A GENERAL EQUILIBRIUM ANALYSIS OF THE

EFFECTS OF CEASING GOVERNMENT PRODUCTION OF

EXOTIC SOFTWOOD TREES IN AUSTRALIA:

Research Proposal

by

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Table A2.1: VARIABLES TO BE SET EXOGENOUSLY IN THE PROPOSED SHORT RUN SIMULATION

Variable [a]	No. of components [b]
Output of the Public Native Forestry industry	1
Exogenous commodity exports	g-G
Powers of exogenous ad valorem export subsidies	G
Import prices (foreign currency)	g
Ad valorem tariff rates	g
Nominal exchange rate ($A/$US)	1
Base period capital stocks by industry	h
Employment of land	10
Balance of trade ($A x 10^9)	1
Aggregate real consumption	1
Number of households	1
Shift term for exports	g
Shift term for occupation wage rates	M
Shift term for industry wage rates	h
Shift term for average wage rate	1
Shift term for other costs (except the PNF industry)	h-1
Shift term for exogenous investment	h-J*
Shift term for other usage (domestic)	g
Shift term for other usage (imports)	g
Composite variables b_1 in cost of capital equation	h
Composite variables b_2 in price equation	h
Composite variables b_3 in domestic consumption equation	h
Composite variables b_4 in import consumption equation	g
Composite variables b_5 in labour demand equation	M
Composite variables b_6 in capital demand equation	h
Composite variables b_7 in land demand equation	10
Composite variables b_8 in domestic market clearing equation	g
Composite variables b_9 in imports market clearing equation	g
Composite variables b_{10} in import price equation	g
Composite variables b_{11} in export cost equation	g
Composite variable b_{12} in CPI equation	1
Composite variables b_{13} in CRETH equation	11

a These variables are explained in Table III.2 of Higgs and Parmenter (1982).

b For the proposed database, the number of commodities (g) is 40, the number of industries (h) is 39, the number of endogenous export commodities (G) is 7, the number of occupations (M) is 10, the number of endogenous investment industries (J*) is 30 and the number of occupations (M) is 10.

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transport margins on log sales via a negative shock to the other costs shift term for Private Forestry.

A variety of experiments may also be undertaken, including the same package as above but with the coincidental elimination of the subsidy on Public Native Forestry output. Another interesting simulation would be the removal of all the subsidies on the public forestry industries.

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Finally, 100 per cent indexation of wages to the CPI and of "other" (government) final demand to real household consumption would be imposed. All non-forestry exogenous industry investment would be set to zero, as would the indexation parameters for each industry's "other costs".

A2.2 The Exogenous Shocks

The policy package is to eliminate the Public Pine Forestry industry by transferring ownership and management of its assets to the Private Forestry Industry whilst eliminating investment (e.g., in afforestation) by the Public Pine Forestry Industry. It is proposed to achieve this result within the economic environment specified above by imposing three shocks simultaneously:

(a) Reduce assets in the Public Pine Forestry industry by 100 per cent;

(b) Increase fixed capital in the Private Forestry Industry by a percentage which is equivalent to the base value of Public Pine Forestry industry assets.

(c) Reduce Public Pine Forestry investment by 100 per cent.

For long run simulations, it may also be appropriate to shock the model so as to reflect the expected rationalisation of land use as plantations which are poorly located are cleared and the land is sold to other users. This might be achieved by simulating the effects of reduced

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1. INTRODUCTION

A considerable amount of government expenditure in Australia is directed to the production of marketable goods and services where there may not be strong theoretical reasons for public production. Examples of industries which are wholly or partly government dominated, and for which the present arrangements can be questioned, include: Communications, Electricity Generation, Railway Rolling Stock and Ships and Boats. Such areas may collectively account for a substantial proportion of Australia's GDP[1].

The purpose of this paper is to outline a research project to analyse the economic effects of the withdrawal from the Australian economy of existing government production of a market commodity: the exotic softwood tree. The paper commences with a description of log sellers and buyers in the Australian forestry sector. Normative economic arguments are then applied to the sector, illuminating its current organisation and

Some Preliminary Ideas on the ORANI Closure and Shocks

A2.1 The Economic Environment

ORANI would be run using the Euler solution algorithm [see Dixon et al. (1982)] in two steps with a short run (and possibly a long run) closure. Variables to be set exogenous are listed in Table A2.1, from which it should be noted that investment will be allowed to vary and the Balance of Trade will be fixed. Other ORANI studies in which the Balance of Trade has been set exogenous are Bonnell (1984), Bruce (1985c) and Dixon, Powell and Parmenter (1979). Further, the output of the Public Native Forestry industry will be set exogenous to reflect its separation from market considerations. It is proposed to set the corresponding shift term for "other costs" endogenous to achieve closure of the model. It will be necessary to retain the output of the Public Pine Forestry industry as endogenous because of the nature of the shocks to be imposed.

Other key decisions in specifying the economic environment for a set of ORANI experiments include the selection of endogenous export commodities and exogenous investment industries. These are indicated in Table A1.3 and, in general, they follow the standard ORANI database for 1977-78 [see Table A.1 of Bruce (1985b)], except for the disaggregated sectors, where the public components of forestry are designated as exogenous investment industries.

promulgating a basis for a change in direction. In Section 4 alternative ways in which a positive economic analysis of the proposed "privatisation" might be undertaken are discussed. Briefly, it is suggested that a special purpose version of the ORANI computable general equilibrium model of the Australian economy might be used. Some prospects for and problems with the project are discussed in Section 5.

2. THE AUSTRALIAN FORESTRY SECTOR: AN OVERVIEW

2.1 Sellers of Logs

Australia's settlers found an abundance of forests and woodlands but relatively little open land suited to food production using their imported technology, especially for cultivation. So they set about clearing large areas and concurrently 'creamed' the residual forests of their best logs for domestic uses [Marshall (1966), Rule (1967) and Lewis (1975)].

Land markets took a long time to develop to an efficient stage because of complete initial Crown ownership², the large areas involved and the low population of colonists. Long before market development could provide for balanced land use with respect to forests, i.e., the equating of the marginal cost of clearing with the marginal cost of investing funds elsewhere, some influential people had become concerned by 'the great extermination'. The solution at the time was to preclude some forest lands from alienation and, later, to have the governments manage those lands to

No.	Mnemonica	Description	Corresponding Nos.b in the Standard Database
19		Non-traded Manufacturing	19, 20, 23, 26, 27, 42, 43, 45, 48, 51, 53, 58-61, 65, 66, 69, 70
20		Import-competing Manufacturing	21, 24, 28, 29, 31-39, 46, 47, 50, 52, 54, 55, 57, 62, 63, 67, 68, 71-75, 79-83
21		Sawmill Products	40
22		Veneers and Boards	41
23		Pulp, Paper and Paperboard	44
24		Chemical Fertilisers	49
25		Petroleum and Coal Products	56
26		Agricultural Machinery	76
27		Construction Machinery	77
28		Other Machinery and Equipment	78
29	X	Utilities	84-86
30	X	Construction	87, 88
31	M	Other Margins	89, 90, 95, 96, 101, 110
32	M	Mechanical Repairs	91
33		Private Services	92, 97-100, 102, 109
34	M	Road Transport	93
35	X M	Rail, Other Transport + Storage	94
36	X	Ownership of Dwellings	103
37	X	Public Services	104-108
38	X	Personal Services	111
39	X	Non-competing Imports	112

a E endogenous export commodity, L "land" using industry, X exogenous investment industry, M Margin commodity.

b See Table A1.1 for descriptions of each standard commodity and industry.

prevent unsustainable exploitation.

Intervention first occurred in each of the Colonies (later States) at various times, with differing objectives and diverse effectiveness. Lewis (1975) records that the South Australian Woods and Forests Department, created in 1882, was possibly the first forest service, in its own right, in the British Commonwealth. There were several changes in and differences between the State forestry services but by about 1920 all of them were managing substantial areas of Crown Lands, gazetted as forest reservations and otherwise, and had powers to levy, and enforcement capacity to collect, royalties on Crown timber [Carron (1979)]. Additionally, they could limit the volume and size of logs removed from 'their' lands. At 30 June 1983 they directly controlled 32 per cent of the area of the Australian forest estate from which wood may be removed, and indirectly controlled up to a further 39 per cent [BAE (1984)].

Technical and cultural preferences for softwood lumber for many end-uses led to the rapid decimation of most of the initially restricted native softwood forests. The later development of softwood plantation forestry was due to the continuation of those preferences, and the resulting domestic scarcity, combined with the relative isolation of Australia and the discovery that certain exotic conifer species can grow quite rapidly in parts of the nation.

More recently there have been substantial increases in the perceived demands for non-wood outputs from native forests, including conservation, wilderness, wildlife, aesthetic appearance and various

Table A1.4: COMMODITIES AND INDUSTRIES IN THE PROPOSED ORANI DATABASE

No.	Mnemonic[a]	Description	Corresponding Nos.[b] in the Standard Database
Industries only			
1	L X	Public Native Forestry (PNF)	10 (part)
2	L X	Public Pine Forestry (PPF)	10 (part)
3	L	Private Forestry (PF)	10 (part)
4	L	Pastoral Zone	1
5	L	Wheat-Sheep Zone	2
6	L	High Rainfall Zone	3
7	L	Northern Beef	4
8	L	Milk Cattle and Pigs	5
9	L	Other Farming (sugar cane, fruits and nuts)	6
10	L	Other Farming (vegetables, cotton, oilseeds and tobacco)	7
Commodities only			
A1		Pines	10 (part)
A2	E	Hardwoods	10 (part)
A3	E	Wool	A1
A4		Sheep	A2
A5	E	Wheat	A3
A6	E	Barley	A4
A7	E	Other Grains	A5
A8		Meat Cattle	A6
A9		Milk Cattle and Pigs	A7
A10		Other Farming (sugar cane, fruits and nuts)	A8
A11		Other Farming (vegetables, cotton, oilseeds and tobacco)	A9
Commodities and Industries			
11		Poultry	8
12		Logging	10 (part)
13	X	Services to Exports	9, 17
14	E	Other Exports	11, 18, 22, 25, 30, 64
15	E	Export Mining	12, 13
16	E	Black Coal	14
17		Oil, Gas and Brown Coal	15
18		Other Minerals	16

recreational opportunities. Substantial areas of public forest have been withdrawn from being available for timber harvest in response to such demands. Other lands are to be logged only once before withdrawal. The net result of these measures, and others which are related but less drastic, is to increase the demands for wood from the alternative sources of domestic plantations and imports. Coniferous logs accounted for about a third of total roundwood removals from Australian forests in 1982-83 [BAE (1984)]. This share is expected to rise to more than two-thirds as the plantations mature.

All the State forest services are following the general aim of State autarky in wood production and this means extensive softwood plantation schemes in most cases. The Queensland Forestry Department aims to maximise the area planted to native softwoods and to make up the perceived shortfall in supply with exotic conifers. The South Australian Woods and Forests Department aims to utilise the entire area of the State which will support softwood plantations, consistent with other appropriate land uses, to support a stable processing industry. The other States are planting to offset reductions in hardwood availability [whatever that means: see Bruce (1980)], and to meet expected increases in intrastate demand. For example, in Western Australia the forest service's stated objectives include the aim of ensuring "sufficient supplies of softwood to guarantee Western Australia's long term self-sufficiency in timber production" [Forestry Department of Western Australia (1984)]. It is crucial to note that since relative production costs have not been published, demand projections for forest products in each State may not have been soundly based [Byron (1981)], and since trade between States is

Table A1.3: SCHEMATIC MAKE MATRIX FOR THE DISAGGREGATED FORESTRY AND LOGGING SECTOR

Commodity	Industry			
	Public Native Forestry	Public Pine Forestry	Private Forestry	Logging
Exotic Softwood Trees (Pines)	Zero	Positive	Positive	Zero
All Other Trees and Minor Forest Products (Hardwoods)	Positive	Zero	Positive	Zero
Logging	Zero	Zero	Zero	Positive

free under Section 92 of the Australian Constitution, the actual management objectives of the government forest services are open to wide interpretation.

The six State forest services, and ACT Forests Section, dominate the ownership and new planting of exotic softwood forests (see Tables 2.1 and 2.2). There is clear evidence that, barring excessive fire or disease losses, the States are planting more than the domestic market will use [BAE (1977), Treadwell (1978)], so that they have moved to examine the export potential of the "surplus" [Byron (1979), Nixon (1980), Senate Standing Committee on Trade and Commerce (1981)].

Supply coordination between the States experienced a quantum leap with the establishment of the Australian Forestry Council in 1964 and later through the Softwood Forestry Agreement Acts of 1967, 1972, 1976 and 1978 and the FORWOOD Conference [Australian Forestry Council (1975)]. The analyses upon which such coordination has been based were largely conducted in the absence of price and other vital considerations [Bruce (1980), Byron (1981), Ferguson and Parkes (1974)]. Reasons for these deficiencies are probably the technical/scientific nature of most of the forestry profession, the isolation of pricing policies from production costs and the separation of public forest managers' salaries from the profits of their forestry ventures [Strahan (1960)]. In most of the coordination there seems to have been an emphasis on State forest service empire building with little consideration of the national context [Carron (1980)] or indeed the international situation — even of New Zealand [Byron (1980), Leslie (1975)].

Table 2.1: **EXTENT AND OWNERSHIP OF EXOTIC SOFTWOOD PLANTATIONS IN AUSTRALIA: 31 March 1983**

Ownership Category	Area	Proportion
	Ma(a)	%
Private	23.06	31.6
Public	49.88	68.4
TOTAL	72.94	100.0

(a) One Ma is one million ares. The are is the SI unit of area, and one are is equal to 100 square metres. Consequently, one Ma is equivalent to 100 square kilometres.

Source: BAE (1984).

Table 2.2: **AUSTRALIAN SOFTWOOD PLANTINGS AND EXTENT OF PUBLIC OWNERSHIP: 1950-1983**

Years	Annual Planting	Proportion of Plantings by Public Sector
	Ma(net)	%
1950-54	0.909	57.9
1955-59	0.776	78.9
1960-64	1.093	65.8
1965-69	2.324	68.9
1970-74	3.197	80.3
1975-79	3.547	67.9
1980-83	3.384	64.9

Sources: BAE (1984), Department of Primary Industry (1983), Forestry and Timber Bureau (1976), Wilson (1969).

Table A1.2: **OCCUPATIONS IN THE STANDARD ORANI DATABASE: 1977-78**

No.	Name
1	Professional
2	Para-professional
3	Skilled White Collar
4	Semi and Unskilled White Collar
5	Skilled Blue Collar - Metal and Electrical
6	Skilled Blue Collar - Building
7	Skilled Blue Collar - Other
8	Semi and Unskilled Blue-Collar
9	Rural Workers
10	Armed Services

Figure A1.1: **PROPOSED DISAGGREGATION OF THE FORESTRY AND LOGGING INDUSTRY**
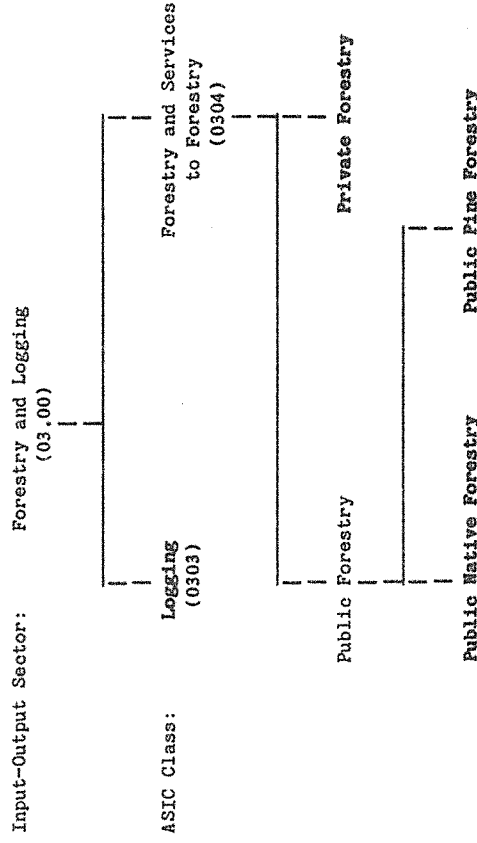

Input-Output Sector:	Forestry and Logging (03.00)	
ASIC Class:	Logging (0303)	Forestry and Services to Forestry (0304)
	Public Forestry	Private Forestry
	Public Native Forestry	Public Pine Forestry

Table A1.1 (Continued)

No.	Description	No.	Description
64	Non-ferrous basic metals	89	Wholesale trade
65	Structural metal products	90	Retail trade
66	Sheet metal products	91	Mechanical repairs
67	Other metal products	92	Other repairs
68	Motor vehicles and parts	93	Road transport
69	Ships and boats	94	Railway, other transport and storage
70	Railway rolling stock	95	Water transport
71	Aircraft	96	Air transport
72	Photographic and scientific equipment	97	Communication
73	Electronic equipment	98	Banking
74	Household appliances	99	Non-bank finance
75	Other electrical equipment	100	Investment
76	Agricultural machinery	101	Insurance, services to insurance
77	Construction equipment	102	Other business services
78	Other machinery and equipment	103	Ownership of dwellings
79	Leather products	104	Public administration
80	Rubber products	105	Defence
81	Plastic and related products	106	Health
82	Signs, writing equipment	107	Education, museums, libraries
83	Other manufacturing	108	Welfare and religious institutions
84	Electricity	109	Entertainment, recreation
85	Gas	110	Restaurants, hotels and clubs
86	Water, sewerage and drainage	111	Personal services
87	Residential building construction	112	Non-competing imports
88	Other construction		

To this must be added the observation that Australian forest service executives have never forecast decreasing wood demand but frequently have forecast "wood famines", with no apparent appreciation of the market clearing function of the price mechanism. Such naive forecasts may again reflect empire-building [see Stigler (1975)] and/or that the forest services are simply incapable of responding, at least cost to the real forest owners (i.e., the citizens), to changes in overseas supply or domestic demand. The philosophy seems to be "plant as much as possible". Policy-level considerations relating to the wise investment of (intramarginal) taxpayers' dollars have not appeared within the forest services so far as the observer can tell, although their empowering legislation gives them control of "all matters of forest policy" in several States. This is not to say that State Treasuries have not imposed external disciplines on the forest services.

It has been noted in the literature that there seems to have been little objective consideration given to the size or location of public softwood forests [Ferguson and Parkes (1974)]. The rational decision of an entrepreneur is to locate his plantations as close as possible to major market centres, given the low value to weight ratio of logs and most intermediate forest products, and non-zero transportation costs. Of course, the location decision must be consistent with the ability to buy land from competing but less profitable uses, with scale economies, and with the pattern of existing or potential transport routes.

Hardwood forestry has historically been a residual land use on terrain not suited to other productive enterprises, and the same approach

has often mistakenly been followed with softwood plantations: especially

since the forest services have faced large internal economies by using

"free" Crown Land. Section 9 of the Softwood Forestry Agreements Act 1967

states: "The State shall ensure that planting during each year is carried

out efficiently and in conformity with sound forestry and financial

practices". The State forest services bear some questioning as to their

(economic) efficiency and the soundness of their financial practices, at

least with regard to sensible forest location and scale.

Australian forest services, like many of their counterparts

elsewhere, have chronically underpriced their logs. In a broad way this

can be seen from their statements of revenues and expenditures (see Table

2.3), although the expenditures include often substantial but unamortised

capital components and spending on items other than wood production, such

as the provision of recreational facilities, publications and much of their

research. On the other hand, it may have been that some log prices have

been set too high to clear the domestic market during housing recessions.

However, the benchmark for Australian log royalties must be the world

price, since logs are now an internationally traded commodity in the

Pacific region [see Maxwell and Baines (1985), Table 1]. To put it another

way, the non-participation of Australian log sellers in exporting

activities has been costing the nation considerable amounts of money.

Log pricing policies in Australia have been analysed by Byron

and Douglas (1981), who indicated five major economic effects:

a) A direct subsidy from taxpayers to log buyers in the case of logs from

public lands, which is not transmitted to final consumers of forest

Table A1.1: COMMODITIES AND INDUSTRIES IN THE STANDARD ORANI DATABASE: 1977-78

No.	Description	No.	Description
Industries only		24	Confectionery and cocoa products
1	Pastoral zone	25	Other food products
2	Wheat-sheep zone	26	Soft drinks, cordials and syrups
3	High rainfall zone	27	Beer and malt
4	Northern beef	28	Other alcoholic drinks
5	Milk cattle and pigs	29	Tobacco products
6	Other farming (sugar cane, fruits and nuts)	30	Cotton ginning
7	Other farming (vegetables, cotton, oilseeds and tobacco)	31	Man-made fibres, yarns, fabrics
		32	Cotton yarns, fabrics, textiles
		33	Worsted woollen yarns
Commodities only		34	Textile finishing
A1	Wool	35	Textile floor coverings
A2	Sheep	36	Other textile products
A3	Wheat	37	Knitting mills
A4	Barley	38	Clothing
A5	Other grains	39	Footwear
A6	Meat cattle	40	Sawmill products
A7	Milk cattle and pigs	41	Veneers and boards
A8	Other farming (sugar cane, fruits and nuts)	42	Joinery and wood products nec
A9	Other farming (vegetables, cotton, oilseeds and tobacco)	43	Furniture and mattresses
		44	Pulp, paper and paperboard
		45	Bags, fibreboard containers
Commodities and Industries		46	Paper products, nec
8	Poultry	47	Publishing, printing
9	Services to agriculture	48	Paper stationery, printing etc.
10	Forestry and logging	49	Chemical fertilisers
11	Fishing and hunting	50	Other basic chemicals
12	Ferrous metal ores	51	Paints
13	Non-ferrous metal ores	52	Pharmaceutical products
14	Black coal	53	Soap and other detergents
15	Oil, gas and brown coal	54	Cosmetics and toilet preparations
16	Other minerals	55	Other chemical products
17	Services to mining	56	Petroleum and coal products
18	Meat products	57	Glass and glass products
19	Milk products	58	Clay products and refractories
20	Fruit and vegetable products	59	Cement
21	Margarine, oils and fats	60	Ready mixed concrete
22	Flourmill and cereal food products	61	Concrete products
23	Bread, cakes and biscuits	62	Other non-metallic mineral products
		63	Basic iron and steel

pines under alternative market arrangements. For example, the possibility would be remote for agents in the Northern Beef and Pastoral Zone industries of the standard ORANI database.

The Personal Services sector remains unaggregated because it has been used as a dumping ground for margins on capital investment in the 1977-78 ORANI capital stocks matrix [see Bruce, Sutton and Da Cruz (1984), pp. 6-7, Lawson (1985) and Stevenson (1981)]. It was necessary to do this because the ORANI capital stock matrix [Hourigan (1980)] was estimated at basic values. Consequently, the rows corresponding to the commodities primary to the margins industries show markups on the capital stocks of each industry. As well as markups, however, some margins industries have direct sales to investment. Since the main use of the capital stock matrix is to derive investment matrices, the values in these rows may give a misleading picture of the distribution of direct investment sales to each industry. Consequently, the values in these margins rows have been added to the Personal Services row and then set to zero. Personal Services was chosen for this purpose because, in 1977-78, it had no sales to capital creation, so there is no distortion to its sales shares in the ORANI database. Were it to be combined with commodity groups which have non-zero sales to capital formation, this desirable feature would be lost. Finally, the dummy industry, Non-competing Imports, has been left alone since the aggregation is not "severe" [see Bruce, Sutton and Da Cruz (1984), p. 6].

products due to manufacturers pricing their finished products commensurately with the landed duty-paid prices of imported substitutes;

b) Restriction of nonindustrial private forestry' to a very low level compared with that expected in a free log market;

c) Relatively wasteful use of: (i) each tree at harvesting; (ii) each log at milling; and (iii) processing residues. Corresponding over-use of labour and capital to the extent that processors act to equate the marginal value products of each input;

d) Distortions to the economics of silviculture;

e) Rendering most of the forest services unprofitable in accounting terms after reasonable deduction for outputs of public goods and investment amortisation, and probably the rendering of all the forest services unprofitable in economic terms.

Table 2.3: COMBINED RECEIPTS AND EXPENDITURES OF GOVERNMENT FOREST SERVICES IN AUSTRALIA: 1927-1982(a)

Years ending 30 June	Average Annual Receipts	Average Annual Expenditures	Receipts as a Proportion of Expenditure
	1979-80 $M	1979-80 $M	%
1927-30	20.66	19.70	105
1931-35	17.91	23.83	75
1936-40	33.08	44.34	75
1941-45	47.83	53.83	89
1946-50	50.39	83.30	60
1951-55	71.75	93.08	77
1956-60	82.08	101.13	81
1961-65	86.36	128.13	67
1966-70	93.71	152.94	61
1971-75	98.29	174.50	56
1976-80	107.98	197.76	55
1980-82	133.79	217.62	61

(a) Excludes Territory forest services from 1964 and the non-commercial component of New South Wales Forestry Commission transactions in 1981-82. From 1963-64, certain attempts have been made to preserve comparability between years for each authority's accounts. Values were deflated using the implicit price deflator for Gross Domestic Product and, prior to 1948-49, the "C" series Retail Price Index for all items in six State capital cities.

Sources: ABS (1984b), CBCS (1952), annual reports of State forest services and Wilson (1964).

Other economic distortions which can be attributed to the activities of the State forest services in wood production are mainly due to the allocations of log quotas from public forests. Hammond (1979) describes the situation in NSW softwood log allocations, which can be described as explicit market closure to favour existing processors.

assumed, as for any other industry. Further, an attempt will be made to allow for the possibility of log exports which, on the basis of New Zealand experience, promise to be lucrative [see Maxwell and Baines (1985)].

To reduce the expense of model development and use, and the volume of results to be checked and interpreted to manageable size, 85 of the remaining industries and commodities will be aggregated to 10 sectors, making 39 industries and 40 commodities in all. This will be done using an existing software facility [Bruce, Sutton and Da Cruz (1984)]. The resulting industry/commodity structure is shown in Table A4.4, along with the mapping from the standard database sectors. Where aggregations are shown, efforts have been made to add like industries and commodities and to reduce unnecessary complexity. For example, six of the eight standard margins sectors have been put into one new sector. Most of the 17 non-agricultural sectors which are neither aggregated nor disaggregated either sell more than 5 per cent of their outputs to, or buy more than 5 per cent of their inputs from, the Forestry and Logging sector.

Except for industries 3 to 10, all the remaining industries will each be modelled as making one product. The multiproduct agricultural industries will be allowed to make the same commodity groups as they do in the standard database [see Bruce (1985b), Table 2.1]. In addition, the Wheat-Sheep Zone, High Rainfall Zone and both Other Farming industries will also be able to grow Pines, again using CRETH technology. This will enable the model to more realistically portray the effects of policy shocks on the farm sector, given the remarks made in Section 3.3. Note that it is not contended that all Australian farmers would seriously consider growing

Proposed Industry/Commodity Structure

The most recent database for ORANI is a representation of the Australian economy as it was in 1977-78 with a typical year agricultural sector [ABS (1983), Bruce (1985b)]. 114 commodity groups, 112 industries and 10 occupational categories are used to portray the structure of the economy (see Tables A1.1 and A1.2). For the present purpose it will be necessary to disaggregate the uniproduct Forestry and Logging industry into four sub-industries as shown in Figure A1.1. Two of these, Public Native Forestry (PNF) and Private Forestry (PF), will each produce two outputs: hardwood and exotic softwood ("pine") trees. The Public Pine Forestry (PPF) will only make pines. Table A1.3 depicts a schematic make matrix for the disaggregated sectors. The output possibilities of the PNF and PF industries will be described by CRETH (Constant Ratio of Elasticity of Transformation, Homothetic) technology, which is used in ORANI to allow choices between the production of different commodities by the major agricultural industries [see Dixon et al. (1982), pp. 74-75].

Software to accomplish the disaggregation of Forestry and Logging with such data as can be obtained is expected to be commissioned shortly [Bruce and Sutton (1984)]. It must be noted that the Private Forestry industry in Australia is in fact largely vertically integrated with forest products manufacturing. ORANI has no mechanism to accommodate these ownership and control linkages which in reality may have substantial effects on industry behaviour. Instead, profit maximisation will be

Potential entrants face the cost of having their case considered at Cabinet level! To run a sawmill using timber from public land in most States requires a licence in addition to a quota. In some States the requirement extends to the sawing of timber from any land.

Since the forest services in most cases have paid nothing for their land, this further disadvantages potential private growers and distorts the land use pattern by limiting competition with directly comparable productive enterprises. Under these circumstances, resource misallocations seem inevitable.

"Oversupply" can be said to occur if the actual return on the forest investment falls below the opportunity interest rate, i.e., if owners' funds have not been used with full economic efficiency. In a free and open log market, oversupply is observed when the market clearing price is less than the average costs of production of a firm or firms. In such a case those firms will cease production (e.g., plantation establishment and silvicultural inputs to existing plantations in the short run, and perhaps log harvesting in the longer run). If log prices fall further to below the average fixed costs⁴ of some firms, the firms would behave rationally by going out of business and engaging their assets in more productive endeavours.

As noted above, Australian log markets are neither free nor open and in such a case it is difficult to judge whether oversupply is occurring. However, given the objectives of the forest services, their pricing policies and their published accounts, it seems highly likely.

Walsh, B.V. (1970). "The Responsibilities of Governments Towards Inducing Private Enterprise to Undertake Tree Farming." Australian Forest Devel-opment Journal 4(2):3-20.

Wilcoxen, P. (1985). "Numerical Methods for Investment Models with Fore-sight." IMPACT Preliminary Working Paper No. IP-23, Melbourne, July.

Wilson, D. (1964). Monetary Statistics of Australian Forest Products: 1935-36 to 1962-63. Forestry and Timber Bureau, Canberra.

_____ (1969). Compendium of Australian Forest Products Statistics: 1935-36 to 1966-67. Forestry and Timber Bureau, Canberra.

Under a somewhat different analysis, Ferguson and Parkes (1974) reached a similar conclusion. Comparisons of actual with projected planting rates [Treadwell (1978)], give further support to this tenet. The oft-made claim that Australia's forest resource base is inadequate to satisfy domestic "requirements" has never been substantiated [Byron (1980)]. Recent, current and expected future plantings will exacerbate the present situation of a resource already in overuse (e.g., firewood is still free or sold well below cost over most of the continent). The real return on taxpayers' funds is not published by any of the State softwood growing enterprises, and any comparative advantage which Australia may have in making wood products remains unproven [Byron and Douglas (1981), Byron (1980, 1981)]. None of this seems to deter the heads of the forest services from repeatedly claiming that more plantations are needed [e.g., Gentle (1985)].

2.2 Buyers of Logs

The major buyers of logs in Australia are the Sawmill Products and Pulp, Paper and Paperboard Industries. Other significant purchasers include the woodchip industry and the Veneers and Manufactured Wood Boards sector. Except for the woodchip export industry, each wood-using sector can be characterised as competing with imports for the Australian market. Some brief notes on each of the log buying industries follow.

The sawntimber industry, with over 1000 establishments, has a fairly stable production level, although stocks fluctuate considerably [BAE

Senate Standing Committee on Trade and Commerce (1981). _Forestry and Forest Products Industries_. AGPS, Canberra.

Stevenson, J. (1981). "The Capital Stocks and Capital Coefficients Matrices for the ORANI 77 Data Base for 1974-75," IMPACT _Research Memorandum_ No. OA-119, ORANI Model, February, Canberra.

Stigler, G. (1975). _The Citizen and the State_. University of Chicago.

Strahan, L.T. (1960). "Status of Forestry," _Australian Forestry_ 24(1):19-21.

Sutton, J.M., D.P. Vincent and J.F. Zeitsch (1984). "Policy Simulations with ORANI-MILK: An Economy-Wide Model of Milk Production and Processing," IMPACT _Research Memorandum_ No. OA-219, ORANI Model, Canberra, February.

Treadwell, R.F. (1978). "Australian Softwood Plantation Requirements," _Quarterly Review of Agricultural Economics_ 31(1):28-50.

_____ (1982). "The Australian Forestry Sector - Its Size and Characteristics," BAE _Occasional Paper_ No. 66, AGPS, Canberra.

Truong, T.P., D.R. Chapman and D.R. Gallagher (1985). Extending the Production Side of the ORANI Model to Include Energy Substitution. Mimeo, August, University of New South Wales.

(1977)]. The BAE study noted that "it would appear that the pricing of domestic timber in Australia is influenced strongly by the level of imports in relation to timber demand (i.e. housing starts)." Imported timber prices are consistently in excess of prices of most domestic timbers, although the differences may relate to substitution imperfections rather than an efficient domestic industry, since Australia imports far more sawnwood than it exports. An empirical study using annual Australian data from 1956-57 to 1976-77 found that the demands for domestic and imported sawntimber were complementary [Doran and Williams (1982)].

Byron and Douglas (1981) noted that, whilst there was no evidence to suggest the presence of above-normal profits in the sawmill sector, the value of quota entitlements to cheap logs had been capitalised into market prices for mills with quotas: the "prices paid for sawmills often exceed the value of their productive assets by considerable amounts" (p. 50). Following the Australian Government's acceptance of the sawnwood recommendations of the IAC (1981), import duties are 5 per cent for early-stage processed timbers and 15 per cent for dressed timbers. The 1981-82 nominal protection rate used in the current ORANI database for Sawmill Products is 6.7 per cent [Bruce (1985b), Table A.2].

The Pulp, Paper and Paperboard industry is highly concentrated, there being six significant producers, most of whom have more than one establishment and are vertically integrated into forest growing and/or other wood using industries. Most of the major vertically integrated companies in the Australian wood-based industries are represented here, including Australian Paper Manufacturers Limited, Associated Pulp and Paper

Mills Limited, Australian Newsprint Mills and Smorgon Consolidated Industries (SCI). Each firm in the industry, with the possible exception of SCI, has obtained State legislation granting long term rights to wood from public lands (mainly native forests). Within product categories, firms either act as monopolists or as duopolists. Import protection rates also vary between products: the BAE (1977) study noted that newsprint was duty free whereas fine and heavy papers have substantial import tariffs. The fine paper segment seems to be particularly sensitive to import competition, and has also obtained production bounties for certain lines which do not compete with imports. The current nominal protection rate for the Pulp, Paper and Paperboard industry in the ORANI database is 6.9 per cent.

Byron and Douglas (1981, p. 55) present information indicating that industrial forest growers own between 55 and 60 per cent of all private coniferous forests in Australia. The share may have increased substantially since their latest datum of 1968 due to the diversification of investment forestry companies into processing activities. The present share may be more like 80 per cent. It has been noted that the objectives of these growers could not be expected to be the same as those firms whose sole purpose in growing wood is to sell the raw material. In particular, Byron and Douglas (pp. 55-56) cite the benefits as including: the assurance of raw material supplies; vertical integration; risk lowering via the provision of raw material buffer stocks; an asset for bargaining for supply from other growers; an entry barrier and/or an overall taxation reduction device. The tax benefit from afforestation was removed in the Treasurer's statement of July 1985.

Muench, J. Jnr. (1966). "Impact of Public vs. Private Ownership of Timber Land on a Rural Economy," Journal of Forestry 64:721-727.

Newman, The Hon. K. (1982). "Government Decision: IAC Report on Wood and Articles of Wood," Minister for Administrative Services Press Release No. 82/56, 9 December, Canberra.

Nixon, The Hon. P.J. (1980). "Tasmanian Forestry Development," Primary Industry Media Release PI80/106, 25 July, Canberra.

Parsons, S., M. Wallace and I. Bruce (1982). "Assistance to the Australian Plywood and Veneer Manufacturing Industries: A Review of Economic Issues," BAE Occasional Paper No. 64, AGPS, Canberra.

Pederick, L.A. (1981). Editorial. Australian Forestry 44(2):73.

Powell, A.A. (1985). "IMPACT Project Report: A Brief Account of Activities Over the Period 1st February 1982 to 28th February 1985 with a Prospectus for Further Developments," IMPACT Project Report No. R-05, University of Melbourne, April.

Rule, A. (1967). Forests of Australia. Angus and Robertson, Melbourne.

Sebire, R.A. (1979). "Private Forestry in Australia," Australian Forestry Development Institute, Sydney, mimeo.

Leslie, A.J. (1965). "The Economic Basis of State Forestry," *Australian Forestry* 29:48-55.

_____ (1975). "An Australasian Strategy for Planning Future Wood Production." *N.Z. Journal of Forestry* 20(2):254-271.

Lewis, N.B. (1975). *A Hundred Years of State Forestry in South Australia, 1875-1975.* South Australian Woods and Forests Department Bulletin No. 22, Government Printer, Adelaide.

Marshall, A. (1966). *The Great Extermination.* Heinemann, London.

Maxwell, J. and D. Baines (1985). "Developments in the New Zealand Forestry Sector: Implications for Australia." In Bureau of Agricultural Economics, *Forest Products Situation and Outlook, 1985.* AGPS, Canberra.

Meagher, G.A. (1984). "An Empirical Analysis of the Effects of a Change in the Mix of Direct and Indirect Taxation on the Australian Economy." IMPACT *General Paper* No. G-53, Melbourne, May.

_____ (1985). "Notes on the Design and Application of ORANI-NAGA: A Model for Analyzing the Effects of Changes in Government Policy on the National and Government Accounts." Presented to the Workshop on Macro-Econometric Models, Fourteenth Conference of Economists, UNSW, Sydney, 17 May.

Australia is the world's largest exporter of hardwood woodchips. The local industry is composed of about ten firms, located in several States. The material is used to make paper products in Japan and other North-East Asian countries. Australia does not (yet) export woodchips from pine plantations. The sector is included in the Sawmill Products industry in the ORANI database [see ABS (1983)].

The Veneers and Manufactured Wood Boards industry comprises a number of distinct activities, including particleboard, plywood and veneer, hardboard and medium density fibreboard (MDF). There are about five plants making particleboard, over 20 making plywood and one each for hardboard and MDF. Tariffs applying to the group have been high relative to other wood products, but are currently being phased down: from 40 to 25 per cent for plywood and from 30 to 20 per cent for particleboard [Newman (1982)]. Import quotas which applied to plywood have also been abolished [IAC (1981), Newman (1982) and Parsons, Wallace and Bruce (1982)]. The overall nominal protection rate for the industry in the ORANI database is 19.8 per cent.

National Parks Journal 23(1):12-14.

Higgs, P.J., D. Parham and B.R. Parmenter (1981). "Occupational Wage Relativities and Labour-Labour Substitution in the Australian Economy: Applications of the ORANI Model." IMPACT Preliminary Working Paper No. OP-30, 45pp.

Higgs, P.J. and B.R. Parmenter (1982). "How to Compute a Johansen-Style Solution with the Melbourne Version of ORANI 78," IMPACT Computing Document No. C3-02, mimeo, 74pp., August, Melbourne.

Hourigan, M.A. (1980). "Estimation of an Australian Capital Stock Matrix for the IMPACT Project." IMPACT Working Paper No. I-11, 212pp.

IAC (Industries Assistance Commission)(1978). Timber and Timber Products and Plywood and Veneer. Report No. 168, 12 May, AGPS, Canberra.

—— (1981). Wood and Articles of Wood. Report No. 275, 17 August, AGPS, Canberra.

—— (1983). The Dairy Industry. Report No. 333, 23 November, AGPS, Canberra.

—— (1984). Heavy Commercial Vehicles, Parts and Accessories. Report No. 343, 29 February, AGPS, Canberra.

Lawson, T. (1985). A 1977-78 Capital StockS Matrix for the ORANI Models,"

3 NORMATIVE ECONOMIC CONSIDERATIONS

"Forestry has traditionally been a government-sponsored enterprise because of the long investment period, high risks and low rates of return. With radiata pine and other fast-growing softwoods under intensive management this is no longer true, and returns to rival other investments can be obtained. The question then arises as to the degree to which an enterprise which is profitable in its own right should be underwritten by government. This is a question of political philosophy..." [Pederick (1981)].

3.1 The Theoretical Basis for State Forestry

In a predominantly free-enterprise economy, the rationale for public involvement in forestry is rooted in the realisation that the social costs and benefits associated with public forestry differ significantly - and favourably - from the private, or market-priced, costs and benefits [Clawson (1977), p. 218]. This observation may be cast in any or all of three forms:

(a) The social discount rate is less than the private rate, so lower harvesting rates are desirable. This is the case for altruism/ resource conservation;

Dixon, P.B., A.A. Powell and B.R. Parmenter (1979). Structural Adaptation in an Ailing Macroeconomy. Melbourne University Press.

Doran, H.E. and D.F. Williams (1982). "The Demand for Domestically Produced Sawn Timber: An Application of the Diewert Cost Function," Australian Journal of Agricultural Economics 26(2):131-150.

Ferguson, I.S. (1982). "Selling Wood from State-Owned Forests," Australian Forestry 45(4):245-254.

Ferguson, I.S. and E.D. Parkes (1974). "Future Forest Policy: An Analytical View," Paper presented to the 7th Triennial Conference of the Institute of Foresters of Australia, Caloundra.

Forestry and Timber Bureau (1976). Annual Report 1974-75. AGPS, Canberra (and previous issues).

Forestry Department of Western Australia (1984). Annual Report 1984. Government Printer, Perth.

Gentle, S.W. (1985). Statements made at the National Agricultural Outlook Conference, Canberra.

Greig, P.J. (1984). "Contributions of Economics to Forestry Planning," Australian Forestry 47(1):16-27.

Hammond, R. (1979). "NSW Forestry Commission - An Uneconomic Concern," The

(b) The social benefits include and exceed the private benefits due to the existence of benefits which are unpriced, such as wilderness, wildlife and soil conservation, due to poor market development;

(c) The social costs include and exceed the private costs, e.g., due to environmentally damaging forest harvesting operations in municipal water catchments.

As an economic argument, (a) may be successfully challenged on the premise that it is essentially an equity consideration between consumption now or later, whereas (b) and (c) are efficiency considerations and are therefore more robust.

The proposition that "forestry is a long term venture and therefore the government must plant for its future citizens" is easily refuted by the extent of private forest management in older western countries where most of the land is freehold, e.g., Scandinavia [see also Walsh (1970), especially p. 8]. As another example, wine production was traditionally a very long term enterprise, yet it has been exclusively in the private sector in most mixed economies.

The need for public management of most of the remaining areas of native forest where significant non-market goals exist is not at issue here (although the question of ownership of such forests is highly debatable). From the private sector viewpoint, there is a cost imposed by public management of these forests. From the social aspect these costs may be

more than outweighed by the provision of non-wood outputs which would not have been produced otherwise, and a similar reduction in social costs. Whilst non-market social benefits and costs can be extraordinarily difficult to measure, they do exist and they may be substantial. Under these circumstances it is wise to retain flexibility for the future, which can probably be best achieved with public management.

Plantations of exotic species grown expressly for wood production are a very different matter. The economics of such forests remain largely unaffected by non-market considerations and there seems to be no real justification for them to be a public enterprise either in contemporary Australia or in the likely future of the nation.

3.2 An Historical Accident?

Twenty years ago an Australian forest economist wrote that "the inability or unwillingness of private forest owners to provide for continuity of the supply has been amply demonstrated in modern history" [Leslie (1965), p. 48]. Whilst Leslie and others have written at length about the "calamitous" effects of private forestry, very little serious attention has been given to the causes of the problem.'

It is contended here that the main underlying cause for public involvement in large-scale pine plantation growing was the practice of the forest services of selling native forest logs, which were relatively close substitutes for pine logs, well below their opportunity cost. Given their

CBCS (Commonwealth Bureau of Census and Statistics) (1952). Labour Report 1950, Commonwealth Government Printer, Canberra.

Clawson, M. (1974). "Conflicts, Strategies and Possibilities for Consensus in Forest Land Use and Management." In Forest Policy for the Future. Resources for the Future Working Paper LW-1, The Johns Hopkins University Press, Washington, D.C.

_____ (1977). "The Role of Public and Private Forestry Sectors." In Clawson, M. (ed.), Research in Forest Economics and Forest Policy. Resources for the Future Research Paper R-3, Washington D.C.

Clements, K.W. and M.D. Smith (1983). "Extending the Consumption Side of the ORANI Model," IMPACT Preliminary Working Paper No. OP-38, Melbourne, February.

Dargavel, J. (1980). "Opportunities for Investment in Plantations in Tasmania 1. Opportunities for Whom? Australian Forestry 44(2):80-87.

Department of Primary Industry (1983). Australian Forest Resources 1982. AGPS, Canberra (and previous issues).

Dixon, P.B., B.R. Parmenter, J. Sutton and D.P. Vincent (1982). ORANI: A Multisectoral Model of the Australian Economy. Contributions to Economic Analysis No. 142, North-Holland Publishing Co., Amsterdam.

Bruce, I.A., J.M. Sutton and M. Da Cruz (1984). "ORANI 78 Large Change Aggregation Facility: Computing Manual," IMPACT Research Memorandum, Computer System, No. CA-72, August.

Byron, R.N. (1979). An Economic Assessment of the Export Potential of Australian Forest Products. BAE Industry Economics Monograph No. 20, AGPS, Canberra.

_____ (1980). "Trans-Tasman Trade in Forest Products - Past and Future," Australian Forestry 43(3):195-202.

_____ (1981). "Forecasting and Forestry Planning," Australian Forestry 44: 247-259.

Byron, R.N. and J.J. Douglas (1981). Log Pricing in Australia: Policies, Practices and Consequences. BFE Press, Canberra, 98pp.

Carron, L.T. (1979). "Forestry in the Australian Environment - The Background," Australian Forestry 42(2):63-73.

_____ (1980). "Self-sufficiency in Forest Policy in Australia," Australian Forestry 43(3):203-209.

_____ (1985). "Golden Jubilee of the Institute of Foresters of Australia," Australian Forestry 48(1):7-33.

legislative mandate to provide wood for the people of the State (usually "at low cost"), the forest services extended the range of their activities into pine afforestation when it became clear that the private sector was not about to do so to a "sufficient" extent. That the prevailing royalty (log pricing) structure precluded much private plantation forestry, especially nonindustrial private forestry, was either not perceived or deliberately ignored — either because of despair at the low probability of Ministers allowing real royalty increases or because of empire building by the forestry bureaucrats. The forest services have been price leaders for logs in each State for many decades. Due to the interaction of the relatively concentrated log buyers with the Ministers in charge, logs have tended to be sold for nominal amounts. No amount of dissension by professional foresters in the forest services has been able to overcome this relationship for any substantial period, although some recent trends are encouraging.

Other causes undeniably existed, although none may persist to the present. The proliferation and subsequent collapse of many plantation investment companies in Australia and elsewhere in the 1920s cannot be wholly attributed to inadequate output prices. In many cases the plantations were poorly planned and managed (if indeed they existed elsewhere than on paper!). Even had the best existing silviculture been applied, the prevailing level of silvicultural technology was considerably inferior to that which now exists. Today, the combined existences of a large, well trained and organised forestry profession with its own code of ethics [Carron (1985)], an association of private consulting foresters with a credible code for business conduct, and a private growers' organisation

with a code of practice for investment forestry companies [Australian Forest Development Institute, (n.d.)], severely curtail the possibility of further bankruptcy in the private plantation sector for reasons of unprofessional management. The domination of exotic plantation forestry by the forest services can therefore be attributed to the unintended effects on log markets of the establishment, and later activities, of these government institutions.

3.3 Motivations for Change

The writer has no dispute with Australia's need for exotic coniferous plantations [Bruce (1979)]. The issue is whether the government sector ought to employ taxpayers' funds to grow and manage such forests in the 1980s and beyond.

Providing wood at low price to the people of a State is a different concept than selling logs below cost to the processors, who then sell their products at a price competitive with that of landed imports of substitute forest products after tariff duty is paid. The forest services do not appear to see it that way, and indeed have behaved as if they could not care less about the final consumers of forest products as, for instance, when the forest services have asked for additional protection for wood-using industries in submissions to the Industries Assistance Commission [see, for examples, IAC (1978), pp. 88-132, and IAC (1981), pp. 84-95].

—— (1984). Australian Forest Resources 1983. AGPS, Canberra.

Bonnell, S.M. (1984). "An Examination of Some Aspects of Changes in Labour Cost and Employment in Australia: 1961-1981" PhD Thesis, School of Economics, La Trobe University, March.

Bruce, I.A. (1979). "Do We Need Exotic Pine Plantations in Australia?" ANU Scientist 3(2):3-6.

—— (1980). "Making Projections of Wood Supply from Australian Forests," Australian Forestry 44(2):102-108.

—— (1985a). "Some Notes on the Treatment of Forestry and Logging in the Australian Economy," IMPACT Research Memorandum No. OA-270, ORANI Model, September.

—— (1985b). "The ORANI 78 Input-Output and Parameter Files for 1977-78," IMPACT Preliminary Working Paper No. OP-51, Melbourne, February.

—— (1985c). "The Sensitivity of ORANI 78 Projections to the Database Used," IMPACT Preliminary Working Paper No. OP-53, Melbourne, August.

Bruce, I. and J. Sutton (1984). "Disaggregation of Commodities and Industries in ORANI 78," IMPACT Research Memorandum, ORANI Module, No.

REFERENCES

ABS (Australian Bureau of Statistics)(1979). Yearbook Australia 1979, Cat. No. 1301.0, Canberra.

_____(1983). Australian National Accounts, Input-Output Tables 1977-78, Cat. No. 5209.0, AGPS, Canberra.

_____(1984a). Australian National Accounts, Input-Output Tables, Commodity Details 1978-79, Cat. No. 5215.0, Canberra.

_____(1984b). Australian National Accounts, National Income and Expenditure 1982-83, Cat. No. 5204.0, Canberra.

Albon, R.P. (1985). "Should Public Monopolies Remain Public and/or Monopolistic?" Paper presented to the 14th Conference of Economists, University of New South Wales, May.

Australian Forest Development Institute (n.d.). "Code of Practice for Afforestation Investment Companies." 4pp.

Australian Forestry Council (1975). FORWOOD: Report of the Forestry and Wood-based Industries Development Conference. Australian Government Publishing Service (AGPS), Canberra.

BAE (Bureau of Agricultural Economics) (1977). The Australian Softwood Products Industry. AGPS, Canberra.

An important consequence of low log prices has been the very limited role which Australian farmers have played in growing trees for financial gain. In Australia in recent years there has been considerably heightened awareness of the value of trees on farms for shade, shelter, salinity control and the like, but not as a viable crop. The economic distortion to relative prices imposed by administered log royalties, and limited export possibilities, has resulted in a considerably lower level of tree cover in much of rural Australia compared to what would have otherwise have been the case. Due mainly to increases in soil salinity and soil erosion, there are substantial social costs imposed on Australia by the irrational production decisions of farmers who choose not to plant trees on the basis of inadequate log prices. State Governments have responded to calls for increased private rural tree plantings with a variety of afforestation loans and grants [see Treadwell (1982), pp. 8-9]. It is argued that these schemes are very poor second-best approaches when compared with the achievable policy goal of freeing up log markets.

The thrust of desirable change in any realm of economic activity ought to emphasize, or at least include, increases in economic efficiency.

In the production and exchange of goods and services where non-market considerations are insignificant, practical experience reveals that private ownership and management with intense interfirm competition is the most effective form of organisation. Advocates of desirable changes in the Australian forest economy in recent years have tended to take the public institutions which dominate it as exogenous and have made suggestions for more appropriate pricing and distribution methods [Byron and Douglas (1981), Dargavel (1980), Ferguson (1982)]. However, whilst such work is

2. Even in 1976-77, 90 per cent of the Australian land surface of 76.8 Ga, (excluding external territories), was publicly owned, although 64 per cent of that (44.4 Ga) was leased, licenced or in the process of alienation to the private sector [ABS (1979), p. 267]. Note that one Ga is equal in area to 100 000 square kilometres.

3. A nonindustrial private forest is defined to be a forest which is privately owned by an individual who does not also process roundwood [after Clawson (1974)]. Less than three per cent of Australian pine plantations fall into this category [see Sebire (1979)].

4. These costs are imputed at the set of log prices which are, after the initial fall in prices, expected to pertain in the long run.

5. In fairness to Leslie, it must be emphasised that the present paper abstracts from the general case, which he considered, in that concern has been restricted to forests from which non-wood outputs are of negligible importance. Whilst focussing on the joint production aspects of forests, Leslie noted that "the objectives and economics of State forestry in the production of wood should therefore be analysed in the same way as in any private industry" [Leslie (1965), p. 521].

6. Note that the Land input shown in Figure 4.1 would be changed to an effective input of land, with a CRESH nest similar to that shown for labour, as a consequence of implementing the proposal in this Section.

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useful, it addresses symptoms, not causes, of economic malaise.

Apart from the cost of making the change itself, there seems to be no valid reason why exotic plantation forestry should continue to be practised by governments in Australia. That is, the conclusion reached by Albon (1985), that there is no strong argument for continuation of public ownership of public monopolies, applies here. This is not a new concept to the forestry profession. Indeed, an officer of the Forests Commission Victoria has written that forest ownership is now "an important planning issue" [Greig (1984), p. 21]. Ferguson [(1982), pp. 247-248] has noted the case for privatisation and the way in which it reduces to consideration of forests where non-wood outputs are of negligible importance. In the absence of other distortions, the desirable market structure is for several private forestry plantations within a given region, to the exclusion of monopolists or large oligopolists. However, the vertically integrated nature of much of the existing private forestry and forest-based industries may be sufficient to render such an alternative market structure undesirable. Further, the expected pattern of import protection for wood products may also loom large in determining the appropriate shape of the new plantation ownership. Such considerations are outside the scope of the project as presently proposed.

Removal of the public sector from the production of exotic timber species would require legislative and policy changes in several State forestry acts and regulations, e.g., in Queensland, softwood production is placed in the hands of the State and any private production is just incidental. The most obvious change is to stop new public planting, but

FOOTNOTES

* A draft version of this paper was presented to meetings of the University of Melbourne's Graduate Economic Seminar and Workshop in Computable General Equilibrium Modelling in October 1985. The present version has benefitted from the constructive comments of the participants at these fora, particularly Professor Ian Ferguson, Mr David Johnson and Professor J.O.N. Perkins. I am especially grateful to Professor Alan Powell for his support for this paper and his helpful comments at all stages of its development. Messrs Tony Lawson, Mike Kenderes and Philip Adams made useful suggestions on the final draft. Marie Silic gave assistance with word processing. Remaining errors are all my own.

1. Public enterprises accounted for 9.9 per cent of Gross Domestic Product at Factor Cost (GDPAFC) in 1980-81 [ABS (1984b)]. However, the national accounts do not recognise the presence of public enterprises in the "Agriculture, Forestry, Fishing and Hunting" sector, so that this figure is probably an underestimate. Given the accounting definition of zero returns to capital in the public sector, an upper bound on the value of market activities in which governments are involved may be set by including the wages, salaries and supplements of general government. Public enterprises plus general government accounted for 25.3 per cent of Australian GDPAFC in 1980-81. The Forestry and Logging sector, as measured, accounted for 0.2 per cent of GDPAFC in 1977-78 [ABS (1983)].

this still leaves nearly half a million hectares of existing public plantations with which some action is necessary. The action in each State may well be different because of differing State policies and obligations.

For example, in South Australia, the only course may be to sell the existing plantations to the existing industry, although there is considerable scope for decision in the way in which this would be done. In general, however, the well advertised sale of plantations to the highest bidders with sealed bid auctions together with some reasonable limit on the area which any individual or organisation could buy, would seem appropriate. The remaining question of what should become of the land underneath the trees may best be left to specific cases although, given the rent and rate-free nature which those lands have had to the present, their continued dedication to wood production may preserve the location of forestry centres in a way which misallocates resources if a more open system would lead to alternative placements [see also Muench (1966)].

industries. These are not likely to be obtainable by direct empirical methods due to severe data constraints, so that plausible guesses will be made using indirect or overseas empirical evidence where possible.

5.2 Software Limitations

In its present form the ORANI model is implemented in computer code which, although it is reliable, is not very user friendly. It is certainly not readily amenable to the insertion of changes to equations as proposed in Section 4.2. This problem has been recognised by the management of the IMPACT Project and moves are afoot to remedy the situation [Powell (1985), pp. 29-33]. The expected time lag before a more friendly code is to hand suggests that the project proposed here be undertaken after 1986.

4 INITIAL IDEAS FOR QUANTIFYING THE EFFECTS OF "PRIVATISATION" OF THE AUSTRALIAN EXOTIC SOFTWOOD PLANTATION INDUSTRY

4.1 Basic Approach

It is one thing to develop a cohesive argument as to why the government ought not to be involved in a particular activity. It is quite a different matter to take account of actual institutional and market arrangements and assess the effects of withdrawing government involvement. Such an analysis may be intrinsically impossible with the use of simple partial equilibrium models, so that a general equilibrium approach is warranted. Further, to minimise disputation over the likely importance of key variables, a quantitative model is to be preferred to a qualitative one.

The only existing Australian economic model which fulfills both the above criteria is the ORANI computable general equilibrium model, which is described in Dixon et al. (1982). Suitably adapted, ORANI is the best existing technology with which to undertake the proposed analysis. This is not to say that ORANI, in its present form, is the best conceivable technology: its comparative statics approach does not address dynamic issues, and its assumptions of constant returns to scale and perfect competition in production make it less than ideal, as does its rather primitive investment theory. Nevertheless, the current version of ORANI will remain attractive until either some better model is invented or new versions of ORANI, which overcome these fundamental problems, are

subsidy on PPF outputs and the designation of PPF as a land using industry (see Table A1.4).

As noted in Section 4.1, the Gross Operating Surplus (GOS) of the Forestry and Logging Industry has been underestimated in the ABS IO tables because public enterprises are defined to have zero GOS. It will therefore be necessary to estimate the implicit returns to capital of the public forestry industries and to insert them into the disaggregated database.

Within each industry, these estimated returns will have to be split between the fixed capital and land categories for the reason given in Section 4.3. The subsidies on the outputs of the public forestry industries would then be set equal to the returns on their assets plus the amount by which the value of sales falls short of all other current expenses.

For all the new industries shown in Figure A1.1 it will be necessary to obtain information on the commodity composition of capital stocks. At the same time a much overdue appraisal of the relevant parts of the IMPACT capital coefficients matrix can be made.

The nature of the proposed study is such that most of the parameters which must be specified for the disaggregated sectors can be default (parent) values. These include the expenditure elasticities, the Armington (import substitution) elasticities, the import protection rates and the export demand elasticities. Investment parameters will be needed for the new industries for which the ORANI rate-of-return theory will be permitted to explain investment: Logging and Private Forestry. CES and CRETH parameters will also be needed for some of the new commodities and

commissioned. Current work at the IMPACT Project is aimed at improving ORANI in several important respects [see Powell (1985), pp. 26-28 and Wilcoxen (1985)].

The nature of suitable adaptations to the current version of ORANI is the major technical difficulty perceived at the time of writing. Four paths might be considered, each of which has its drawbacks.

Firstly, ORANI could be run in its standard form with a standard database. This is the first option which confronts the would-be user of ORANI in any situation, and one needs to have sound reasons for rejecting it. In the present case, the industry/commodity structure is too aggregated because all forestry components are lumped in together along with the logging industry [Bruce (1985b)]. The act of selling the plantations to the private sector would only be manifest in the model as a removal of part of the net commodity subsidies on sales of Forestry and Logging. Whilst the cost consequences for downstream buyers of the Forestry and Logging commodity group would be reasonably projected by such an experiment, there would be no distinguishable details of the micro level effects on the various components of the forestry sector or on the logging industry. For this reason, a necessary part of the final model will include a disaggregated Forestry and Logging sector, and the remaining options each presume this. The proposed structure is developed in Appendix 1. At this stage we may also note that ORANI proper has no mechanism for showing the effects of the tax relief engendered by the cessation of subvention; this deficiency, however, is overcome in recent work by Meagher (1984, 1985) on the fiscal elaboration of ORANI.

Table 5.1: THE ABS DISAGGREGATION OF THE FORESTRY AND LOGGING SECTOR

ASIC Class	IOCC Item	Description
0303		**Logging**
	005	Hardwoods, brushwoods, scrubwoods etc
	010	Softwoods - conifers
	015	Hewn and other timber
	020	Firewood
0304		**Forestry and Services to Forestry**
	005	Tanning barks, oils, resins and gums
	010	Other forest products
	015	Forestry and services to forestry
	995	Re-exports

<u>Sources:</u> ABS (1984a, personal communication 1985).

The ABS input-output information to hand provides no basis for the further splits of ASIC 0304 to form the three forestry sectors shown in Figure A1.1. The only way to proceed is to use other sources, such as Department of Primary Industry (1983), and to impose plausible assumptions. In particular, it is proposed to place IOCC 0304005 and 0304010 into the Public Native Forestry (PNF) sector, and to split 0304015 into the Public Native Forestry (PNF) sector. The ABS data reveal 0304995, Re-exports, to be negligible.

Whilst the silvicultural technology available to both the Private Forestry (PF) and Public Pine Forestry (PPF) industries are virtually identical, it will be necessary to accommodate the cost consequences of past plantation location decisions by the PPF industry, noted in Section 2.1, in the database. It is proposed to achieve this by imposing a higher unit road transport margin on PF output than on PF output. Other simulations will include the differences in the cost structures of the two industries will include the

The second strategem is to run the standard ORANI software with the disaggregated database. It would certainly be feasible to do this from the programming angle. The ORANI facility which enables the exclusion of selected industries' investments from being explained by a rate-of-return mechanism would be used for the public forestry sector and, where feasible, the current output of the sector would be separated from being price-determined by setting it exogenously. The problem with this approach is that intermediate inputs which are in fact close substitutes, hardwood and softwood trees, would be modelled as being combined in fixed proportions.

Thirdly, the ORANI equations could be modified and/or augmented. One direction in which it might be thought that this strategem could be followed could be to model public enterprise behaviour more realistically. That is, a non-competitive computable general equilibrium model would be used in which explicit, non-cost-minimising behaviour, is attributed to government enterprises. The author does not have firm ideas on how to build such a model, and is unaware of any computable general equilibrium models which may have been built along these lines.

More achievable goals within the ambit of this third strategem would be: to allow substitution possibilities between forestry commodities sold to intermediate users; to introduce into the model subsidies on industry outputs for the public forestry sector; and, in long run simulations, to model competition for land between private forestry and some agricultural industries. It is planned to have both public and

5 PROBLEMS AND PROSPECTS

5.1 Data Problems

The ABS has supplied data which will enable most of the splits between the Logging (ASIC 0303) and the Forestry and Services to Forestry (ASIC 0304) sectors - see Figure A1.1 - to be made [ABS (1985), personal communication]. This information is presented according to the Input-Output Commodity Classification (IOCC), as shown in Table 5.1. An initial appraisal of this material indicates much the expected pattern except for a basic value flow of $7 769 000 in 1977-78 from forestry and services to forestry (IOCC 0304015) to the Meat Cattle Industry (IO 01.03). That flow seems anomalous when compared with the reported basic value sale of $4 839 000 from forestry and services to forestry to the Forestry and Logging industry (IO 03.00), which is taken to represent total Australian log sales on stump at basic values. The anomaly persists in the 1978-79 data. It has been indicated that, for 1978-79, a more reasonable flow to the Meat Cattle industry would be $1 million [ABS (1985), personal communication].

private "industries" producing the same commodities. Consequently, it will be necessary to model the subsidy on public log sales as an industry subsidy, rather than via the standard ORANI method which only recognises commodity subsidies. The role of these industry subsidies would be to eliminate the erroneous impression of a near-zero capital intensity. This could arise in an ORANI database because capital intensity is measured, ultimately, by the relative sizes of the gross operating surplus (GOS) and the value added attributed to the industry in the input-output accounts. A convention used in preparing the national accounts is not to include any notional GOS in the value added of public enterprises. The incorporation of an explicit subsidy, just matching such a notional GOS, would correct the specification error.

Whilst there have been no ORANI studies which have modified the supply side of the model by allowing a richer set of substitution possibilities among intermediate inputs, the household demand specification has been extended in the ORANI-WINE and ORANI-MILK models to allow for non-zero cross-price elasticities between substitutes in consumption [Clements and Smith (1983), IAC (1983), Sutton, Vincent and Zeitsch (1984)]. It must be emphasised that the problem of implementing supply side substitution possibilities for material inputs is different in substance to, and rather more difficult than, that faced by those who extended the demand specification. However, the materials substitution problem in ORANI is the subject of current work at the University of New South Wales [Truong, Chapman and Gallagher (1985)]. Some ideas on the required substitution possibilities for the forestry study are given in Section 4.2. Good reasons exist for postponing the computer implementation

proposed to model the demand for land similarly to the way in which industries demand labour in ORANI: with CRESH technology subject to constraints on the total available quantity of the primary factor in question. Consequently, there will be several land categories, each of which could conceptually be used by all 10 industries. Some land types would in fact be only used by one industry, and others by more than one. The proposed structure is shown in Table 4.1⁶.

4.2 The Proposed Change to the ORANI Input Demand Theory

As noted in Section 4.1, it is proposed to modify the ORANI input demand theory of Dixon et al. [(1982), pp. 76-90] to allow non-Leontief substitution possibilities between forestry inputs to current production. The idea is portrayed in Figure 4.1, which has been adapted from Higgs, Parham and Parmenter (1981). The figure shows that the only departure from the standard ORANI technology is the way in which an effective unit of forestry input is obtained. A CES function is used to combine Hardwood and Pine trees. A nested CES function is used in the usual ORANI way to combine domestic and imported "Hardwood Trees" (actually, minor forest products, notably eucalyptus oils). There are no imports of "Pine Trees" as such. While 39 commodities will be produced domestically in the model, it is clear from Figure 4.1 that each industry will, in general, use 38 composite commodities as inputs to current production.

4.3 Inter Industry Competition for Land in the Long Run

Table A1.4 shows that a total of 10 industries will use the land primary factor in the proposed database. Of these, the seven agricultural industries are modelled as being land users in the standard ORANI database. Since the remaining three, the forestry industries, all employ land as an essential productive input in reality, it seems wise to have them doing so here. However, there is an important distinction to be drawn between the lands used by the public forestry industries and by PF: the former comprise assets which are precluded by law from being shifted to other industries [see Bruce (1985a)], whereas private forest lands are more or less free to be used for other purposes.

The standard ORANI theory assumes equality between the demand for, and supply of, land in each industry. That is, land is nonshiftable between industries [Dixon et al. 1982, p. 124]. This practice works well with the agricultural industries, when the standard database is used, since they are mainly defined on a regional basis and each has some flexibility in commodity output choices. In standard ORANI simulations it is customary to model the quantity of land used by each industry as being fixed, even in (so called) long run simulations.

However, the database structure proposed for this study recognises the existence of an industry, Private Forestry, which would in reality compete for land with the Wheat-sheep Zone, High Rainfall Zone and both Other Farming industries. Such competition would occur in the long run within the ORANI paradigm. In order to model this competition, it is
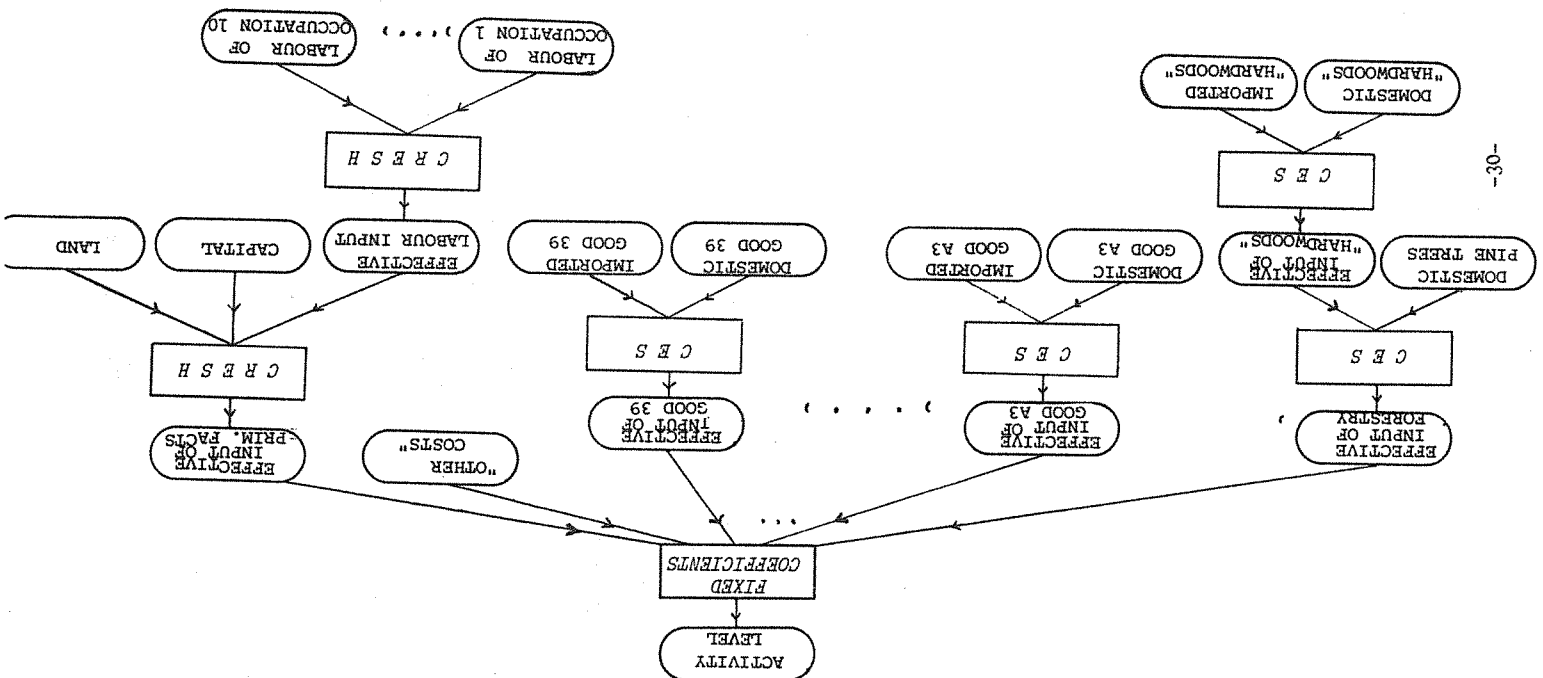
Figure 4.1 : INPUT TECHNOLOGY IN THE MODIFIED ORANI THEORY