Regional Income and Employment Impacts of Farming and Forestry in the Mackenzie/Waitaki Basin

G V Butcher

March 1997

Research Report No.235

Agribusiness and Economics Research Unit
PO Box 84
Lincoln University
Canterbury
New Zealand

Ph:(64)(3) 325-2811
Fax: (64)(3) 325-3847

ISSN 1170-7682
ISBN 0-909042-11-X

Contents

List of Tables

Preface

The AERU has played an important role in a large-scale, multi-disciplinary study of the effects of proposed land use change in the Mackenzie/Waitaki District. An earlier Research Report (No.224) documented preferences for land use options as indicated by a variety of stakeholders, and AERU personnel with others at Lincoln University have published other results elsewhere (Fairweather & Swaffield (1995), Fairweather & Swaffield (1996) and Swaffield and Fairweather (1996)). In this report the contribution of Geoff Butcher, a member of the research team, is reported by way of an input-output analysis of the regional impacts of forestry development. This report will be of value to regional planners and those concerned with the economic effects of land use change. It also serves as an example of regional economic analysis.

Tony Zwart
DIRECTOR

Acknowledgements

Funding for this study was provided by the Government via the Foundation for Research, Science and Technology. I am very grateful to various forestry contractors and Mackenzie Basin farmers for their generosity in making available their time and financial records, and to other members of the multi-disciplinary team for educating me in their areas of expertise sufficiently for me to avoid some of the grosser errors. I would also like to thank Agribusiness and Economics Research Unit for publishing this paper, and particularly Dr John Fairweather for his encouragement and editorial work.

Summary

1. Forestry is likely to expand in the Mackenzie/Waitaki Basin (hereinafter called the Basin), and such a change will have an effect on regional employment. To try and assess the magnitude of this impact, regional economic models were developed using a national economic model as a starting point and then using data on the regional distribution of output and employment to develop approximate regional models. Models were developed for the Basin, the combined Waitaki and Mackenzie districts, and the combined Otago and Canterbury regions. These geographical and administrative boundaries were chosen so that the results would be relevant to the needs of policy makers.

2. The accuracy of the regional models was improved by a survey of farmers in the Basin and by using data from a study of forestry sub-industry inputs in the Gisborne region and a limited survey of forestry operators in South Canterbury. The objective of these surveys was to more accurately identify the industries' inputs and where inputs came from.

3. Farmers were also asked to comment on the impacts on agricultural production of the forestry developments they would like to pursue on their farms. Their comments suggest that in many cases impacts would be small because the land they would prefer to plant in trees currently has a very low carrying capacity. Further work on this aspect was done by Landcare New Zealand and is reported briefly in Hock et al., (in preparation).

4. It is estimated that sheep farming in the Basin generates 1 Full Time Equivalent job (FTE) directly for every 3,020 Stock Units. The additional impacts of farm spending and purchases of inputs make the total impact 1.16 FTEs in the Basin; 1.75 FTEs in the combined Mackenzie/Waitaki districts and 2.89 FTEs in the combined Canterbury/Otago regions. The total impact is likely to be up to 20 % higher than this over the long term because product prices (and hence farm income and expenditure) were at less than long-term-average levels over the period surveyed.

Table S.1
Total Employment Impacts of Sheep Farming in the Basin
(FTEs Per 000 SU)

	Mackenzie Basin	**Mackenzie/Waitaki District**	**Canterbury/Otago Region**
Total	0.4	0.6	1.0

5. Forestry potentially generates an estimated 5.2 FTEs directly for every 1,000 Ha managed as a normal forest with a 45 year rotation, (i.e. a rotation where 22.2 Ha are being harvested annually). However, probably not all of this employment will occur in the Basin since it is probable that planting and pruning/thinning gangs will come into the Basin for short periods on contract. It is, of course, quite possible that existing residents will do much of this work. Logging is more labour intensive than silviculture, and a five man gang would be employed full time on an annual cut of about 57 Ha. Transport operators are likely to continue to be based outside the Basin unless there is a significant wood processing facility inside the Basin. Nurseries and forest management are likely to be based outside the Basin. Total employment impacts of forestry are shown below. Although potential direct employment in the Basin is 5.2 FTEs per 000 Ha in rotation, it seems likely that closer to 3.2 FTEs will actually reside in the Basin. This direct employment will lead to further indirect employment, and total Basin employment is likely to be 3.9 FTEs per 000 Ha in rotation.

Table S.2
Potential Employment Impacts of Forestry in the Basin
(FTEs per 000 Ha in rotation)

	Mackenzie/Waitaki Basin		Mackenzie/Waitaki District	Canterbury/ Otago Region
	Potential	Likely (estimate)		
Nursery				
Direct	0.20	0.00	0.20	0.20
Indirect	0.01	0.00	0.03	0.06
Total	0.23	0.00	0.23	0.26
Planting & Silviculture				
Direct	0.58	0.29	0.58	0.58
Indirect	0.03	0.02	0.08	0.18
Total	0.61	0.31	0.66	0.76
Logging				
Direct	2.00	2.00	2.00	2.00
Indirect	0.18	0.18	0.46	1.08
Total	2.18	2.18	2.46	3.08
Freight				
Direct	1.60	0.80	1.60	1.60
Indirect	0.34	0.17	0.78	1.50
Total	1.94	0.97	2.38	3.10
Preparation & Roading				
Direct	0.10	0.10	0.10	0.10
Indirect	0.02	0.02	0.05	0.10
Total	0.12	0.12	0.15	0.20
Management				
Direct	0.72	0.00	0.72	0.72
Indirect	0.21	0.00	0.39	0.84
Total	0.93	0.00	1.11	1.56
Royalty				
Direct	0.00	0.00	0.00	0.00
Indirect	0.30	0.30	0.67	1.56
Total	0.30	0.30	0.67	1.56
TOTAL				
Direct	5.2	3.2	5.2	5.2
Indirect	1.1	0.7	2.5	5.3
Total	**6.3**	**3.9**	**7.7**	**10.5**

6. Forestry is likely to lead to establishment of wood processing in the Basin. The degree of processing is impossible to predict accurately, but varying forestry scenarios (corresponding to a forestry estate of 10,000 - 72,000 Ha) have been developed by FRI, and associated processing scenarios have also been developed. The employment and income associated with these processing scenarios have been estimated on the basis of data from similar processing plants in other regions.

Table S.3
Potential Employment and Income Impacts in the Basin of Processing Industry Impacts Under Four Scenarios

	Sawmills	MDF Mills	Treatment Plants	Total
Total Employment (FTEs)				
Scenario A	230	450	39	719
Scenario B	28	0	20	48
Scenarios D & E	53	0	20	53
Total Gross Household Income ($m)				
Scenario A	6.2	15.2	2.2	23.6
Scenario B	0.8	0.0	1.1	1.9
Scenarios D & E	1.4	0.0	1.1	2.5

Note: *Scenario A:* *Forestry Estate is 72,000 Ha*
Scenario B: *Forestry Estate is 10,000 Ha*
Scenarios D & E: *Forestry Estate is 15,000 Ha*

7. Since forestry (excluding processing) is likely to eventually generate perhaps 3.9 jobs in the Basin per 000 Ha in forestry and farming generates 0.4 jobs per 000 Stock Units (SU), then as long as forestry displaces less than 10 SU per Ha, employment will eventually be higher under forestry than under farming.

8. Most of this employment is generated once logging begins in year 45. Prior to this, forestry generates only 0.31 jobs per 000 Ha in rotation, so if forestry displaces more than 0.8 SU / Ha, then in the medium term forestry will lead to a reduction in employment. NZFRI (1997) examines in greater detail the level of employment over time.

INTRODUCTION

Context

The research results presented in this report are part of a multi-disciplinary study which aimed to identify the way in which the impacts (biological, ecological, economic and social) of proposed changes in land use can be identified and evaluated. The overall study involved researchers from the New Zealand Forest Research Institute (NZFRI), Lincoln University, Landcare Research and Butcher Partners. This research report documents the likely economic impacts (on regional income and employment) of a change in Mackenzie Basin land use from farming to forestry. The results are generally reported here on a "per 000 Ha" or "per 000 SU" basis, while other work combined these results with scenarios of total land use changes to generate total regional economic impacts for particular development scenarios. A full account of the whole programme of research will be published in the near future in Hock et al., (in preparation).

Information on likely total effects (visual, social and economic) of the various scenarios were conveyed to stakeholders to ascertain their reactions (Fairweather and Swaffield, 1994), and to establish the acceptability of the various scenarios (Fairweather and Swaffield, 1996). The results of the research are expected to be of value to the territorial local authority in carrying out their responsibilities under the Resource Management Act.

Geographical Framework and Overview of the Report

The Mackenzie/Waitaki Basin study area (hereinafter called the Basin) has been chosen as an appropriate geographical region to study. While the Basin is an obvious geographical identity, it also has very strong links with service centres on the periphery (e.g. the town of Fairlie) which are not within the study area but are within the administrative district. Moreover, forestry is likely to have strong impacts on the port of Timaru, which is outside the district but within the administrative region.

Economic analysis needs to be appropriate in terms of the use to which such analysis can be expected to be put. Primary users of such information are likely to be planners and the various bodies charged with making decisions under the Resource Management Act. For this reason it was decided to undertake analysis at three geographic levels. The first level was the geographic region, while the next levels were the administrative District Council and the Regional Council. The Basin is awkward in this respect since it is not an administrative region on its own, but straddles parts of two District Councils (Waitaki and Mackenzie) and parts of two Regional Councils (Canterbury and Otago). Since it is assumed that the groups will work together in making decisions, it has been decided to estimate impacts within the combined Waitaki/Mackenzie district and the combined Canterbury/Otago region. Basic population and employment data are presented in Chapter 1 of this report.

The economic impact of the various land uses has been assessed using input-output tables derived for each of the regions under study. The procedure for deriving basic input-output tables for these regions is described in Chapter 2. While tables derived in this manner are of limited accuracy, their reliability can be improved greatly by surveying the expenditure and income of those regional industries (sheep farming and forestry in this instance) which are of

particular interest. To improve the reliability of the regional tables used in this project, a survey of the income and expenditure of farmers in the Basin was carried out (and is described in Chapter 3). The improved regional table was used to assess regional impacts and multipliers which are reported in Chapter 4. Chapter 5 describes surveyed farmers' expectations about changes in agricultural production if they are able to establish forestry as they would wish on their land. Information on potential forestry regimes is described in Chapter 6, as are the demand for employment per 000 Ha of various forestry sub-industries. Information on the input structure of the sub-industries is used to estimate multipliers and these multipliers are used in Chapter 7 to estimate regional income and employment impacts of forestry. Chapter 8 considers the impacts of forestry processing. Finally, Chapter 9 estimates the word processing impacts under the four scenarios of land use change.

CHAPTER ONE

EMPLOYMENT IN THE REGIONS

Statistics NZ was requested to provide 1991 census data on employment by industry for the regions of interest. The employment was provided at the 184 industry level as defined in the 1986/87 inter-industry table (see Table 1.1).

Table 1.1
Employment by Industry (FTEs 1990/91) in Basin, Waitaki/Mackenzie Districts, and Canterbury/Otago Region

	Mackenzie/ Waitaki Basin	Mackenzie/ Waitaki Districts	Canterbury/Otago Regions
Sheep farming	195	1,043	8,843
Other farming	51	817	10,695
Agricultural Contracting	6	158	2,480
Forestry	2	18	354
Other Primary	0	93	672
Meat Processing	0	751	5,650
Other Food, Beverages & Tobacco	2	160	5,020
Textiles & Clothing	0	467	6,539
Wood & Wood Products	0	94	3,085
Pulp, Paper & Printing	0	52	3,297
Chemicals, Petrol & Rubber	2	2	2,505
Non-metallic Minerals	2	13	928
Basic Metals	0	64	1,889
Fabricated Metal Products	4	108	5,305
Other Manufacturing	2	24	4,820
Electricity, Gas & Water	91	257	1,571
Construction	37	527	15,175
Wholesale & Retail Trade	82	1,202	36,840
Restaurants & Hotels	220	742	10,413
Transport & Storage	6	198	10,608
Communications	6	88	4,360
Finance, Insurance, etc.	25	384	21,669
Commercial & Social Services	45	669	43,229
Central & Local Gov't Services	21	229	11,660
Household Domestic Services	3	94	3,048

Total	**803**	**8,252**	**220,634**

This data revealed, as expected, a narrow spread of employment in the Basin, with employment occurring in only 37 of the 184 defined industries; more than ten persons being employed in only 14 industries; and seven of the 184 industries providing 76 per cent of all employment in the Basin. The major sources of employment were agriculture, electricity generation, construction, retail trade, restaurants, accommodation, and education and research.

Comparative data for the Basin are not available for earlier years, but analysis of the data for communities and districts within the Mackenzie district reveals a 49 per cent decline in "usually resident" population, and a similar decline in employment, between 1981 and 1991 (Table 1.2). The rapid decline in the residential base has meant that local businesses, particularly retail trade, have become much more dependent on visitors to the region.

Table 1.2
Resident and Non-Resident Population in Mackenzie District

Community	**1981**	**1986**	**1991**
Twizel	4,117	1,274	1,774
Fairlie	882	788	768
Mackenzie	1,759	1,773	1,682
Mt Cook	573	589	461
Tekapo	372	442	372
Total	7,703	4,866	5,057
Resident	6,882	4,314	3,381
Non-resident	821	652	1,676

An obvious cause of the decline is the winding down of the hydro development workforce based at Twizel. While the population outside Twizel is also declining, it is doing so much more slowly. The rural population in the district declined by four per cent, Fairlie declined by 13 per cent, and Lake Tekapo community was unchanged.

CHAPTER TWO

GENERATION OF REGIONAL INPUT-OUTPUT TABLES

2.1 Format of Input-Output Tables

An input-output (IO) table is a matrix (see Table 2.1) with each industry having an associated row and column. The row relating to an industry shows the distribution of outputs of that industry, while the column describes the mix of inputs used by that industry.

Table 2.1
NZ Input-Output Table in Transactions Format

	INDUSTRIES			FINAL DEMAND			TOTAL
	Primary	Manufac.	Services	Household	Gov't	Other	OUTPUTS
INDUSTRIES							
Primary	2,560	6,912	624	309	3	2,604	13,012
Manufacturing	1,308	9,696	9,627	9,042	0	13,432	43,105
Services	2,362	8,273	29,455	27,253	12,145	13,781	93,269
PRIMARY INPUTS							
Households	1,670	5,783	21,150	0	0	57	28,660
Other factors	4,602	7,232	27,397	4,342	0	1,504	45,077
Imports	512	5,209	5,016	6,065	0	3,678	20,480
TOTAL INPUTS	13,014	43,105	93,269	47,011	12,148	35,056	243,603

2.2 Estimation of Multipliers

Expansion in an industry increases output, income and employment in that industry directly. However, it also increases demand for inputs and hence increases production, income and employment in those input-supplying industries. Additional household income also leads to increased consumption and further rounds of increased production, income and employment. This circular effect is limited by losses through taxes, savings, and imports. The total impact on all sectors of an increase in output by any particular sector can be estimated by the use of matrix algebra, using the relationships implied in the table above and described explicitly in the matrix columns of Table 2.2 below (Table 2.2 is based on Table 2.1 above, with the column entries showing the proportion of total inputs to the industry coming from each supplying industry).

As described in Table 2, a $1 million expansion of output in farming will lead directly to a $0.1 million expansion in manufacturing, whereas a similar increase in manufacturing will lead directly to a $0.19 million increase in services. Manipulation of Table 2 (using matrix algebra) enables the calculation of the total impacts on all industries of an increase in output of one industry. A multiplier is the ratio of the total effect of an increase in output to the direct effect of an increase. Type I multipliers assume there is no change in output of final demand sectors flowing from the increased production, while Type II multipliers take into account expected changes in household consumption but assume that other aspects of final demand (e.g. investment and exports) will not be affected by a change in demand.

Table 2.2

Input-Output Table in Coefficients Form

	INDUSTRIES			FINAL DEMAND			TOTAL
	Primary	Manufac.	Services	Household	Gov't	Other	OUTPUTS
INDUSTRIES							
Primary	0.197	0.160	0.007	0.007	0.000	0.074	0.053
Manufacturing	0.100	0.225	0.103	0.192	0.000	0.383	0.177
Services	0.181	0.192	0.316	0.580	1.000	0.393	0.383
PRIMARY INPUTS							
Households	0.128	0.134	0.227	0.000	0.000	0.002	0.118
Other factors	0.354	0.167	0.294	0.092	0.000	0.043	0.185
Imports	0.039	0.121	0.054	0.129	0.000	0.105	0.084
TOTAL INPUTS	1.000	1.000	1.000	1.000	1.000	1.000	1.000

2.3 New Zealand and Regional Tables

A national inter-industry table was last produced by Statistics NZ for the year 1986/87. An update of this for 1990/91 was estimated by Butcher (1993). Generation of such tables is expensive, and a procedure for mathematically generating regional tables using the national tables as a basis was developed in the 1970s (see Hubbard & Brown, 1981) and has been used to develop regional tables for New Zealand.

Tables for the regions of interest (Basin, Mackenzie/Waitaki district, and Canterbury/Otago region) were estimated for this project using Butcher's 1990/91 national inter-industry table and generating regional tables on the basis of the regional distribution of industry. The regional distribution is based on the economy-wide census of 1986/87 and distribution of employment as contained in the 1990/91 census. The regional output figures are hence of limited accuracy. Better data are potentially available through Statistics New Zealand's Annual Enterprise Survey data, but much of the this is suppressed for reasons of confidentiality and lack of accuracy at a minor region level.

2.4 Accuracy and Superior Data

The mathematically-generated tables have significant shortcomings (see Butcher, 1985) in that they assume constant technologies across the country for a given industry and they make rather arbitrary assumptions about the self-sufficiency of a region with respect to particular industries. However, the reliability of the table in analysing the impacts of a particular industry can be significantly improved by undertaking a survey of the participants in that industry in the region in question. This survey provides "superior" data on the input structure of the regional industry and the source of those inputs, and remaining inaccuracies in other sections of the IO table will not have a particularly significant effect on estimates of total impacts. Hence the total impact estimates for that industry can be considered to be reasonably reliable.

Data on the input structure for farming in the Mackenzie Basin came from a survey of farms in the Basin, while information on forestry input structures was based on work being done concurrently in Gisborne as well as information from forestry companies in South Canterbury.

CHAPTER THREE

SURVEY OF BASIN FARMERS AND INPUT STRUCTURES

Discussions were held in May 1994 with nine runholders in the Basin. Farm accounts were analysed in detail to get information on inputs used, with respondents identifying the source of inputs and also identifying where household spending took place. The nine properties ranged from end to end of the Basin and both the wetter and drier areas were represented, although the majority of the runs were in the wetter areas. The reason for this was that the sample was biased towards those runholders who have indicated the greatest interest in growing trees, and forest growth is likely to be fastest and most profitable in the higher rainfall areas. Respondents were also asked about their experience with growing trees, their expectations about future forestry developments (in terms of who would do the work and what sort of silvicultural regimes would be in place), and their estimates of changes in stocking capacity if they developed in forest the areas they would like to develop.

The bias in the sample was deliberate in that it was felt that forestry was most likely to occur on properties where owners were enthusiastic, and it was also felt that those owners would have put more thought into assessing the impacts on their existing farming operations of partial conversion to forestry, hence giving more reliable information.

Input structures were based on farm working expenses. A problem with estimating average farm input structures is the volatility of farm income and expenditure. Fine wool prices have fluctuated violently in the last few years and are currently less than half of the peak reached in 1989. To try and get a longer term average input structure, accounts were averaged for up to four years. However, the majority of accounts related to 1991/92 -1993/94, and it is likely that a long term average income would be perhaps thirty per cent higher than that. Given that expenditure would be higher with higher income, it is possible that the indirect employment estimates contained here could be as much as 20 per cent less than the long term average per stock unit. No adjustment has been made to the figures because of the possibility of declining profitability for other reasons (such as hieracium).

Major points to emerge from the survey were:

- Virtually all freight services were based outside the Basin.
- Shearing contractors were all outside the Basin.
- Extensive use is made of vehicle and plant repair facilities in Tekapo, Twizel and Omarama, although the Census data do not show any persons employed in the Basin in "repair services". Presumably such persons are listed according to some other predominant activity.
- Average direct employment on-farm (including part-timers but excluding contractors such as shearers) was one person (full time equivalent) per 3,020 SUs.
- Rabbit control is a major cost, but the switch from council funding to "user pays", and the interim funding by the Rabbit and Land Management Plan, make estimation of long term costs difficult. In any case, the properties surveyed tended on the whole to have a less severe rabbit problem than the average in the Basin.
- Consumption spending within the Basin was only around 25 per cent of residents' total household consumption spending. The majority of spending is done in Fairlie and the

coastal towns, although there was evidence of increasing spending in Twizel. This low level of retail spending in the region suggests that the mathematically-estimated 50 per cent regional self-sufficiency in wholesale and retail trade does not take into account the high demand by passing tourists, and overstates the reality for local residents. For this reason, the Basin wholesale and retail trade coefficients in the inter-industry table were reduced to half of the mathematically-estimated level.

The survey results were used to estimate the inputs and outputs of the Basin sheep runs (Table 3.1). The following considerations were relevant to this table:

1. Only the distribution cost of electricity is attributed as a cost (generation does not vary with regional demand).
2. An estimated 22 per cent of consumption occurs within the Basin, 45 per cent within the Districts, and 90 per cent within the Regions.
3. Mark ups of 25 per cent are assumed for wholesale and retail trade.
4. Insurance is treated as a payment for insurance services and a purchase of goods and services to meet claims.
5 Shearing is treated as a "livestock contracting" service. This industry has a lesser wage component than has shearing, and hence the employment impacts are probably understated.
6. Rabbit costs are a combination of shooters wages, transport, carrots, poisons, and flying. A rough split was made, but it will vary widely from year to year depending on whether a major poisoning campaign is underway. It appears as though rabbit hunting is generating significant employment on some properties.
7. Note that by convention inputs = outputs, with profits being the balancing item.

Table 3.1
Direct Inputs and Outputs of Basin Sheep Runs
($000, 1990/91 prices)

	Mackenzie/ Waitaki Basin	Mackenzie / Waitaki Districts	Canterbury/ Otago Regions
Sheep Farming	130	140	140
Other Farming	0	20	340
Agricultural Contracting	190	1,400	2,260
Forestry	0	10	65
Other Food, Beverages & Tobacco	0	40	250
Textiles & Clothing	0	0	80
Wood & Wood Products	0	125	160
Pulp, Paper & Printing	0	5	30
Chemicals	0	0	1,240
Other Manufacturing	0	0	570
Electricity, Gas & Water	10	20	20
Construction & Repairs	595	770	1,360
Wholesale & Retail Trade	25	240	490
Transport & Storage	35	520	530
Air Transport	220	300	300
Communications	10	50	120
Finance, Insurance, etc.	5	45	400
Community & Social Services	5	10	20
Central Government Services	0	0	0
Local Government Services	0	350	380
Household Consumption in Area	600	1,200	2,400
Imports into Area and Other Primary Inputs	11,345	7,825	1,915
Total Value of Inputs (equals value of outputs)	**13,070**	**13,070**	**13,070**

Source: Estimated on basis of survey of farmers.

CHAPTER FOUR

INCOME, OUTPUT, AND EMPLOYMENT IMPACTS OF FARMING

The data described above were incorporated into Basin, district and region economic models. Estimates of farm statistics and employment impacts were as follows:

Farmed area:	600,000 Ha
Stock units:	380,000
Direct employment:	126
Direct income (gross):	$ 3.2 million
Value of production:	$13.1 million

Table 4.1
Total Impacts of Basin Sheep Runs (1990/91 Prices)

	Mackenzie/ Waitaki Basin	Mackenzie/ Waitaki Districts	Canterbury/ Otago Regions
Output ($m)			
Direct	13.1	13.1	13.1
Indirect	2.2	7.5	20.2
Total	15.3	20.6	33.3
Income (gross $m)			
Direct	3.2	3.2	3.2
Indirect	0.6	2.4	6.9
Total	3.8	5.6	10.1
Employment (FTEs)			
Direct	126	126	126
Indirect	20	95	238
Total	146	221	364
Employment (FTEs/000 SU)			
Total	**0.4**	**0.6**	**1.0**

The above estimates do not take into account any reduction of government services (e.g. education) which might take place if employment were lost and people migrate. This is because it seems likely that losses in farm employment will be offset by increases in forestry employment. Nor do the estimates take any account of changes in activity in processing plants (e.g. meat processing).

CHAPTER FIVE

CHANGES IN AGRICULTURAL PRODUCTION WITH ADDITIONAL FORESTRY

If entire farms are converted to forestry, it is obvious that the entire agricultural production of that area, and the employment generated thereby, will be lost to the region. However, in most cases it is anticipated that only parts of a property will be converted to forestry. The impact on farm production will depend on what areas the runholders choose to plant in trees, and the degree to which an area of forestry will act as stock shelter and hence complement other farming operations. During the interviews, runholders were asked about their planting intentions or wishes. Of the nine persons interviewed, seven took the view that there would be minimal or no loss of production (although two qualified that by saying they would also consider putting some of their better land into trees - which would cut production). Runholders' reasoning appeared to be that they would choose to plant areas which are severely affected by hieracium or other weeds at present, or which are relatively infertile. Moreover, they felt that trees would reduce stock exposure to the weather, would reduce evaporation, and may provide grazing between the trees in years 5-15. The exceptions to this "low impact" point of view were a dryland run-holder (who felt that the only suitable area for growing trees was the area of his property which had the greatest rainfall, and to grow trees there would reduce his carrying capacity by half), and a wet land run-holder (who felt that trees would grow exceptionally well on his land and the switch in land use made commercial - and environmental - sense). The responses are summarised in Table 5.1, and they suggest that while a considerable increase in forestry can be achieved with minimal loss of agricultural production, there are also areas where forestry would lead to a considerable loss of agricultural production.

In assessing the impact of partial conversion of farms and reduced stocking, it has been assumed that inputs are linearly related to outputs. This is consistent with comments from farmers, and with the significant proportion of costs which are directly related to stock numbers (animal health, shearing, etc).

Table 5.1
Impact on Stock Numbers of Conversion to Forestry

Respondent	Area planted (Ha)	Current Cover	Stock Reduction (SU)
1.	8000	Hieracium	Minor short term Increase long term
2.	1,000	Matagouri	Minimal
3.	< 250 250 - 500	Hieracium	None Minor
4.	1,000 (of 6,000)	Grazing	3,000 (of 6,500)
5.	200	Infertile, hieracium	20
6.	5,000	Infertile, hieracium	700
7.	4,000	Grazing & wildings	2,500
8.	1,000 +	Native grass & hieracium	None
9.	80 100	Hieracium Pasture	None 4 SU/Ha

CHAPTER SIX

PLANTING METHODS, SILVICULTURAL REGIMES, AND LABOUR DEMAND

Data in this chapter are based on 1993 and 1994 survey work in Gisborne and on some discussions with Canterbury forestry contractors familiar with the Basin. Values are in 1994 prices unless otherwise noted.

6.1 Runholders Expectations

Most runholders expected that trees would be planted on a 50 -70 year rotation, and that there would be minimal pruning. However, some have already pruned existing stands (Douglas Fir 20 Ha two lifts) and expect future stands to be pruned. The source of labour for planting depends on the scale of planting and the type of ground. A machine developed by Colin Mackay has been used successfully by local runholders even in stony soils, and with this machine three people can plant between 5,000 and 10,000 trees in a day (or perhaps 1.7 Ha/person/day on average). In contrast, typical hand planters would plant around 0.5 Ha per person per day[1]. While some runholders anticipate planting even quite large areas (50-100 Ha per year) with local labour and machine planting, others expect to use planting gangs from outside the region as has already been done in some cases. The employment figures are given in Table 6.1.

6.2 FRI Expectations

Current FRI expectations are that stands of Douglas Fir and Ponderosa Pine sawlogs will be planted at around 1,250 stems per Ha, will be thinned and pruned to 2.5 metres at age 12, and will be felled at age 40-50. The volume of roundwood produced is estimated at 700m^3 per Ha. Additional pruning is considered unlikely since premiums for pruned Douglas Fir are insufficient to justify commercial pruning costs.

An alternative is to grow Corsican Pine for poles (at around 1600 stems per Ha) and to fell these at age 25.

6.3 Labour Demand

Labour demand has been estimated on a per 000 Ha basis, and assumes a 45 year rotation with only 22.2 Ha being due for a particular operation in each year. Demand is expressed in person-days or full-time equivalents (FTEs).

6.3.1 Nursery

[1] This is a considerably smaller area than in Gisborne, but reflects local ground conditions and the higher stocking rates proposed.

The direct labour demand for a large scale nursery has been estimated at approximately three persons per million seedlings. However, a smaller scale nursery (in more difficult soils and climate) may have a considerably greater demand. Given the expected planting rates of 1,250 stems per Ha, an estate of 1,000 Ha would generate 0.2 FTEs.

6.3.2 Planting

Machine planting would take approximately 0.6 person-days per Ha, hand planting would take approximately 2.0 person-days per Ha, and releasing takes 0.5 person days per Ha. Based on half the area being hand planted, half being machine planted and all being release sprayed, the labour planting demand per 000 Ha in rotation would be 40 person-days per year[2].

Costs of hand and machine planting are estimated by Belton (1991) at $420/Ha and $240/Ha respectively, (although note that this is considerably higher than costs in other parts of the country and higher than one could expect for Mackay's machine (one recent planting cost less than $100 per Ha).

6.3.3 Pruning and Thinning

Typical times for pruning 400 - 500 stems per Ha to 2.5 metres are about 2.4 person-days per Ha. Thinning to waste is about 1.0 person-days per Ha[3]. For stands that get one thinning and pruning in their 45 year rotation, the long-term labour demand per 1,000 Ha is 76 person-days (1,000/45 x 3.4 =) per year. At a cost per Ha of $570 ($1994) (c.f. Belton $200/Ha for thinning alone), the annual cost of pruning and thinning is $12,700 per 000 Ha.

6.3.4 Logging

Logging costs in the Mackenzie will vary according to the terrain. It is assumed here that logging will be primarily by skidder and will cost $18-19 per cubic metre (1994 prices). At production of 450m^3 per Ha and productivity of around 25m^3 per person-day, long term direct labour demand per 000 Ha in rotation will be around 400[4] person-days per year. Total cost will be $190,000.

6.3.5 Transport

At an average cost of 10 cents per tonne-kilometre and an average distance of 200km to an export port, the annualised freight cost per 000 Ha will be $200,000[5]. Direct labour demand is estimated on the basis of 8 FTEs per $1 million and is equivalent to 1.6 FTEs[6] per 1,000 Ha in rotation.

---

2 [(50% x 0.6 days + 50% x 2 days) + 0.5 days] x 1,000/45 years = 40 days

3 Thinning speed in Gisborne is much higher, but they have lower initial stocking rates and generally do two thinnings, hence taking out fewer trees per thinning.

4 1,000 Ha/45 years x 450/25 = 400 person days/year

5 $0.10/tonne x 200km x 450 tonnes/Ha x 1000Ha/45 years = $200,000

6 Fewer drivers would work longer days (2 round trips per day), but the estimate is of FTEs.

6.3.6 Management

Management figures reflect overheads such as tracks, rates, pest control and insurance (which all have a labour component) as well as the activities of the forest managers. Costs are assessed at $5/Ha/year plus costs for supervision of specific activities. These specific activity costs are approximately $150 per rotation (planting $40, releasing $20, pruning $55, thinning $40), or an average of $3.30/year. Hence total management costs (excluding management of log sales) average around $8.30 per Ha/year, or $8,300 per 000 Ha in rotation. At $500 per chargeable day (approximately $250 per total day worked), this gives an annual management labour demand of 33 days (0.14 FTEs) per 1,000 Ha.

Adding in costs of administration at logging (approximately $1,500 per Ha logged, or $33/Ha/year), adds 133 days (0.58 FTEs) per 000 Ha in rotation.

6.3.7 Roading

The initial minor tracking costs for planting are incorporated into overheads (which have been included as part of an expanded "management cost" - see 6.3.6). Average logging road costs of $2/$m^3$ has been assessed. Given typical volumes of 450m^3/Ha, this equates to approximately $20,000 per year per 000 Ha in rotation. On the basis of 1 km of road per 25 Ha, this implies a road construction cost of $22,500/km, which is possibly on the high side for Mackenzie country geology. Typical employment to output ratios for road construction are of the order of 5 FTEs per $1 million of output. Hence employment in roading is around 0.1 FTEs (although subsequent rotations will probably have much lower costs).

6.3.8 Royalty

The royalty reflects the differences between costs and revenues. A very rough assessment is that it will be approximately $27,000/Ha logged, and about $8,000 will go to households in the region (the balance going to debt repayment, outside owners, etc). Royalties have no direct impact on employment, but there will be an indirect impact as households spend the money on goods and services. The Mackenzie Basin indirect employment impact of royalties has been assessed as 1.7 FTEs per $1 million of household income. Hence royalties generate 0.30[7] indirect FTEs per 000 Ha in rotation. These figures are rated up by factors of 2.2 and 5.2 respectively to get district and region impacts[8].

[7] 1.7 FTEs /$million x $8,000/ Ha x 22.2 Ha/year = 0.30 FTEs

[8] There are much higher impacts at the district and regional level because of the very low level of Basin self-sufficiency in consumer industries.

6.4 Total Forestry Impacts

The employment impacts described above are summarised in Table 6.1. Note that in the conversion to FTEs, it is assumed that in forestry operations there are 200 working days per year except in management where there are 230 days. A 1,000 Ha permanent rotation would provide the equivalent of 5.2 direct full time equivalent (FTE) jobs (including all operations prior to processing).

Table 6.1
Summary of Annual Direct Labour Demand for Forestry
(per 000 Ha planted in full 45 year rotation, assuming one prune and one thin)

	Person-days per year	FTEs
Nursery	40	0.20
Planting (machine 50 %)	7	}
Planting (hand 50 %)	22	} 0.20
Releasing	11	}
Thinning	22	} 0.38
Pruning	53	}
Logging	400	2.00
Roading	20	0.10
Transport of Logs to Export	320	1.60
Management	166	0.72
TOTAL	**1,061**	**5.20**

Note: Person days per year are assessed on the basis that for 1,000 Ha in a 45 year rotation, every operation will be done on 22.2 Ha per year.

6.5 Sources of Labour

6.5.1 Nursery

It is possible that a nursery will be established within the Basin. Advantages that may be seen are minimisation of transport costs and possibly some advantage from hardier stock. With Douglas Fir seedlings at approx $0.4 each, it is possible that a nursery could be profitably established on relatively low volumes of perhaps 250,000 (200 Ha) per year. Given a rotation of an average 45 years, a total forested area of 9,000 Ha would possibly be sufficient to justify the establishment of a nursery. However, the success already achieved with trees from outside nurseries suggests that establishment of a nursery is not a necessary corollary to forestry development in the Basin.

6.5.2 Planting and Silviculture

If development on a farm is small scale, it is possible that existing farm owners will undertake planting and possibly even pruning and thinning. On one farm a 10 Ha block was pruned by the owner, and on two other farms significant areas have been planted by the owners. However, some owners will not wish to do planting and pruning themselves, while larger plantings (in excess of perhaps 10 Ha per year on a farm or 450 Ha in permanent

rotation) are likely to demand more time than owners have available (10 Ha would require perhaps 50 days per year).

A number of runholders spoken to would like to plant more than the 450 Ha which they might conceivably manage, and it seems probable that the majority of planting and pruning/thinning will be done by forestry contractors. At present, such contractors come from outside the Basin, and they may well continue to do so in the future. It is not uncommon in some areas for forestry gangs to commute daily for up to an hour and a half each way to work. If the volume of work were sufficient, it is possible that contractors would become permanent residents of the Basin. However, a gang of 9 -12 pruners, thinners and planters would be able to cope with around 15 - 20,000 Ha total land in forest (with each 000 Ha requiring a long term average input of only 0.58 FTEs per year) which is at the upper limit of what seems likely. It is, of course, possible that existing residents (other than runholders) will undertake the work on a part-time basis, particularly when demand for labour in other activities is at a low ebb.

6.5.3 Logging

Logging is more labour-intensive per Ha, and a five man logging gang would be permanently employed felling 56 Ha per year. Hence development of 1,230 Ha would support such a gang full-time. It is quite feasible that a large scale forestry development would lead to the establishment over time of a permanent population of loggers and their families in the Basin. However, it is noticeable in other regions that forestry workers frequently travel up to an hour and a half each way to work, and it is quite possible that loggers will commute from outside the Basin.

6.5.4 Transport

Where wood is being trucked in log form out of the Basin, the location efficiencies would be similar anywhere along the route, and servicing would be more practicable where adequate support services are available. Hence it seems likely that road transport would continue to operate from outside the Basin so that operators could conveniently work in other areas if they lost a Basin contract. The location efficiencies would change if a significant processing plant started up within the Basin.

6.5.5 Management

It is possible that forest managers will reside within the Basin since the requirement for 15,000 Ha would be around ten full-time persons. However, this will depend on the forest ownership structure since if ownership is widely held and owners wish to employ different managers, there may be insufficient work to support a management team in the Basin. Moreover, most of the management work does not need to be done on location, so the advantages of living in the Basin are not as great as for some other operations.

6.6 Summary

At this stage it is unclear what percentage of various operations will be done within the Basin, and this will depend on local attitudes to employment in forestry (which are likely to change as forestry becomes more established), the size of the estate and the development of local processing. The working hypothesis for estimation of population impacts is that half of

all planting, pruning and transport and all nursery work and forest management will be by people normally resident outside the Basin. Hence while potential direct forestry employment in the Basin will be 5.2 FTEs per thousand hectares in permanent rotation, actual direct employment is likely to be closer to 3.2 FTEs. The generation of additional indirect employment means that total forestry -dependent employment in Mackenzie Basin is likely to be close to 3.9 FTEs per 000 Ha in forestry estate.

CHAPTER SEVEN

FORESTRY OPERATIONS IMPACTS

The various operations described above all have their own upstream effects. Use has been made of forestry operations input data gathered for a related project in Gisborne, and this has been supplemented with a limited survey of input costs in Canterbury and data from the Logging Industry Research Organisation transport model. Planting and pruning and thinning are approximately 75 per cent wages, with the balance being primarily travel, chainsaws and tools, and administrative overheads. Logging is approximately 50 per cent wages, although this can vary considerably according to the type of logging.

7.1 Forestry Multipliers

Note that both Type I and Type II multipliers are given in the tables below for completeness (see Chapter 2 for a discussion of the difference). However, the relevant multipliers are considered to be Type II (which incorporate the effects of additional household income and spending). Type I multipliers are included for the interest of those readers who consider them to be relevant. Direct income:output ratios are also given (Table 7.1) to facilitate estimation of total household income effects.

Table 7.1
Direct Gross Household Income : Output Ratios

	Direct Gross Household Income:Output
Road Construction	0.18
Planting & Pruning	0.80
Logging	0.50
Freight	0.33
Royalty	0.30 of revenue net of costs

Table 7.2
Multipliers for Forestry Industries in the Basin

	Output		**Income**		**Employment**	
BASIN	**I**	**II**	**I**	**II**	**I**	**II**
Road Construction	1.12	1.21	1.10	1.15	1.13	1.20
Planting &	1.05	1.22	1.02	1.07	1.02	1.06
Pruning	1.03	1.15	1.02	1.06	1.02	1.09
Logging	1.14	1.20	1.16	1.21	1.21	1.29
Management	1.12	1.21	1.11	1.16	1.12	1.21
Freight	----	1.07	----	1.05	-----	0.014 *
Royalty						

Table 7.3
Multipliers for Forestry Industries in the Mackenzie/Waitaki District

	Output		Income		Employment	
DISTRICT	**I**	**II**	**I**	**II**	**I**	**II**
Road Construction	1.25	1.46	1.22	1.34	1.30	1.48
Planting & Pruning	1.08	1.43	1.04	1.15	1.03	1.13
Logging	1.09	1.34	1.06	1.17	1.07	1.23
Management	1.36	1.59	1.34	1.48	1.41	1.58
Freight	1.26	1.44	1.25	1.37	1.29	1.49
Royalty	----	1.13	----	1.10	----	0.030*

Table 7.4
Multipliers for Forestry Industries in the Canterbury/Otago Region

	Output		Income		Employment	
REGION	**I**	**II**	**I**	**II**	**I**	**II**
Road Construction	1.42	1.95	1.36	1.73	1.49	1.96
Planting & Pruning	1.17	1.99	1.08	1.37	1.06	1.31
Logging	1.18	1.78	1.12	1.41	1.14	1.54
Management	1.56	2.17	1.57	1.99	1.67	2.16
Freight	1.39	1.86	1.33	1.68	2.34	1.94
Royalty	----	1.28	----	1.26	----	0.071 *

* *FTEs per Ha Clearfelled. Employment results from additional household expenditure of royalty.*

7.2 Forestry Employment Impacts

The multipliers have been combined with the direct employment impacts to provide estimates of total employment impacts per 000 Ha. The results are presented in Table 7.4. Note that this table records both potential and likely employment impacts in the Mackenzie Basin. As noted earlier, it is likely that some proportion of direct employment will be taken up by people who do not reside in the Basin and hence the likely employment is significantly less than the potential employment.

Table 7.5
Direct and Total Employment Impacts of Forestry
(FTEs per 000 Ha in rotation)

	Mackenzie/Waitaki Basin		Mackenzie/Waitaki District	Canterbury/ Otago Region
	Potential	Likely (estimate)		
Nursery				
Direct	0.20	0.00	0.20	0.20
Indirect	0.01	0.00	0.03	0.06
Total	0.23	0.00	0.23	0.26
Planting & Silviculture				
Direct	0.58	0.29	0.58	0.58
Indirect	0.03	0.02	0.08	0.18
Total	0.61	0.31	0.66	0.76
Logging				
Direct	2.00	2.00	2.00	2.00
Indirect	0.18	0.18	0.46	1.08
Total	2.18	2.18	2.46	3.08
Freight				
Direct	1.60	0.80	1.60	1.60
Indirect	0.34	0.17	0.78	1.50
Total	1.94	0.97	2.38	3.10
Preparation & Roading				
Direct	0.10	0.10	0.10	0.10
Indirect	0.02	0.02	0.05	0.10
Total	0.12	0.12	0.15	0.20
Management				
Direct	0.72	0.00	0.72	0.72
Indirect	0.21	0.00	0.39	0.84
Total	0.93	0.00	1.11	1.56
Royalty				
Direct	0.00	0.00	0.00	0.00
Indirect	0.30	0.30	0.67	1.56
Total	0.30	0.30	0.67	1.56
TOTAL				
Direct	5.2	3.2	5.2	5.2
Indirect	1.1	0.7	2.5	5.3
Total	**6.3**	**3.9**	**7.7**	**10.5**

CHAPTER EIGHT

IMPACTS OF POSSIBLE WOOD PROCESSING INDUSTRIES ON THE MACKENZIE BASIN

The preceding estimates of forestry employment are based on an assumption that wood is transported out of the region in a raw form. However, the large distances involved from forest to export port or other market make it likely that processing will take place in the Basin, primarily because processing reduces product volumes by 40 - 50 per cent. Pole treatment in the Basin is perhaps less likely because the reduction in weight (bark removal) is much less significant than for other products. While many processing possibilities exists, only three are examined here. They are:

1. A sawmill (medium scale cutting about 50,000m^3 of sawn timber per year and generating waste fibre of approximately 25,000 tonnes per year).

2. A medium density fibreboard (MDF) mill using approximately 200,000m^3 of raw wood (which could include sawmill residues).

3. A pole treatment plant (to cover the possibility of Corsican Pines managed for poles).

No consideration has been given to the environmental issues associated with such developments. They are presumed not to be limiting factors.

8.1 Data Sources

The data on sawmill costs was derived from a 1990 survey of sawmilling costs, and is based on average costs for 14 mills producing in the 20,000 - 70,000m^3 of green sawn timber per year. The outlined variations in labour requirements reflect different assumptions about sawmill types and technologies, and are based on discussions with operators in the industry. Data on MDF cost structures was supplied by MDF plants, and information on pole processing was supplied by treatment plant operators. In all cases, the costs of wood and inwards freight are ignored since these costs and related impacts have already been estimated directly. Profitability is also ignored, both for reasons of commercial confidentiality and also because profit is assumed to be not directly related to economic activity in the region (it is assumed to go to outside shareholders). The input structures are incorporated into the regional models and multipliers are calculated.

8.2 Impacts and Multipliers

8.2.1 Sawmills

A 50,000m^3 output sawmill could generate direct household income of approximately $0.75 million, and direct employment for around 25 people. Indirect effects include a reduction in log freight and hence total gross household income in the Basin increases by only $0.62 million, and total employment in the Basin increases by only 23 FTEs.

These results are indicative only, since the actual outcome will be so heavily dependent on a range of factors. To accurately assess sawmill impacts would require knowledge of the expected end-product and markets (and hence the degree of processing on site), the input wood (radiata requires extensive grading because of the variability through the log, whereas Douglas Fir is less demanding), the variability in size (a more uniform size of log means a more efficient mill can be designed), and the capital intensiveness of the plant (which reflects products, labour costs, and the philosophy of the mill owners). While some of these factors are known for the proposed scenarios, others are not. Direct employment in the surveyed mills averaged about 70 persons per 100,000m^3 of output per year, whereas some modern mills will employ as few as 3 people per 100,000m^3 (plus administrative staff). These figures reflect only processing to the green sawn stage, whereas processing in a typical large New Zealand mill could easily treble that figure to around 200 persons per 100,000m^3 of output. There are substantial economies of scale and a small mill (6 - 10,000m^3) undertaking limited processing (kiln drying and some shaping for example) could employ 15 people on its own.

On balance, it seems reasonable to assume that large modern mills cutting in excess of 50,000m^3 output per year (77,000m^3 input) and undertaking significant processing or re-manufacturing are likely to employ about 25 persons per 50,000m^3. Smaller mills might well employ twice as many per 000m^3, but it is doubtful that a small scale mill could compete effectively for logs. The indirect impacts of a mill in the Mackenzie Basin will be negative. Extra demand will be for maintenance and household support services, but there will be an offset via reduced demand for transport (compared to the log export scenario).

Sawn timber volumes will be only two thirds of log volumes, and drying of timber will reduce the weight even further, to perhaps 50 per cent of original log weight. However, for half of the logs in the mill catchment, the mill will not be on the direct route out of the Basin, and hence total product tonne-kilometres will fall by approximately one third. Given the earlier direct transport costs of $20 per m^3, employment in transport of eight FTEs per $million, and income:output ratios of 0.33, a 35 per cent reduction in transport costs for 77,000 tonnes of logs would reduce direct employment by 4.3 FTEs and direct household income by $0.51m. There will also be indirect effects of this reduction in freight.

Table 8.1
Employment Impacts (FTEs) of Typical 50,000m^3 Sawn Output Sawmill (including freight reduction)

		Basin	District	Region
Sawmill	Direct	25	25	25
	Multiplier	1.12	1.65	2.35
	Total	28	41	59
less				
Freight	Direct	4.3	4.3	4.3
	Multiplier	1.21	1.49	1.94
	Total	5	6	8
Total Impact and Multiplier		**23**	**35**	**51**
		0.92	1.4	2.0

Taking the negative freight impact into account, the Basin sawmilling employment multiplier is 0.92 (Table 8.1) and the income multiplier is 0.83. Employment in the Basin will rise by

25 FTEs directly and 23 FTEs in total for every 50,000m^3 of output from a large scale mill, while gross household incomes will rise by approximately $0.75 million directly and $0.62 million in total. At the district level total impacts are 35 FTEs and $0.83 million, and at the regional level total impacts are 51 FTEs and $1.2 million.

8.2.2 Medium Density Fibreboard Mill

A typical MDF plant processes about 200,000 tonnes of raw logs and waste (from sawmills and small logs normally left behind during logging). An MDF mill is an extensive user of electricity (in addition to energy generated by burning waste wood), chemicals (resins used in manufacture), freight, engineering and repair services, and labour. Direct employment at a 100,000 tonnes of output per year mill is estimated at 220 FTEs, (there are very considerable economies of scale, and doubling the output would only increase employment to perhaps 250) and a mill of at least that scale could be expected in the Mackenzie Basin. Indirect impacts in the Basin are likely to be minor. Electricity demand is unlikely to affect generation in the Mackenzie Basin, chemicals will be manufactured elsewhere, and freight is a substitute for the freight of raw logs which has already been allowed for. In fact there should be a substantial reduction in freight (40 per cent reduction for logs going into MDF) since this is the primary justification for siting an MDF mill in the Basin. Approximate freight savings for a 200,000 tonnes of raw wood per year mill would be of the order of $1.6 million per year (40% x 200,000 tonnes x $20/tonne = $1.6 million) which equates to a **loss** of approximately 13 jobs directly and 14[9] jobs in total in the Basin.

Employment in the Basin would be generated primarily in the services industries (engineering repairs and wholesale and retail trade), and an estimated 22 FTE jobs would be created. Hence **net** indirect job creation from an MDF mill would be only about 8 FTEs, with a total employment impact of 228 FTEs. At a district and regional level the impacts would be 265 FTEs and 440 FTEs respectively. Gross annual household incomes in the Basin would rise by about $7.8 million directly, but indirect effects would be zero (because of the negative effects of freight reductions) for a total overall gross household income increase in the Basin of $7.8 million. At the regional and district level the total gross household income increases would be $8.9 million and $14.5 million respectively.

The above estimates assume that all employees of the MDF plant would reside in the Basin. There are considerable economies of scale in an MDF plant, and larger plants may require fewer employees per unit of output.

8.2.3 Pole Treatment

Pole treatment is reasonably labour intensive, and indications are that approximately 7 persons per 10,000m^3 are required. However, there are likely to be considerable economies of scale, and an indicative figure of half that has been used here. Direct gross household income impacts are estimated at $0.18 million.

There is less demand for local external inputs than in sawmills, with the primary inputs being labour, chemicals, and electricity (in debarking machines). For an area of 10,000 Ha in Corsican Pines producing 120,000m^3 per year, direct employment in pole treatment plus indirect employment in other industries and would be of the order of 50 persons (considerably more than are likely to be involved in producing the trees and transporting the

9 $1.6 million x 8 FTEs/$1m x 1.12 employment multiplier = 14 FTEs

wood and poles). Insufficient data exists to estimate multipliers accurately, but initial indications are that they are of the order of 1.1 (Basin), 1.3 (district) and 1.7 (region). Electricity is not considered to be a marginal impact, and chemicals have very low employment and income impacts.

CHAPTER NINE

WOOD PROCESSING IMPACTS UNDER FOUR SCENARIOS

Four forestry scenarios were developed by FRI, (see below for roundwood production) and on the basis of discussions with people involved in forestry, a feasible processing scenario was developed for each production scenario. Many scenarios could be developed, but the objective was to demonstrate the scale of processing-based employment that might reasonably be expected to occur if the forestry scenarios were adopted. The employment impacts and multipliers were assessed for each scenario on the basis of the processing employment impacts developed in Chapter 8.

Table 9.1
Roundwood Production Under Various Scenarios (000m^3/annum)

	Scenario A 70% forests on all slopes	**Scenario D & E** 15% forests on all slopes	**Scenario B** 15% on slope 4 plus shelter
Sawlogs (export)	630	135	100
Sawlogs (domestic)	660	142	70
Poles (inc. in sawlogs)	(210)	(48)	50
Pulp	154	33	30

Notes: At 450m^3 per Ha and 45 year rotation, the annual volume implies forest estates as follows:

1. *Scenario A: 72,000 Ha.*
2. *Scenario B: 10,000 Ha.*
3. *Scenarios D & E: 15,000 Ha.*

9.1 Scenario A

Assume that approximately 25 per cent of the export sawlogs and all the domestic sawlogs are sawn in the Basin, and that half of the wood suitable for poles are treated as poles (rather than going as export sawlogs). Hence there would be 785,000m^3[10] of raw wood sawn in the Basin, and 100,000m^3 of poles treated in the Basin. The output of the sawmills would be 500,000m^3 of sawn timber and 250,000m^3 of residue (plus waste). The residue, together with another 150,000m^3 of pulp wood, would be used in two MDF plants , each with output of 100,000 tonnes of product.

[10] 0.25 x (600 - 100) + 660

Direct Impacts:

Sawmills:		
Employment:	500,000m^3/50,000m^3/mill x 25 FTEs/mill	= 250 FTEs
Income:	500,000m^3/50,000m^3/mill x $0.75m/mill	= $7.5m
MDF mills		
Employment:	2 mills x 220 FTEs/mill	= 440 FTEs
Income:	2 mills x $7.8m/mill	= $15.6m
Pole Treatment Plants		
Employment:	100,000m^3 /10,000m^3/plant x 3.5 FTEs/plant	= 35 FTEs
Income:	100,000m^3 / 10,000m^3/plant x $0.20m/plant	= $2.0m

9.2 Scenario B

Assume that approximately 50 per cent of the export sawlogs and all the domestic sawlogs are sawn in the Basin, and that all of the wood suitable for poles are treated as poles (rather than going as export sawlogs). Hence there would be 95,0000[11] $m^3$of raw wood sawn in the Basin, and 50,000m^3 of poles treated in the Basin. The output of the sawmills would be 61,000m^3 of sawn timber and 30,000m^3 of residue (plus waste). The residue, together with the 30,000m^3 of pulp wood, would be insufficient to support an MDF mill and would possibly be trucked out of the region and would support one quarter of an MDF mill.

Impacts:

Sawmills:		
Employment:	61,000/50,000 x 25	= 31 FTEs
Income:	61,000/50,000 x $0.75m	= $0.9m
MDF mills (none in Basin, but perhaps 1/4 of a mill in the region)		
Employment:	0.25 x 220	= 55 FTEs
Income:	0.25 x $7.8m	= $1.9m
Treatment Plants		
Employment:	50,000/10,000 x 3.5	= 18 FTEs
Income:	50,000/10,000 x $0.20m	= $1.0m

9.3 Scenarios D & E

Assume that approximately 50 per cent of the export sawlogs and all the domestic sawlogs are sawn in the Basin, and that all of the wood suitable for poles is treated as poles (rather than going as export sawlogs). Hence there would be 180,000[12] m^3 of raw wood sawn in the Basin, and 50,000m^3 of poles treated in the Basin. The output of the sawmills would be 115,000m^3 of sawn timber and 50,000m^3 of residue (plus waste). The residue, together with another 33,000m^3 of pulp wood, would be insufficient to support an MDF plant, and would possibly be trucked out of the region (the $20/tonne freight would be less than the wood value) to support 40 per cent of a regional MDF mill.

---

11 0.5 x (100 - 50) + 70

12 0.5 x (135 - 50) + 140

Direct Impacts:

Sawmills:

Employment:	115,000/50,000 x 25	= 58 FTEs
Income:	115,000/50,000 x $0.75m	= $1.7m

MDF mills (none in region, but perhaps 40% of a mill outside the region)

Employment:	0.4 x 220	= 90 FTEs
Income:	0.4 x $7.8m	= $3.1m

Treatment Plants

Employment:	50,000/10,000 x 3.5	= 18 FTEs
Income:	50,000/10,000 x $0.20m	= $1.0m

9.4 Summary

Tables 9.2 to 9.4 provide a summary of the processing impacts under the four scenarios for the Basin, the district and the region. These are total impacts, and hence differ from the direct impacts above. The figures show the enormous impact on employment of processing. For example, in Scenario A forestry (including production and transport) generates around 280 direct and indirect jobs. By contrast, processing could generate a further 720 jobs. In the other scenarios (which do not produce enough wood to support a board mill), the divergence is less. Scenario B generates 40 FTEs in forestry and 48 FTEs in processing while Scenarios D & E generate around 60 FTEs in forestry and 53 FTEs in processing.

Table 9.2
Total Basin Processing Industry Impacts Under Four Scenarios

	Sawmills	MDF Mills	Treatment Plants	Total
Total Employment (FTEs)				
Scenario A	230	450	39	719
Scenario B	28	0	20	48
Scenarios D & E	53	0	20	53
Total Gross Household Income ($m)				
Scenario A	6.2	15.2	2.2	23.6
Scenario B	0.8	0.0	1.1	1.9
Scenarios D & E	1.4	0.0	1.1	2.5

Table 9.3
Total Mackenzie/Waitaki District Processing Industry Impacts Under Four Scenarios

	Sawmills	MDF Mills	Treatment Plants	Total
Total Employment (FTEs)				
Scenario A	350	520	46	916
Scenario B	43	65	23	131
Scenarios D & E	81	100	23	204
Total Gross Household Income ($m)				
Scenario A	8.3	17.4	2.6	28.3
Scenario B	1.0	2.2	1.3	4.5
Scenarios D & E	1.9	3.5	1.3	6.7

Table 9.4
Total Canterbury/Otago Region Processing Industry Impacts Under Four Scenarios

	Sawmills	MDF Mills	Treatment Plants	Total
Total Employment (FTEs)				
Scenario A	510	860	60	1,430
Scenario B	62	110	30	202
Scenarios D & E	117	170	30	317
Total Gross Household Income ($m)				
Scenario A	12.0	28.6	3.4	44.0
Scenario B	1.5	3.6	1.7	6.8
Scenarios D & E	2.8	5.7	1.7	10.2

References

Belton, M. (1991), "Options for Forestry as a Landuse in Mackenzie Rabbit and Land Management Area". Ministry of Forestry, Christchurch.

Butcher, G. (1985), "Regional Income, Output and Employment Multipliers: Their Uses and Estimates of Them". Ministry of Agriculture and Fisheries; Wellington.

Butcher, G. (1993), "New Zealand Inter-Industry Table 1990/91". Christchurch. Unpublished.

Hubbard, L.J. and Brown, W.A.N (1981), "Multipliers from Regional Non-Survey Input-Output Tables for New Zealand". Research Report No. 117, Canterbury: Agricultural Economics Research Unit, Lincoln College.

Fairweather, J.R. and S.R. Swaffield (1994), "Preferences for Land Use Options in the Mackenzie/Waitaki Basin". AERU Research Report No.224, Lincoln University.

Fairweather, J.R. and Swaffield S.R. (1995), "Preferences for Land Use Options Involving Forestry in the Mackenzie/Waitaki Basin". New Zealand Journal of Forestry Science 21(1).

Fairweather, J.R. and S.R. Swaffield (1996), "Preferences for Scenarios of Land-Use Change in the Mackenzie/Waitaki Basin". New Zealand Forestry 41(1):17-26.

Hock, B.; Fairweather, J.; Langer, L.; Ledgard, N.; Manley, B. and Swaffield S. (in preparation), "Economic and Social Impacts of Land Use Change in the Unimproved Pastoral Lands of the New Zealand High Country: Methodological Case Study". New Zealand Forest Research Institute Bulletin, Rotorua.

Swaffield, S.R. and Fairweather, J.R. (1996), "Investigation of Attitudes Towards Effects' of Land Use Change Using Image Editing and Q Sort Method:. Landscape and Urban Planning 35:213-230.