were allowed for preventing or combatting soil erosion.</td>
</tr>
<tr>
<td>From September 1985:</td>
<td>Land degradation substituted for soil erosion, and included other effects such as decline in soil fertility and structure, degradation of natural vegetation and the effects of eroded material and salinisation.</td>
</tr>
</tbody>
</table>

Source: Roberts 1989

Other indirect, but nonetheless potent, influences on land use and management include controls on trade, research and development funding; environmental policy (witness the Wesley Vale mill fiasco); and extension work like that provided through the Australian Heritage Commission. Also tariffs apply to imports of certain forest
products, such as dressed timber, plywood and paper. The present tariff reductions will drop the duty on most forest products to 10 per cent by 1992 (IAC 1989: 5), still affording a degree of protection for domestic production. Tariffs on inputs, particularly heavy machinery, increase the input costs of forestry.

The States and local governments have extensive powers to regulate land use. They have specific powers over forestry operations, through ownership and special forestry and land use legislation. Several States have schemes to encourage private forestry, using loans or grants to subsidise establishment and/or operating costs. Most States subsidise the operation of their forestry agency. State governments also influence forestry activities through fiscal and taxation policies, which affect investment decisions, and through franchise agreements - legislation setting out obligations of the State and the developer in respect of infrastructure, royalties and other charges (Head 1986:38).

2.2 Future Trends

Some important trends both endogenous and exogenous to Australia will greatly affect forestry activities into the next century. Firstly it seems unlikely that the structure of forest ownership will differ greatly from the present, although the mechanisms (eg Helsham 1988, Stewart 1989) and the potential (eg, Kirkpatrick 1987) exist for further transfers within the public estate of lands from wood production to protection. These transfers will eventually affect the supply and prices of wood, as alternative supplies and substitutes are found and developed.

There is an accelerating trend for governments to require their agencies to demonstrate real returns on assets. For instance, the Victorian government proposes that its forest agency make a four per cent return on timber investments (Victoria 1986). Economic planning and accounting systems within forestry commissions are becoming more refined and focussed on improving the accuracy and relevance of their financial reporting to government objectives (Greig 1984, Victoria 1986).

It can be expected that the State governments will gradually raise the real prices of royalties in the future. This will lead to general increases in the price of wood and wood products. But it may also positively affect the prospects of developing a significant eucalypt plantation sector. The extent of these effects is currently impossible to estimate with any degree of accuracy. It is likely, however, that this variable will be of less import than other.
governmental policies, notably macroeconomic, fiscal and regulatory effects.

The establishment of the Resource Assessment Commission, and its brief to assess policies for and impacts of, resource utilisation and management, has placed a firm national focus on resource issues. The RAC's Forest and Timber Inquiry has the potential to continue the drift from the States to the Commonwealth of the management of Australia's forest resources. The RAC is also charged with exploring and developing more sophisticated economic tools to improve resource allocation decisions. The provision and value of non-market goods and services will need to be better specified, and new analytic approaches and improved information-gathering and handling technologies will assist in improving evaluation of the community's economic welfare.

Australian forestry's future will also be partly determined by exogenous forces. Likely factors are the tendency for the world economy to overwhelm national economic management in shaping economic events; Japan's dominating influence on the forest product market (Leslie 1987a); and the declining market for construction timber. To this could be added social and technological change, particularly in the electronic media (Edquist & Wallace 1985) that may, for instance, reduce the demand for paper products.

2.4 Summary

To the extent that the state is seen to act as custodian and arbiter of the public interest, it will retain a legitimate role in intervening in recognised cases of market failure or imperfection. Market solutions may be ineffective in some cases, or inadequate in others, and may bring about neither socially desirable benefits nor eliminate socially unacceptable costs (eg Chisholm & Reynolds 1982; Leslie 1986). However improved techniques for assessing non-market values and outcomes will better permit these values to be included in public policy formulation and implementation.

It seems inevitable that, over issues with a strong environmental content, there will be some contention for power between the Commonwealth and the States, if only because environmental issues transcend State boundaries. This latter perception will either result in the longer term in a transfer of control over standards, regulations and enforcement to the Commonwealth government or, possibly, greater coordination between the two levels of government.
The comfortable arrangements between the State governments' wood suppliers and the private sector wood-users that have developed over many decades will be substantially affected by these new developments. If the changes are gradual, adjustment will occur; if they are sudden, dislocations will occur.

The state has now a variety of interests in forestry. The addition of an environmental imperative complicates predictions about the development of these interests. For example, the political pressure to reduce native forest usage by substituting plantation production will create tensions between the various roles of the state in the industry. State subsidisation of timber exploitation may not be feasible if fiscal resources are diverted to the subsidisation of plantation establishment. Such a policy shift would have profound short-term effects in the dislocation of regional economies. These dislocations would have immediate political/electoral consequences.

Ultimately, exogenous factors will be of over-riding importance to the future management of Australian forestry.

3. The Industry Context (a) - Forestry, Timber Resources and Wood-based Industries

We may however be sure of this, that we are exhausting the stock of some of the most valuable timber trees more quickly than it can be replaced by the growth of young ones'

(Queensland, Report of Under-Secretary for Lands, 1880)

3.1 Australian Forest Resources

Large areas of forested land still remain in Australia, despite extensive clearing for agriculture and exploitation of the timber resource for sawlogs, railway sleepers, posts and poles for fencing and mining, fuelwood and pulpwood. Australians are relatively well endowed with forest resources, with around 2.4 ha per capita of forested lands compared with a global average of 0.5 ha, and 0.72 ha per capita of forest reserved for, and 2.1 ha not alienated from, timber production. Forests however occupy a small portion of the continent (5.3 per cent of land area). Table 3.1 below lists forest areas.

In recent years the native forest resource has been reappraised and significantly downgraded - in extent, quality, and availability for future production - particularly due to reassessment of rotation.
times and the re-growth potential of logged forests. In addition, large forested areas have been, and may continue to be, withdrawn from potential production for conservation purposes.

Estimated roundwood removals in Australia are shown in Table 3.2 below. Three points about these data are relevant: hardwood sawlog removals are dropping, hardwood pulpwood removal is increasing, and softwood sawlog and pulpwood removals are increasing. There is a substantial substitution of hardwood sawlogs by softwoods.

Australian production of roundwood is currently around 20 million cubic metres. Of this 65 per cent was hardwood, and came almost entirely from native forests. In contrast, virtually all the softwood removals, some 6.8 million cubic metres came from plantations (1987 figures in FAO 1989: 3,13,15). Given the production areas listed in Table 3.1, this shows yields of about 8.5 cubic metres per hectare (m³/ha.) for softwoods and 0.6 m³/ha. for hardwoods (adding state forests to privately owned land). For around the last 50 years, about a quarter of the hardwood removals have come from forests under freehold or leasehold tenure, and practically all of these removals have come from clearing of land for agriculture or from one-off wood sales (Carron 1985: 319-20). The forest services have for a long time regarded private forests as a dwindling and increasingly unreliable source of supply.

Australia has a long history of interest and experimentation in plantation establishment, which lead to a large and expanding area under exotic softwoods. The softwood resource is a separate issue with one important exception - softwood substitutability for hardwood. Land for softwood plantations is generally not suitable for eucalypt plantations, and they do not compete on that basis. Softwood plantations are intensively managed, and provide an important resource for a high volume-high technology industry. This industry contrasts with that presently exploiting the native forests.

Table 3.1: **Australian Forest Areas (million hectares)**

<table>
<thead>
<tr>
<th>Type of Forest Area (a)</th>
<th>1975</th>
<th>1985</th>
<th>1987</th>
</tr>
</thead>
<tbody>
<tr>
<td>State forests (Public 1)</td>
<td>12.4</td>
<td>12.4</td>
<td>12.3</td>
</tr>
<tr>
<td>Other public forest (Public 2)</td>
<td>19.6</td>
<td>13.0</td>
<td>12.5</td>
</tr>
<tr>
<td>National parks or reserves (Public 3)</td>
<td>2.1</td>
<td>4.9</td>
<td>5.1</td>
</tr>
<tr>
<td>Private</td>
<td>9.0</td>
<td>11.0</td>
<td>10.9</td>
</tr>
<tr>
<td>total</td>
<td>43.1</td>
<td>41.3</td>
<td>40.8</td>
</tr>
</tbody>
</table>
Plantations - softwoods 0.57 0.86 0.86
- hardwoods 0.03 0.05 0.05

(a) Public 1 - managed for multiple use including wood production
Public 2 - Crown land, available or used for wood harvesting, but not reserved as such
Public 3 - wood production excluded


Plantations occupy a small fraction of land area, but supplied 60 per cent of Australia's consumption of softwoods in 1986-87 (ABARE 1988: 5, 6), and a negligible proportion of hardwood consumption. Plantation areas by state are shown in Table 3.3. It appears that ownership of eucalypt plantations is fairly evenly divided between the public and private sector, although the absence of figures from NSW complicates the comparison (there are extensive public plantations on the NSW North Coast). Tasmania supports the largest area of eucalypt plantations, followed by Victoria, with these two States accounting for over two thirds by area of eucalypt plantations.

3.2 Australia's Forestry Sector

The domestic forest growing and processing sector comprises the State forest services - with about 70 per cent of commercially exploitable land supplying 80 per cent of sawlog production - and the private sector dominating the processing of sawn timber, domestic pulpwood, and export woodchips. Hardwood sawmilling is declining in employment terms and as a component of the forest industry sector, a combined effect of diminishing supplies, mill amalgamation, and substitution from pine. Hardwood consumption is stable, but dropping on a per capita basis. Domestic pulpwood is used largely by three major companies, each specialising in one market segment: newsprint, industrial and packaging, and printing and writing papers. Export woodchips are extracted predominantly by four companies, operating from five locations in Tasmania, N.S.W. and W.A., and sold to Japan for paper manufacture. Control of wood supplies, industry structure and product characteristics are such that these three market sectors operate with a certain independence of each other (Byron & Douglas 1981, Bruce 1988).

Forestry is declining. But it is still a significant sector of the economy employing some 13,600 people, particularly in rural areas. Processing industries employ 47,000 persons in wood-based products.
and some 22,000 in paper products. The forestry and forest industries contribute about 1.2 per cent of GDP.

Table 3.2: Estimated Roundwood Removal (,000s m³)

<table>
<thead>
<tr>
<th>Wood Type</th>
<th>1976/77</th>
<th>1980/81</th>
<th>1986/87</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardwood saw and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>veneer logs</td>
<td>5494</td>
<td>5427</td>
<td>4481</td>
</tr>
<tr>
<td>pulpwood</td>
<td>4481</td>
<td>5011</td>
<td>5698</td>
</tr>
<tr>
<td>other</td>
<td>921</td>
<td>1026</td>
<td>930</td>
</tr>
<tr>
<td>Softwood saw and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>veneer logs</td>
<td>2007</td>
<td>2897</td>
<td>3331</td>
</tr>
<tr>
<td>pulpwood</td>
<td>822</td>
<td>1403</td>
<td>2396</td>
</tr>
<tr>
<td>other</td>
<td>94</td>
<td>147</td>
<td>148</td>
</tr>
<tr>
<td>Total</td>
<td>13,819</td>
<td>15,911</td>
<td>16,984</td>
</tr>
</tbody>
</table>

Source: Australia 1987

Total employment has fallen steadily for two decades (Figure 1 below). Forestry and logging have declined continuously as a share in primary production, and the wood manufacturing industries (including paper) share of total manufacturing has also decreased steadily (BAE 1982). The total value of sales in wood and wood products manufacturing in 1987-88 was $4.3 billion, and that for paper and paper products was $4 billion (RAC 1990:32).

Table 3.3: Plantation Areas: By Ownership, by State, by Species Type (in hectares)

<table>
<thead>
<tr>
<th>Species Type</th>
<th>NSW</th>
<th>Vic.</th>
<th>Qld</th>
<th>WA</th>
<th>SA</th>
<th>NT</th>
<th>ACT</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC OWNERSHIP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softwood:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pinus radiata</td>
<td>152,804</td>
<td>96,330</td>
<td>2,244</td>
<td>34,677</td>
<td>61,761</td>
<td>13,365</td>
<td>37,977</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>13,631</td>
<td>3,366</td>
<td>156,042</td>
<td>28,504</td>
<td>3,808</td>
<td>514</td>
<td>203,886</td>
<td></td>
</tr>
<tr>
<td>Broadleaved:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eucalyptus spp.</td>
<td>-</td>
<td>7,687</td>
<td>1,328</td>
<td>8,300</td>
<td>1,199</td>
<td>3,490</td>
<td>2,2004</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>-</td>
<td>87</td>
<td>458</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>610</td>
<td></td>
</tr>
</tbody>
</table>
PRIVATE OWNERSHIP

Softwood:
- Pinus radiata: 59,317, 96,143, 983, 14,257, 24,200, 26,990
- Other: 1,244, 964, 23,985, 197, 4201, 10

Broadleaved:
- Eucalyptus spp.: 1,202, 5,927, 1,170
- Other: 1,877, 242

PUBLIC AND PRIVATE OWNERSHIP

Softwood:
- 226,996, 196,803, 183,254, 77,635, 89,769, 65,300

Broadleaved:
- Eucalyptus spp.: 1,202, 13,614, 1,328, 9,470, 1,199
- Other: 1,877, 329, 458

(a) Native broadleaved species on public land are not identified separately from native forests areas

Source: ABARE 1988: Table 3

3.3 Production, Consumption and Trade

Imports and exports of forest products are shown in Table 3.4 below. Australia produces one significant export - woodchips - which represent over 70 per cent of the export earnings from forest products. This increased to $500 million in 1988-89, composing just over one per cent of total merchandise exports (RAC 1990). Paper constituted over half the cost of forest product imports, with sawn timber contributing another 24 per cent. Total forest product imports cost $2.1 billion in 1988-89, or 4 per cent of merchandise imports (RAC 1990). The annual deficit on trade in wood products increased to $1.6 billion in 1988-89 (RAC 1990).
Table 3.4: Value of Wood Products - Imports and Exports
1986-87 (1988 $,000s)

<table>
<thead>
<tr>
<th>Product</th>
<th>Imports</th>
<th>Exports</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roundwood</td>
<td>600</td>
<td>2,400</td>
<td>1,800</td>
</tr>
<tr>
<td>Sawnwood &amp; sleepers</td>
<td>317,000</td>
<td>12,300</td>
<td>-304,700</td>
</tr>
<tr>
<td>Processed wood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- plywood</td>
<td>43,600</td>
<td>3,300</td>
<td>-40,400</td>
</tr>
<tr>
<td>- veneer</td>
<td>16,400</td>
<td>1,100</td>
<td>-15,300</td>
</tr>
<tr>
<td>- particleboard</td>
<td>700</td>
<td>200</td>
<td>-500</td>
</tr>
<tr>
<td>- other wood manufactures</td>
<td>100,400</td>
<td>3,500</td>
<td>-96,900</td>
</tr>
<tr>
<td>- cork manufactures</td>
<td>20,800</td>
<td>600</td>
<td>-20,200</td>
</tr>
<tr>
<td>Wood pulp and pulp products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- hardboard</td>
<td>1,000</td>
<td>2,700</td>
<td>1,700</td>
</tr>
<tr>
<td>- softboard</td>
<td>10,000</td>
<td>100</td>
<td>-9,900</td>
</tr>
<tr>
<td>- pulp and waste paper</td>
<td>183,400</td>
<td>19,000</td>
<td>-164,400</td>
</tr>
<tr>
<td>- paper and paperboard</td>
<td>896,700</td>
<td>71,300</td>
<td>-825,400</td>
</tr>
<tr>
<td>- paper manufactures</td>
<td>162,900</td>
<td>18,500</td>
<td>-144,400</td>
</tr>
<tr>
<td>Minor forest products</td>
<td>22,500</td>
<td>2,800</td>
<td>-19,700</td>
</tr>
<tr>
<td>Wood chips</td>
<td></td>
<td>322,500</td>
<td>322,500</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,776,000</td>
<td>460,300</td>
<td>-1,315,700</td>
</tr>
</tbody>
</table>

Source: ABARE 1987

Figure 1 below illustrates the employment situation in forestry and the forest industries.

Volumes of hardwood and softwood sawnwood production and imports are shown in Figure 2 below, and paper and paperboard production and imports are shown in Figure 3 following.
Paper and paperboard products comprise the single largest category of forest products in Australia by value, and constitute the fastest growing products of the wood-based industries. Australian production of paper and paperboard grew by 46 per cent over the period 1976-1987, and imports grew by 57 per cent. Apparent consumption (production + imports - exports) grew by 43 per cent over this period, with imports averaging around 30 per cent of the total (from FAO 1989: 246, 248). World trade in these products shows similar trends.
3.4 World Trends

World roundwood production was around 3.4 billion m\(^3\) in 1987, approximately 60 per cent of which was hardwood. Developed market economies produced about one third of the total, largely softwoods, with 68 per cent of the hardwoods coming from developing market economies (cf. FAO 1989: 2, 3, 12-15). Table 3.5, below, provides a brief overview of world trade and production in forest products.

Australia contributes about 0.6 per cent of world roundwood production, and Australian trade represents about one per cent of world trade. Australia has dominated the Japanese hardwood chip import market since 1972, supplying about 64 per cent of the total in 1986-87. The Japanese have diversified to include imports from South Africa, USA and New Zealand, with a new chip plant commissioned in Chile based on eucalypt plantations (Fenton 1989). Brazil is also a major supplier of hardwood pulp to Japan, with production based on extensive eucalypt plantations. The value of world trade in chips is about eight per cent of that in wood pulp, and three per cent of trade in paper and paper products (FAO 1989).

3.5 The Trade Position

In the international wood products trade Australia is a price taker, exerting no market power over its imports or exports. It is a small player, severely exposed to international competition. Australia's wood resource is running down due to poorly controlled exploitation and inadequate attention to its replacement. Resource withdrawal (alienation from wood production) consequent upon the political efforts of wilderness conservationists has had until now a small effect on potential productivity. Lack of knowledge of the resource
and poor planning are more responsible for forestry's present predicament. Australia's major export income earner, woodchips, will soon be facing stiff competition from suppliers of eucalypt pulp, notably Brazil which in 1986 produced 2.4 million tonnes from around 500,000 ha of eucalypt plantations (Rodrigues et al 1989).

Table 3.5: World Production and Trade in Forest Products (1976-1987)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Roundwood (c)</td>
<td>2687</td>
<td>3352</td>
<td>24.7</td>
<td>10.6</td>
</tr>
<tr>
<td>Sawnwood (d)</td>
<td>435.5</td>
<td>502.2</td>
<td>15.3</td>
<td>15.7</td>
</tr>
<tr>
<td>Panels (d)</td>
<td>95.4</td>
<td>122</td>
<td>27.9</td>
<td>7.2</td>
</tr>
<tr>
<td>Pulp (c)</td>
<td>111.4</td>
<td>145.7</td>
<td>30.8</td>
<td>12.7</td>
</tr>
<tr>
<td>Paper (c)</td>
<td>147.2</td>
<td>212.8</td>
<td>44.6</td>
<td>33.8</td>
</tr>
<tr>
<td>Total trade</td>
<td></td>
<td></td>
<td></td>
<td>80.0</td>
</tr>
</tbody>
</table>

Notes:
(a) Standard International Trade Classification, Rev 2 code
(b) Imports, average c.i.f. figures
(c) Million tonnes
(d) Million cubic metres

Source: FAO 1989

The Industry Context (b) - Plantation Microeconomics

Competent analysis using conventional microeconomic parameters should conclude that there is no prospect for hardwood plantations replacing production from old-growth forests within the next twenty years. Plantation development will require "a degree of altruism and subsidy" (Landsberg; Jones & Pryor: 1990: 25). Nevertheless there is a case for clearly identifying and analysing the exact costs and subsidies involved in eucalypt plantation production.

There are many factors that have a major impact on the technical and economic feasibility of eucalypt plantation establishment. This section outlines factors involved in establishing and growing eucalypt plantations, and the published costings. It then discusses their significance on the economic feasibility of plantations. Any evaluation of plantations as an option for supplementing or substituting existing supplies of industrial wood must take these factors into account. This is the case even for plantation advocates.
who argue that, if plantations prevent exploitation of native forests, then any costing for those plantations would still provide a net social benefit.

Only a few detailed economic studies are available for eucalypt plantations (eg A ACM 1988, Neilsen & Wilkinson 1989 and Prosser 1989). Carter (1974) presented a less detailed analysis. The A ACM study was prepared for the ACF publication The Wood and the Trees (ACF 1988). A number of criticisms of the A ACM/ACF study have been published (eg ACIL 1988; F AFPIC 1989). Surprisingly, published information on plantation yields in Australia is sparse (Borough et al. 1984) and of variable quality. Virtually none is adequate to permit predictions of the medium-term effects of treatments such as fertiliser application, thinning, or site-preparation techniques, although a reasonable literature exists from overseas experience (as reviewed in Schöner & Herbert, 1989 and Schöner & Coetzee, 1989).

This section deals with the following factors: land; establishment and site preparation; maintenance; harvesting and utilisation; and exogenous factors.

Costings are used by various proponents to support their proposals, or to dismiss or undermine those of their opponents'. While no single costing of the multitude of factors listed below will apply across all States or for any length of time, some indication is necessary of the magnitude and distribution of the costs involved. The ACF report, with its national focus, used indicative costings, whereas Prosser was able to apply more specific figures to his restricted NSW North Coast example.

3.6 Land

Land is the key input. Land must be suitable, and available, for tree growing. In addition, for public policy purposes, consideration must be made of the implications of purchase, for example the social impact on local landholders. The criteria for selection of land suitable for eucalypt plantation establishment have been discussed in a number of reports (eg A ACM 1988; Prosser 1989; Turvey et al. 1989). Table 3.6 presents a summary of these criteria and lists critical values suggested in the literature. The selection of suitable land is a key determinant of plantation success. The pricing of that land is also centrally relevant.

A number of technical developments will alter some of the selection criteria in Table 3.6. For example, as improved genotypes are bred, and appropriate fertiliser and silvicultural regimes developed,
rainfall thresholds for plantation establishment will drop and utilisation of land that is now marginal will become feasible.

Sufficient suitable land must also be available. Cameron & Penna (ACF 1988: Chapter 9), AACM (1988: 6-8), and Turvey et al (1989) estimate that sufficient cleared land exists to accommodate the ACF (and FAFPIC) proposals, although all state that better information is required to more rigorously identify the suitable sites for plantations. The development and application of State and national geographic information systems (GIS) for land use planning will considerably aid this process. Earlier work in identifying suitable sites for radiata pine has established a useful methodology and body of information (eg Reilly et al 1977).

Land purchase is the largest single outlay involved. In general, the better the quality of land, the higher its price. Land that best meets the selection criteria listed in Table 3.6 may already be in use or suitable for many other activities, often with higher or more secure returns. State and regional priorities, and local governments, are very important in determining land use policies and the local availability of land. The debate about specific land prices is only relevant to particular proposals and parcels of land. It is clear that land cost is the largest single component of initial costs.

There are a number of alternatives to outright purchase; sharefarming, leasing, and various forms of joint ventures have been, and continue to be, administered or encouraged by State governments and industry. Further work is needed to define and evaluate these options, especially with respect to the role of the Commonwealth.

These issues are discussed further in section 4. For the present it is sufficient to note that land prices are the major obstacle to establishing eucalyptus plantations.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Critical values</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Proximity to processing centres</td>
<td>&lt;100km</td>
<td>1,9</td>
</tr>
<tr>
<td>2: Altitude -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tasmania</td>
<td>&lt;7-800</td>
<td>8,10</td>
</tr>
<tr>
<td>Victoria</td>
<td>&lt;1300mm asl</td>
<td>3,4</td>
</tr>
<tr>
<td>NSW</td>
<td>&lt;700m asl</td>
<td>3</td>
</tr>
<tr>
<td>Climate: (annual rainfall)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1000mm</td>
<td>2,3,4,10</td>
<td></td>
</tr>
<tr>
<td>&gt;800mm</td>
<td>2,3,7,8</td>
<td></td>
</tr>
</tbody>
</table>
### 3.7 Site Preparation and Establishment

The main factors affecting initial establishment and subsequent growth of eucalypts in plantations are water availability, soil nutrients, friability and rooting depth, seed and nursery stock quality, site preparation and weed control (Cremer et al 1984: 115-124; Schöner & Herbert 1989: 234). Some of these are site-dependent, but all are open to manipulation by plantation managers.

The preparation of land and the planting and early tending of seedlings involve a number of reasonably discrete factors. Some of these factors are ignored in some studies. For example, clearing may not be necessary on reclaimed pasture lands; early Tasmanian trials used intensive cultivation techniques, which are not now recommended in part for economic reasons.

Table 3.7 presents an aggregated list. Depending on the site chosen not all factors may be important. But from the limited literature on the silviculture of plantation eucalypts, it is apparent that the establishment phase is critical for future growth rates (which in turn greatly influences financial returns and project viability).

| Rainfall, distribution | >600mm | 3 |
| Temperature | depends on species | 6.7 |
| Extreme events - frost | - do - | 7 |
| Evaporation>rainfall | - do - | 7 |
| Soil/parent rock - depth | >50cm | 2,3,7 |
| - fertility | the higher the better | 3.7 |
| Slope | <30° | 3 (Vic), 4 |
| | <18° | 1,5 |
| | <15° | 8 (Tas) |
| Area (individual parcels) | >20ha | 1 |
| Fragmentation | maximise parcel aggregation | 1 |

**Sources:**
1. Prosser 1989
2. AACM 1988
3. Turvey et al 1989
4. A.C.I.L 1988
5. F.A.F.P.I.C. 1989
7. Turnbull & Pryor 1984
8. TFC 1987
9. Ferguson & Dargavel 1984
### Table 3.7: Site Preparation and Establishment Factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveying and mapping</td>
<td>Roads, fences, firebreaks, water management, esp runoff (1,2)</td>
</tr>
<tr>
<td>Fencing</td>
<td>To control stock and native browsers, (may already exist on agricultural lands) (1,6) Chemical repellants for browsers (being developed) may prove more economic. Baiting is also used (6)</td>
</tr>
<tr>
<td>Roads</td>
<td>Construct, or if present, upgrade primary access roads and fire trails. Logging roads and tracks can be constructed later at thinning (1,2)</td>
</tr>
<tr>
<td>Clearing</td>
<td>This depends on vegetation cover and means: machinery or chemical, by hand or mechanically. Soil disturbance should be minimised, therefore chemical means usually preferred. (2,6,16)</td>
</tr>
<tr>
<td>Cultivation</td>
<td>Successful establishment depends on rapid early growth of seedlings, deep ripping recommended, but other techniques include ploughing (1,6,16)</td>
</tr>
<tr>
<td>Herbicides</td>
<td>Essential for weed control to minimise competition; may involve knockdown, or residual or both (5,7,16)</td>
</tr>
<tr>
<td>Fertilisers</td>
<td>Generally recommended, but interactive effects between fertilisers, soil and seedling genotype not well understood (3,4,9,10,11,1519). Inoculation with appropriate mycorrhizal fungi has great potential and needs further exploration (14)</td>
</tr>
<tr>
<td>Choice of species/provenances</td>
<td>This is critical - performance differences between genotypes (within-species and -population variation) can be enormous (4,8,12,13)</td>
</tr>
<tr>
<td>Plant material supply</td>
<td>Large-scale nurseries for economies of scale (16)</td>
</tr>
<tr>
<td>Stocking rates</td>
<td>Depend on end-product and thinning regime, usually in the range of 800-1600 stems/ha (16,17,18)</td>
</tr>
<tr>
<td>Planting methods/technology</td>
<td>Hand planting or mechanical. The time of year can be important. More care (higher survival and growth) means lower costs later in replanting and tending. (16)</td>
</tr>
</tbody>
</table>
Establishment costs, because they are large and incurred at the outset, have a substantial effect on profitability. Subsequent growth rates depend on sound establishment techniques. Improvements in their cost-effectiveness can bring significant economic benefits. This is likely to be particularly important if subsequent rotations utilise resprouting stems. Some components of establishment costs are relatively small but exert considerable influence on yields and thus returns. In particular, fertiliser application affects establishment success and shortens rotation times (or increases final yields), with estimated real internal rates of return on fertilisation costs between 15 and 41 per cent (Schaner & Herbert 1989:233). Many of the establishment costs are directly dependent on the stocking rate adopted, although the stocking rate itself is a function of many factors including desired end-product, species, site and harvesting technology (Schoener & Coetzee 1989).

3.8 Maintenance

Following establishment, there are a number of recurrent activities, some annual, some less frequent, that improve survival and growth. These are listed in Table 3.8. Again, some of these are site-specific. For example, native browsers appear to be a greater problem in Tasmania and Victoria than elsewhere. Little specific information is available detailing silvicultural programmes for plantation eucalypts, although the general effects and importance of fertiliser application, weed and pest control, and thinning on plantation yields are well established (Cromer et al 1975; Cremer et al 1984; Schoener & Herbert 1989; Schoener & Coetzee 1989; Neilsen & Wilkinson 1989).

Table 3.8: Recurrent Activities (Maintenance)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilisation</td>
<td>Follow up fertilising recommended, especially on poorer quality sites (1,6,7,10)</td>
</tr>
<tr>
<td>Pest control</td>
<td>Mostly herbivores, mamalian (1,2) and insect (1,3). But other pests - borers and fungal (such as root</td>
</tr>
</tbody>
</table>
rots and stem rots) can be significant (3). There are important interactions between fertilisation and pest incidence (4).

**Herbicides**
Effective weed control in early years has a strong effect on growth rates (5,8). Requirement will depend on treatment at establishment.

**Fire protection**
A function of plantation size, proximity to forested lands, human habitation, and those control measures already in place.

**Roads, fences**
Most studies do not allow for upkeep on fences and roads, although both are necessary. Logging tracks will also need to be constructed prior to harvest.

**Administration/overheads**
Subject to economies of scale, usually allowed for as a percentage of other recurrent costs. This factor disadvantages small owners/plantations.

**Thinning regime**
Highly dependent on end-product desired. May not be necessary for pulpwood production, although some pulpwood silvicultural regimes incorporate thinning (9, 10).

**Sources:**
1. Neilsen & Wilkinson 1989
2. Landsberg 1987
3. Elliott et al 1989
4. Landsberg 1990
5. Fagg 1988
6. AACM 1988
7. Schöner & Herbert 1989
8. Cremer et al 1984

The two major plantation products, pulpwood and timber, differ in silvicultural, harvesting, and processing requirements. The selection of production goals will influence the choice of species, stocking rate, and (especially) rotation times, with timber production requiring greater rotation times than pulpwood. One important advantage that plantation eucalypts offer over wood from native forests is uniformity of size and wood properties, which enables harvesting and utilisation technologies to address a specific raw material.

Pulpwood and sawlog production are not necessarily incompatible. For instance, thinnings from long rotation plantations may be sold for pulp, but there are significant interactions between the choice of product and other factors. Most sawlog regimes include at least one and up to three thinnings, depending on initial stocking rate, desired products and markets.
The majority of eucalypt species coppice (resprout) from cut stems, and most plantation regimes overseas use this feature to obtain multiple harvests from a single planting. It seems advantageous to exploit this feature in Australia for pulpwood production from subsequent rotations (Carter 1974; AACM 1988; ACF 1988). It would simplify establishment treatments for later rotations, although there may be additional costs involved in thinning the resprouting stems.

Maintenance costs generally exert a small influence on overall profitability, representing marginal costs for marginal gains, with some potentially important exceptions. One of these exceptions is fire protection. Here the degree of risk depends on a large number of factors, not only on specific fire protection measures such as fire break construction, but on other choices and practices such as species grown (fire resistant varies) and weed control. The risk of fire, and its likely effect on a plantation, can only be assessed for each plantation proposal. If fire protection measures are already in place around a new plantation, the potential exists for free-rider effects for new entrants, or marginal benefits for existing owners.

Costings for annual maintenance vary widely; the figure of $50 per hectare p.a. is quoted by industry sources (eg APPM in ACF 1988), but probably reflects economies of scale within a large organisation. The estimates shown in Table 3.9 below suggest much higher recurrent costs.

### 3.9 Harvesting and Utilisation

Most studies ignore harvesting, and treat plantation products at stump, thereby avoiding some vexed problems. There are, however, substantial differences between at-stump and mill-door costs. Harvesting costs are a significant component of mill door costs (Carter 1974) as they involve felling, topping (removing leaves), debarking, chipping and transport to mill.

While debarking technology is well established for pines, it is less so for eucalypts. It may or may not be necessary, depending on species, end-use and processing technology. Debarking may be undertaken in the stand, desirable for returning nutrients to the soil, at landing, undesirable because of fire hazard, or at the mill and so involving additional transportation costs (Wingate-Hill & MacArthur 1987). Improvements in pulping technology may permit the use of unbarked stems (Silby et al 1976).
Chipping may be performed in the plantation, at landing (prior to transport) or at the mill. Although there are few technical barriers to chipping at stump (Kerruish 1984), until recently little effort has been directed to developing fully-mechanised harvesting systems for short rotation eucalypts that included chipping on site (Kerruish 1988, Prosser 1989). At present, technological progress is driven more by research interest than economic imperatives.

Most plantation proposals terminate at stump, with responsibility for harvesting and transport residing with the buyer. Buyers are likely, however, to take factors such as distance from mill, quality of the wood resource, stem density and size, and plantation size into account. These must therefore be considered at the outset. At a recent hearing of the RAC Inquiry into Australia's Forest and Timber Resources, the assistant chief of the CSIRO Division of Forestry and Forest Products was reported as estimating that 60 per cent of the costs of wood was in harvesting and transportation (Burgess, 1990). If this is the case then siting of plantations near processing centres, and careful surveying and planting of the plantation area may be significant determinants of mill-door costs, and thus of plantation feasibility.

### 3.10 Exogenous Factors

There are a number of important exogenous factors which have enormous potential impacts on many of the factors discussed above. The single most important exogenous factor is the cost of capital. Interest rates, largely a function of world interest rates and Australia's trading position, affect the availability of capital, especially for long-term projects such as plantations that require substantial investment early on for land purchase and establishment costs. High interest rates favour investments with quick returns.

Here again the discount rates on the capital employed is relevant. Most plantation proposals imply at least implicitly "social" discount rates for the capital employed. Even when private rates of discount are assumed this is usually in combination with taxation and other incentives that reproduce the social rate of discount, in effect if not in theory.

Other factors affecting demand and supply of wood-products, particularly paper and paper-products, have an impact on the technical aspects of plantation establishment. Social preferences, political pressures and substitutable products can be important market determinants (Johnson 1985). The availability, price and social demand for substitutes for major wood products - such as
steel for framing and alternative sources of fibre for paper production - may also be important. The impending surplus of radiata pine from Australian producers as well as from overseas competitors (especially NZ and Chile) will affect the domestic sawntimber market, and lower the price of softwood pulp. This may redirect investment in plantations from softwoods to hardwoods, especially for pulpwood production, as these two pulpwood markets are largely discrete, and eucalypt pulp will continue to fetch a premium price into the foreseeable future.

Interest in recycling, and using recycled, paper can have a significant effect on the demand for wood supplies. For example, Australia currently recycles about 30 per cent of its paper, compared with Japan's 50 per cent. There is potential for increasing the domestic rate. Cameron & Penna (1988) estimate that increasing Australia's recycling rate to 45 per cent would save 1 million m³ of roundwood per year.

Public interest in environmental matters, including amenity, watershed protection, water quality and conservation values will be important in determining access to alternative (current) wood supplies from native forests. Political pressure from interest groups to restrict use of imported hardwoods (largely sawntimber) will result in increased pressure on domestic sawlog supplies. This will effect the calculation of the benefits of plantations. At the margin it leads to an argument for the social benefits of plantations, which then overrides the calculation of private benefits.

Other, exogenous, factors could affect land price and availability. The imminent entry of New Zealand dairy products under the CER may have a dramatic effect on the value of dairy farms in NSW, Victoria and Tasmania, and make alternative land uses more attractive than they are at present. The extent of this effect is difficult to estimate, though it should become apparent by the turn of the century.

### 3.11 Returns

Wood from plantations is sold as pulpwood or as logs, which may be used as poles, cut for timber, or peeled for veneer. This sequence is a function of increasing tree diameter, with royalties (also called stumpage) increasing with log size and quality (freedom from defects). Royalties provide the sole income to a plantation, unless another objective has been prescribed, such as agro-forestry. Most plantation regimes incorporate one thinning, usually for pulpwood, unless pulpwood is the sole production objective.
Royalties for the four plantation products (pulpwood, poles, sawlogs and veneer logs) increase in a step function, with minimum size and quality criteria. Prosser makes the important point that "the greatest advantage can usually be gained by harvesting the stand as soon as the majority of stems meet the minimum requirements for the higher royalty. Only in rare cases does the increased size of the stems offset the accumulating interest charges where no royalty increase is expected" (Prosser 1989:84).

There has been a trend, for all end uses, towards the lowering of size requirements as technological improvements have enabled mills to process smaller wood. This trend will have a bearing on the product mix chosen, and the timing of thinning and harvesting operations. Such "technological" improvements in milling will be spurred by high prices for product, eventually reducing that price effect, though the time lags and actual dimensions of this effect are extremely difficult to predict.

It is important to recall here that there is no given market price for wood in Australia; prices are negotiated within a set of regional bilateral monopolies (Byron & Douglas 1981; Leslie 1985). The impact of the state, as a forest grower, is such that it acts as, or is taken as, the price leader (Leslie 1986). This has important implications for investment decisions in plantations, which should depend on accurate estimates of royalties.

**Pulpwood**

Pulpwood prices are determined in two markets: the domestic pulpwood industry, dominated by paper and paperboard production, and the export wood chip industry. These have quite different structures and are largely independent, mainly as a result of government regulation. Importantly, the actual stumpage price of pulpwood is a relatively insignificant proportion of the final value of most paper products (Byron & Douglas 1981: 44), implying that pulpwood prices have little effect on final prices or final demand.

Prices and access to wood supplies within each market are determined by negotiation between the supplier (generally state forest commissions) and a specific industry. Prices are usually related to royalties charged by governments for timber extracted from State forests. Negotiated prices mean that there is a high information requirement imposed on buyers and sellers. Leslie (1985) argues that the full market value of a pulpwood resource is not captured by the State under the present bilateral monopoly.
negotiations because the parties are not evenly matched and third party interests are involved. This market structure also imposes major barriers to entry for new growers.

In addition Leslie (1985: 9) notes that governments, as suppliers, have objectives other than revenue in mind, with royalties only one dimension in the exchange of property rights arising from the sale of wood. Others include license duration, product specification, rights to renewal, exclusivity of access, standards for the conduct of logging operations, rights to access roads, rehabilitation, and supervision.

Plantation feasibility, whether from the social or the private rate of return, depends on secure estimates of future royalty rates. New growers will therefore need to be linked to either existing suppliers through support schemes, or buyers through contractual arrangements. This was discussed above.

Royalties vary widely, from low values of $2.60 - $6.30/m³ for forest sources in Tasmania; $7.00 in Victoria, and $10.00-$11.00 in W.A. and N.S.W. (ACF 1988: 89,94) to around $12.00/m³ in Western Australia to $15.00/m³ in N.S.W. for plantation pulpwood (AACM 1988). All these figures are in 1988 dollars. Major determinants of this charges variation are quality and size of the roundwood, and distance from mill. From a very low base, royalties have risen (for those series spanning at least ten years) faster than the inflation rate since the mid-1970s (ACF 1988: 88). This may not continue; Cameron & Penna assumed pulpwood royalty rates would rise from an estimated average value of $7.10 in 1987-88 to $11.00/m³ over the next 10 years (ACF 1988:94), and added a premium of $4. 00/m³ for pulp logs from plantations.

Sawlogs

The sawlog market also departs from a freely competitive market, with a larger number of buyers than is the case for pulpwood, but with the States again dominating actual and potential wood supply and negotiating prices that take into account non-tradeable social and environmental objectives, such as industry stability and the production of non-wood values (Leslie 1986). Log buyers form an oligopsony engaging "in informal methods of collusion or price-leadership to avoid cut-throat competition developing" (Ferguson 1982: 248).
The demand for logs is derived from the demand for processed timber goods. Johnson (1985) lists own price, per capita income, housing starts, and taste and technology as components of the demand for sawn timber. Thus sawlog royalty rates will depend on location, the final product and its market, and government objectives.

3.12 Potential for Improvement

There are a number of issues which contribute to the uncertainties about prospects for eucalypt plantations. If these are addressed it will improve the potential for investment. These uncertainties can be discussed under three headings: costs, returns and security.

3.12.1 Costs

The up-front costs of plantation establishment, land purchase and site preparation and planting provide the major barrier to investment in eucalypt plantations. It is apparent from Table 3.9 that establishment costs are of similar magnitude to initial land costs on a per hectare basis. Reducing costs at the outset would greatly affect the economic feasibility of plantations.

Past and present governments have attempted to reduce these costs by subsidies, loans, tax incentives, extension services, and providing or subsidising the production of raw materials such as seedlings. In addition, in locations near major pulp mills, some industries provide financial assistance for private land owners to grow trees. In parts of Tasmania, the planting of eucalypts on non-industrial private land is reported to attract financial assistance from the State Government and industrial companies such that the direct cost of establishment to the private landholders may be as low as 30 per cent of total costs (Cannon 1988b).

Considerable achievements have been made by the private forestry sector over the last decade in developing more efficient and cost-effective establishment techniques for planting eucalypts (Cannon 1988a). The availability and cost of land is an issue being addressed by governments (see section 2 above).

Table 3.9: Costings for Plantation Establishment ($/ha) (Assuming Pulpwood Production Only (a))

<table>
<thead>
<tr>
<th>Item</th>
<th>AACM^1</th>
<th>N&amp;W^2</th>
<th>Prosser^3</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land purchase</td>
<td>1200</td>
<td>1400</td>
<td>1500</td>
<td></td>
</tr>
<tr>
<td>Range of estimates</td>
<td>800-1400</td>
<td>1-2000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
or lease (pa) 72  -  -  
or Crown land 0  

<table>
<thead>
<tr>
<th>Site preparation and establishment</th>
<th>1250</th>
<th>800?</th>
<th>800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stocking rate (stems/ha)</td>
<td>1250</td>
<td>800?</td>
<td>800</td>
</tr>
<tr>
<td>Surveying and mapping</td>
<td>30</td>
<td>280</td>
<td>30</td>
</tr>
<tr>
<td>Roading</td>
<td>158</td>
<td>-</td>
<td>250</td>
</tr>
<tr>
<td>Fencing</td>
<td>300</td>
<td>50</td>
<td>305</td>
</tr>
<tr>
<td>Clearing</td>
<td>-</td>
<td>700</td>
<td>250</td>
</tr>
<tr>
<td>Cultivation</td>
<td>52</td>
<td>-</td>
<td>85</td>
</tr>
<tr>
<td>Herbicides</td>
<td>85</td>
<td>110</td>
<td>85</td>
</tr>
<tr>
<td>Fertiliser</td>
<td>213</td>
<td>160</td>
<td>200</td>
</tr>
<tr>
<td>Seedlings</td>
<td>500</td>
<td>160</td>
<td>220</td>
</tr>
<tr>
<td>Planting</td>
<td>-</td>
<td>160</td>
<td>150</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1038</td>
<td>1840</td>
<td>1370</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance (annual, or 1.2. times during rotation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replanting (yr. 2 only)</td>
</tr>
<tr>
<td>Fertilisers</td>
</tr>
<tr>
<td>Weed control</td>
</tr>
<tr>
<td>Herbivore control (insect)</td>
</tr>
<tr>
<td>Other pests (eg browsers) fenced</td>
</tr>
<tr>
<td>Fire protection</td>
</tr>
<tr>
<td>Roads and fences (Annual)</td>
</tr>
<tr>
<td>Admin. and overheads</td>
</tr>
<tr>
<td>Other (marketing)</td>
</tr>
<tr>
<td>Thinning regime</td>
</tr>
<tr>
<td><strong>Harvesting at stump</strong></td>
</tr>
</tbody>
</table>

(a) Assuming a pulpwood rotation of around 30 years with one thinning. Costs are not directly comparable (see text).

**Sources:**
1. AACM 1988
3. Prosser 1989
4. TFC 1987
5. NSW Forestry Commission (quoted in Prosser 1989)

Other areas with developmental potential include the creation of improved genotypes for plantations; thinning and fertilising regimes; control of pests and diseases; and improvements in harvesting and processing technologies. There appears to be consensus on the need for further research on establishment and breeding techniques.
Improved technologies for delivering appropriate fungal innocula, fertilisers, and weed control need to be developed. Some of the cost of these developments will be borne by the private sector where a direct economic return can be foreseen. But the bulk of these investments fall under publicly-funded research and development. In addition a considerable portion of the private research and development work is probably funded from the public purse via the 150 per cent tax deductibility arrangements for R & D. There is little information either about the extent to which this occurs or what impact publicly-funded R & D has on plantation costings.

A proportion of the costs of site preparation, planting, maintenance, harvesting, and transport are functions of labour and fuel costs. Another component is the capital cost of the machinery involved and (consequently) interest rates. The opportunity cost of the capital employed can critically affect this input. These factors must remain as exogenous costs in this study, although there is no lack of precedents for government assistance or intervention on "social" grounds.

Arguably the area of greatest potential technical improvement is in the selection of suitable species and breeding the most suitable genotypes matched to site conditions and end-product specifications (Volker & Orme 1988; Griffin et al 1989). Foresters still use wild types (by collecting seed from natural stands) for the bulk of plantings - an inappropriate practice, given current knowledge of breeding for tree crops. Overseas experience has shown that investment in tree-improvement programs to be one of the most cost-effective activities in tree-planting in temperate countries, with internal rates of return of between 6 per cent and 20 per cent (Willan 1988). Higher yields mean shorter rotation times, thereby reducing the time between outlays and returns.

3.12.2 Returns

At present the returns on private plantation investment are uncertain.

Gross returns could be improved through higher royalty rates. Net returns could be increased by special consideration of plantation forestry through the Income Tax Assessment Act. Royalty rates may rise, through market forces as wood supply is constrained, or by alterations to the royalty pricing system. Royalties for wood from the private sector are generally closely related to those negotiated for public wood supplies, the government agencies operating as price fixers.
A recent trend for governments to require public authorities to achieve real rates of return on assets may increase royalty rates (McLennan & Karl 1989). There appears to be capacity with the pulpwood and sawlog markets for rises in royalty rates (Byron & Douglas 1981; Leslie 1985). One way for governments to stimulate a shift in investment interest towards plantation forestry would be to increase royalty rates for timber from public forests so the market reflected social and infrastructure costs presently not recouped.

Taxation policy affects returns to the extent that capital expenditure on equipment and establishment costs may be deductible, or depreciation on capital investment allowed to offset income from plantations or from other sources. Income from sale of wood is presently assessable in the year it is incurred. Alterations to income tax assessments for returns from plantation forestry could be made so that the income could be averaged over longer periods or even the lifetime of the project. Such governmental interventions would have a substantial effect on the profitability of plantations investment.

3.12.3 Security

Investors, public or private, need to be confident that there will be a resource of the highest possible value to harvest at some time in the future. The timber resource faces product uncertainty (e.g., will it escape fire damage?) and price uncertainty (the world market and the possible consequences of conservationists' activities). This pervasive uncertainty is a critical, and usually non-costed, aspect of the investment decision, especially given the multitude of influences on yields listed above. Consistent and predictable governmental policies can ameliorate some of these uncertainties.

Relatively unsophisticated growth models (such as yield tables) exist for some forest types and plantations, and a number of simulation models for growth, yield, and optimisation have been listed for various wood supply divisions in Australia (Bruce 1983).

One approach with great potential to improve investor security is the use of production functions to model tree growth and yield. Belli & Nautiyal (1989) provide an example for a *Eucalyptus grandis* plantation in Brazil, applying a production function to assess the economic feasibility of various stocking rates and fertiliser applications. Further development of this technique should permit more specific and appropriate silvicultural techniques to be applied to particular tree crops and enable managers to plan their crop with greater precision.
In a business with time horizons measured in decades, it is good sense to manage a plantation investment by modelling, monitoring and manipulating performance so as to maximise quantity and quality of yield. Such modelling requires some stability of governmental policy.

3.13 Discussion

The three critical variables in plantation micro-economics are the magnitude of initial outlays and the timing and magnitude of returns. They are interrelated and are also under the influence of a number of other factors. High initial outlays mean that the cost of capital is very important. Scheduling and magnitude of returns then determine economic viability.

Many deterministic factors affect establishment costs, yields, and rotation times. Most of these are open to manipulation by managers with suitable raw materials, enough information, and appropriate planning techniques. Scheduling of returns is then a function of cost of capital (ie. interest rates) and management. The magnitude of returns also significantly depends on royalty rates.

Considerable debate rages over the philosophy and determination of appropriate royalty rates (Hanson & Leslie 1962; Byron & Douglas 1981; Leslie 1985). The issue is complicated, particularly for the case of cost-recovery for wood from public forests, which jointly produce wood, a range of public goods and services, industry stabilisation, as well as providing other resources, infrastructure and incentives for economic development.

The entry of third parties into the bilateral bargaining process - "environmental groups as de facto guardians of the public interest in forestry matters" (Leslie 1986) - portends the possibility of change to the composition and weighting of non-priced values included in stumpage rates (Gerritsen 1990: 57-58). These will need to be better specified than at present. The advent of environmentalist pressures also implies that costs of production will increase, probably initially by a rise in the labour/capital ratio, and later as capital investment in forestry (Johnson 1985). Environmental constraints on logging will eventually decrease native forest output, raising prices, and favouring a shift to plantation-based supply.

While the present pulpwood and sawlog market structures exist, with governments as majority suppliers, a major role will remain for governments to determine royalty rates, including those from plantations. As industry access to public forests is reduced, the
The direct participatory role of government in these markets may diminish, unless public investment in hardwood plantations is greatly increased, or governments intervene to regulate the siting, establishment, management and/or harvesting of plantations. It seems likely that involvement by the States and the Commonwealth in regulating wood supplies will continue. A move to replace native forests as sources of industrial wood by plantations will encourage a shift in the present mix of public and private investment. The precise effects of these factors is difficult to model at present, with governmental policy still in a state of flux.

The trend for wood-using industries to become vertically-integrated will continue and will extend into the development or acquisition of wood supplies from plantations. These plantations will increasingly be seen to offer greater longer-term security than that prevailing at the present for supplies from native forests, both public and private.

4. Government Intervention

The Commonwealth government has a strong interest in seeing an improvement in the deficit in trade of forest products. Exporting raw materials, and importing valued-added products, makes little economic (and political) sense when there are unresolved questions about the price placed on the raw material, the costs of harvesting and replacing the raw materials, and major electoral sensitivities regarding resource management and protection. These issues are currently to the fore in the southeast forests of NSW and in Tasmania.

There are many aspects of production and trade in forest products where governments do or could intervene. Many of these, such as influencing the recycling rates for paper and paper products, have great potential for shifting patterns of forest utilisation and management. We focus here only on the issue of plantation establishment, but note the potential for intervention in many other areas to have positive and negative impacts on supply and demand of forest products.

The major problems in plantation establishment are finding suitable land; the initial outlays for land acquisition and establishing trees; the time lapse to returns; and the presently-substantial risks involved in ending up with a marketable product yielding a price that brings a satisfactory return to the investor.

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If new plantation areas are to be established at a greater rate than at present - and it seems generally agreed by both FAFPIC and ACF that the present rate is inadequate - they will be on private and/or public land. If they are on public land, it will be State-owned or controlled, as the Commonwealth is currently not a significant owner of suitable land. Nor is it likely to purchase such land in the foreseeable future.

If plantations are to be established on private land, then there will need to be changes in the market signals involved to make plantation forestry "economic". Because of the centrality of the role of the state in forestry in Australia, these changes will inevitably require State and/or Commonwealth initiatives, probably in the form of subsidies.

It is difficult to consider specific proposals to establish eucalypt plantations without considering the markets in which the products will be sold. It seems likely, given the present state of knowledge of plantation forestry and present technology for harvesting and processing the wood, that the major product from eucalypt plantations initially will be pulpwood (cf. Sections 3.3, 3.4 above).

Harvesting, transportation and processing costs are capital-intensive, and proximity to a processing site is an important criterion in plantation location. The availability and siting of pulp mills are therefore key factors. Commercially viable plantations will need to be linked to existing or proposed pulpmills. There is naturally a degree of circularity to this argument. New pulpmills will not be constructed unless there is a guaranteed resource to be exploited; new plantations will not be established unless there is some certainty that a market (ie. a processor) will exist. The scale of the overall investments, plantation establishment and pulpmill construction, is such that government support, either through direct investment or indirect regulatory interventions, will be critical. The case for these interventions rests primarily on the "social" values associated with wilderness preservation and only secondarily on the positive current account effects.

In their control over lands the States possess the major resource for plantation forestry. They also administer and determine land use policies that affect the siting and operation of forestry enterprises. Most of the States already have schemes to promote private forestry. Western Australia has the most ambitious and extensive program, administered through its Department of Conservation and Land Management. Through sharefarming agreements with sheep and wheat farmers, it intends to plant 105,000 ha of eucalypt plantations in the southwest of the State to support a new pulpmill (Campbell 1990: 8).
Since 1967 the Victorian government has operated a scheme to encourage the establishment of private plantations. By 1986 this scheme had loaned $1.5 million and resulted in the establishment of 8,270 ha of mostly softwood plantations (Hurley 1986). Hurley has criticised the scheme's effectiveness on several fronts: the cost of administration (with administrative costs estimated at around $166 per ha in 1980) and loans advanced averaging $180 per ha planted; the loan structure, which deferred repayments of loan and interest for 12.5 years and implicitly imposed a particular thinning regime on owners; and a level of assistance that failed to keep pace with inflation. He noted that a similar scheme in New Zealand experienced spiralling administrative costs and switched to outright grants. These have the advantage of transparency and allow better estimation of real costs.

Tasmania also has a history of supporting private plantation activity. In 1978 a separate division within the Tasmanian Forestry Commission, called the Private Forestry Division (PFD), was created and set up a range of financial assistance schemes, some of which complemented private industry schemes for landowners near chip mills (Cannon 1988b). By 1980 a non-repayable Eucalypt Plantation Grant of up to 50 per cent of establishment costs to a maximum total cost of $600/ha was available as a PFD grant. The landholder's contribution was a minimum of 20 per cent of establishment costs. By 1987 the PFD grant had dropped to 30 per cent of establishment costs, but had increased to a maximum of $1200/ha. In 1988, the Commonwealth made National Afforestation Program funds available to the PFD to increase grants up to 50 per cent of costs, with some private companies, under Joint Assistance Schemes, providing an additional 30 per cent.

Pressure by conservation groups over export woodchips in the early 1970s led the Commonwealth to use its powers over the issue of export licences to force modifications to harvesting and forest regeneration practices. By the early 1980s, export licences for woodchips were linked to private sector commitments to eucalypt plantation establishment (Cannon 1988b) and by 1988 the Commonwealth was requiring that for each 1,000 tonnes of wood logged by woodchip companies, five hectares must be reforested, and at least one of these must be plantation (Helsham 1988:294).

The establishment of the National Afforestation Program (1987-88), a development from the National Tree Program, signalled a significant additional interest of the Commonwealth in tree planting for conservation and land management purposes. The creation of the Resources Assessment Commission in 1989 and its first reference,
the forest and timber inquiry, has now firmly placed the issue of forest management in the federal arena.

While the States are unlikely willingly to relinquish their land management powers, it seems increasingly possible that the Commonwealth may consolidate and extend its influence in this area. For instance, the Secretary of the RAC Forest and Timber Inquiry stated at an open day held by the RAC (10 April 1990) that the powers of the Commonwealth over the management of Australia's resources may reasonably be expected to be included in the Inquiry's discussion of future options.

4.1 Options

The constitutional separation of State and Commonwealth powers and responsibilities requires that public policy discussions take into account these two foci of interests. But because the Commonwealth provides the money, and Commonwealth legislation ultimately overrides that of the States, the intergovernmental arena offers great potential for negotiated change.

4.1.1 State Participation

The States, as large landowners, and by controlling land uses and royalty rates for crown (and, by association, private) harvests from native forests, will continue to exert a strong influence on most aspects of plantation establishment.

The resource inputs for large-scale processing enterprises, with the possible exception of east Gippsland and southeastern NSW, will lie entirely within a single State's borders. The scale of operation of these enterprises will restrict their siting, and their number. State governments will therefore be interacting with a small set of players seeking raw materials for processing. In the past this has been to the disadvantage of State governments, as they have been played off against one another, resulting in underpricing, subsidies in the form of infrastructure provision, grants, etc. There is potential for Commonwealth involvement in this process. The Wesley Vale pulpmill proposal certainly signalled the Commonwealth’s interest and intention to intervene.

Currently the States are more likely to champion the interests of the forests industry and resist the demands of the conservationists. This is fiscally perverse, given the nature of State subsidisation of the industry's activities (Gerritsen 1990: 58-9). If the States charge more proximately market-based royalties then more rational
political and economic behaviour can ultimately be expected from them. Consequently, Commonwealth pressure for the States to more realistically price their interventions in the forests industry may be a means whereby an appropriate incentives structure is established for the forestry industry. Then, also, if subsidisation of plantations is judged to be desirable, the nature of such inputs becomes transparent and amenable to cost-benefit analysis.

Wood supply for large-scale enterprises need not come from a single source. However supply must be secure for a major new investment to proceed. State governments, with the exception of Tasmania which has a high proportion of privately owned forests, will need to guarantee at least a limited access to State wood supplies to ensure initial project feasibility. Plantation projects are unlikely to proceed unless there is a guaranteed market for their products, though they could subsequently be linked into major processing developments.

State schemes for encouraging tree planting generally, and plantation establishment to a more limited extent, will develop and expand to the extent that funding continues from the Commonwealth. The political investment in tree planting programs has become substantial in many States - particularly Victoria, Tasmania and Western Australia - and sufficient momentum may have been already generated for these schemes to produce a large increase in the area of eucalypt plantations.

State governments may be increasingly sensitive to charges of misusing and misapplying government funds in ill-advised ventures. Western Australia and Victoria have relevant unhappy experiences. This should limit the scale of any particular assistance scheme, and more importantly, assistance to any particular private enterprise, and therefore spread the risks of any one investment failing.

The States will continue to lobby the Commonwealth for more funding, and exploit political, economic and social opportunities to do so.

4.1.2 Commonwealth Participation

There is little doubt that the Commonwealth will become the major governmental player in plantation forestry. It's major initiative in establishing the Resources Assessment Commission has created a national focus for forest management. The Commonwealth, by taking a high profile on environmental issues, has encouraged the conservation movement and the general public to adopt a national
oulook. This has been in part a reaction to political pressure from conservationists (Gerritsen 1990: 53-54).

The existing powers the Commonwealth could use include: export controls; various taxation incentives; the extension of tied specific purpose grants to States; and its adopted obligation to protect national estate forests and therefore to stimulate alternative sources of wood supply.

What new powers could the Commonwealth create? Where would the source of legislative power come from? The Commonwealth's recently-adopted power to intervene in some matters related to the management of properties listed on the World Heritage List has received qualified support through the High Court in the Franklin Dams case. That many of the issues implicit in this issue of the management of World Heritage properties were not resolved in the High Court has meant that considerable latitude exists for the Commonwealth to further extend its powers, or for the States to attempt to regain some lost jurisdictional ground. The present structure of the High Court suggests that a Commonwealth perspective will be favoured, for the foreseeable future at least.

The Commonwealth could introduce legislation to regulate land management practices, or to specify standards for forestry operations. It could extend its powers over the protection of areas that it identifies as having high conservation value. The role and powers of federal statutory agencies such as the Australian National Parks and Wildlife Service or the Australian Heritage Commission could be expanded. The Commonwealth could also stimulate an increase in the number and extent of conservation reserves by creating a new national category of protection or reserve. It could certainly encourage, and perhaps escalate, the present trend of transferring land from exploitative management to more sustained management goals.

The RAC report on forest and timber resources due in 1991 may continue to shift the balance of opinion towards Commonwealth regulation of forest management. It may contribute to altering public opinion regarding Commonwealth powers so that a referendum on transferring powers over land use or environmental issues to the Commonwealth may have some chance of success. The support of the Opposition parties will still have a critical bearing on the fate of such referendum proposals. At present the Opposition could be expected to oppose such an extension of Commonwealth powers.
The Commonwealth of course already has substantial powers over export licences - it may choose more stringently to regulate the operations of woodchip exporters, to scrutinise more closely the management of the forests producing export products, or to strengthen and extend the conditions consequent on the granting of export licences. These conditions could include an enhancement requirement for plantation establishment. This could impose a levy on export woodchips specifically to fund the establishment of new plantations.

The Commonwealth can take actions to expand the domestic market and export opportunities for pulpwood by facilitating the establishment of one or more pulpmills in suitable locations. It may force the export woodchip industry into adding value to chips by processing in Australia. In order to supplement existing supplies from State-owned forests, the Commonwealth may enter into agreements with one or more States to fund a hardwood plantation policy, along the lines of the Softwood Forestry Agreements of the 1970s. This appears to be a current possibility with renewed proposals by the Tasmanian government for a new pulp mill.

The Commonwealth should certainly examine the implications of its taxation policies for plantation establishment. Provisions for deducting capital costs, or part thereof, for plantation enterprises would improve investment prospects. Averaging of income, perhaps along the model of agriculture’s five-year tax averaging mechanism but over the lifetime of the project would increase investor interest.

One of the more promising arrangements that some of the States are embarking upon is sharefarming or leasing land from private landholders for tree growing. An annual rent is paid, and some guarantee made of a market for the wood produced. This avoids currently prohibitive land purchase costs and introduces regular income to offset the cost of establishment and maintenance. The major danger of this approach is that the administrative costs of these schemes may approach or exceed the value of the benefits received by the landholder and the community. The current leaseholding and sharefarming schemes should be carefully monitored.

The Commonwealth could take steps to reduce some of the uncertainty about wood supplies from public forests and future markets by developing a national forest strategy that set out objectives for forest management and the supply of wood, guidelines for harvesting and processing industries, and environmental standards. It should certainly produce better policy guidelines than
the series of generalisations that comprise the present National Forests Strategy (AFC1986).

The Commonwealth could consider the creation of a national forest service, removing responsibility for forest management from the States. This would permit a more uniform approach to the management of publicly-owned forests. There is a parallel between the present situation in Australia and that prevailing in the USA prior to the establishment of the US Forest Service, particularly with respect to public concern on environmental issues. However, the political and constitutional impediments here may be insurmountable unless the new spirit of cooperative federalism initiated by the Prime Minister is translated from rhetoric into action through the transfer of such functions.

4.2 Discussion

There seems little doubt that the Commonwealth's involvement in forestry issues will increase. Whether this involvement takes the form of direct legislation, intervention, or co-operative arrangements with the States will depend on the nature of the Commonwealth-State relationships, on public opinion, on the conservation lobby, and on the extent to which factors outside Australia control the debate on environmental and economic issues. The dramatically increased tendency over the last five years or so for environmental issues to be seen and treated nationally does place the onus for initiative on the Commonwealth.

The major implications are budgetary and political. Increased budget outlays in periods of fiscal stringency and noisy losers are politically sensitive, providing powerful incentives to "get-it-right".

Irrespective of whether the States or the Commonwealth channel the funds, public support for plantation forestry will employ taxpayers' money. Taxpayers need therefore to know where and how the funds are distributed, who benefits, and how the community is better off if public funds are employed.

5 Conclusions

There is little doubt that in future eucalypt plantations will play an important role in supplementing Australia's production of hardwood pulp. Australia should increase its rate of establishment of eucalypt plantations for pulpwood production because - compared with reliance upon native forests - managing and harvesting plantation
wood represents a more efficient use of land and yields a product of superior quality and uniformity and therefore of higher value. The technical and economic rationale appears to be soundly-based, given certain sympathetic assumptions about the discount rates on the capital employed. The (inevitable?) involvement of governments in encouraging and facilitating investment in commercial tree planting enterprises should be seriously examined.

Australia's deficit in trade of forest products can be addressed by more efficient production of eucalypt pulpwood and local value-added processing and by increased recycling of paper products. In the longer-term plantations could also supply the bulk of sawmilling requirements. This would allow greater emphasis to be placed on the conservative and economically rational management of remaining native forest resources.

The forestry and forest products markets are imperfect and isolated from domestic market forces for historical, political, and geographic reasons. It is surprising to note that the RAC background paper to the Forest and Timber Inquiry (RAC 1990) does not mention royalty rates, given the influence that royalty rates have on harvesting decisions and potential investment in the forestry and logging industry. It is important to reiterate here that there is no free market price for wood in Australia; prices are negotiated within a set of regional bilateral monopolies (Byron & Douglas 1981; Leslie 1985). This has important implications for investment decisions in plantations. There is scope for government, particularly State governments, to improve stability and security in the business of growing trees by opening up the process of price negotiation to greater public scrutiny and involvement.

In future exogenous forces will increasingly dominate import, export and domestic markets for wood products. State governments, as majority suppliers, and the Commonwealth as regulator, should continue to intervene in these markets to ensure that land management practices meet acceptable environmental criteria within rational economic parameters. The Commonwealth should play the leading role in specifying environmental standards, determining appropriate policy stances, and developing Commonwealth and Commonwealth-State instruments for implementation and evaluation of such policies.

Plantations can reduce logging pressures on native forests. But the economics of plantation establishment are characterised by major up-front costs, particularly land and establishment costs, long temporal delays to returns, and uncertainties about final products,
markets and returns. The Commonwealth will need to intervene to support plantation establishment if it wishes to reduce the political conflict associated with forestry operations and management.

More specific principles than available at present should be developed to guide public investment in forestry. The extent to which public funds are currently being used to finance plantation establishment at State and Federal levels - for instance through the NAP and the scheme permitting 150 per cent tax deductibility for research and development - should be investigated, probably by the RAC. Whether such support could either be more appropriately targetted or more efficiently applied, can and should be determined.

The longer term question is not whether but the extent to which the native forest resource is either supplemented by or substituted for through plantations. The policy issue of hardwood plantations is as much about their future extent as it is about their feasibility. "Politics" dictates that plantation expansion is a must: the imperative being to ensure the conservation of existing native forests as much as its macroeconomic effects on the current account.

State schemes encouraging private forestry should be evaluated through appropriate cost-benefit instruments. Government assistance through tariff protection, grants, tax incentives and disincentives needs to be better detailed. Specific case studies should be commissioned to detail costs and explore the implications of government programs for particular locations near existing or proposed processing centres. An example is the study of plantation strategy for the southeast forests of NSW by Landsberg, Jones & Pryor (1990). Greatly expanded eucalypt plantations require either the direct participation of governmental production or the subsidisation by the state of private sector activities (or a mixture of both courses). Whatever the course chosen, it needs careful attention to its costs and benefits.
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