

Studies in Land Use Change and Socio-economic Consequences

A Comparison of the Employment Generated by Forestry and Agriculture in New Zealand

John R. Fairweather

Peter J. Mayell

and

Simon R. Swaffield

August 2000

Research Report No. 246

**Agribusiness and Economics Research Unit
P O Box 84
Lincoln University
Canterbury
New Zealand**

Ph: (64) (3) 325 2811

Fax: (64) (3) 325 3847

<http://www.lincoln.ac.nz/AERU/>

ISSN 1170-7682

ISBN 0-909042-25-X

Contents

LIST OF TABLES	V
LIST OF FIGURES	VII
PREFACE	IX
ACKNOWLEDGEMENTS	XI
SUMMARY	XIII
CHAPTER 1 INTRODUCTION: BACKGROUND AND RESEARCH OBJECTIVES	1
CHAPTER 2 PREVIOUS RESEARCH ON EMPLOYMENT GENERATED BY AGRICULTURE AND FORESTRY, AND METHODS USED IN THIS STUDY	3
2.1 Introduction.....	3
2.2 The Socio-economic Effects of Land Use Change from Agriculture to Forestry	3
2.3 Post-1991 Assessments of Forestry and Community	6
2.4 Forestry and Employment.....	8
2.5 Conclusion: Advancing Research on Employment Generation.....	14
CHAPTER 3 RESULTS	17
3.1 Introduction.....	17
3.2 An Overview of Forest Sector Expansion	17
3.3 A Regional Geography of the New Zealand Forestry Industry	20
3.4 Comparing Forestry and Agriculture Employment: A National Perspective	22
3.5 Comparing Forestry and Agriculture Employment: A Regional Perspective	24
CHAPTER 4 CONCLUSION	31
4.1 Summary	31
4.2 Discussion.....	33
BIBLIOGRAPHY	35
REFERENCES	37
APPENDIX 1	41

List of Tables

Table 1: Forest Ownership in New Zealand, 1998	18
Table 2: Area and Volume Characteristics of Exotic Forest by Wood Supply Region.....	20
Table 3: Species – Area Characteristics of Exotic Forest by Wood Supply Region	21
Table 4: Forest Area by Age Group by Wood Supply Region	22
Table 5: Employment in Forestry and Agriculture, 1986-1996.....	23
Table 6: Employment in Forestry and Agriculture by Wood Supply Region, 1986-1996.....	24
Table 7: On-land and Processing Forestry Employment by Wood Supply Region, 1996	27
Table 8: On-land Employment in Forestry and Agriculture by Wood Supply Region, 1986-1996	29
Table 9: Processing Employment in Forestry and Agriculture by Wood Supply Region, 1986- 1996.....	30
Table 10: Prior Estimates and Current Findings Comparing Forestry and Agricultural Employment.....	32

List of Figures

Figure 1: Map Showing the Study Area and Location Within New Zealand.....	2
Figure 2: New Forest Area in New Zealand, 1920 - 1997.....	17
Figure 3: Total Forest Area in New Zealand, 1931 - 1998.....	19

Preface

The topics of land use, and issues associated with land use change, have been a major theme of research in the AERU since its inception in 1962. In earlier years the research focused on pastoral land uses, reflecting the dominance that pastoralism has had in New Zealand's primary production history. In recent decades, forestry has become more important in terms of both land use and contribution to the economy. However, the ascendancy of forestry has not been without contention. In the recent past there has been vigorous debate about planning regulations as they relate to forest development. Now, much debate is heard about the effect of forest sector development on the rural community.

This research report is one of two related reports that address the second issue above. One report focuses on national and regional data on employment generated by agriculture and forestry, and the other focuses on the North Island East Coast, and considers both employment and other socio-economic variables. This report has the national and regional perspective. Both reports are intended to contribute to policy debates about forestry and its role in regional development. Rural people, planners, councillors and sector representatives will find this report provides a basis for an improved understanding of the consequences of land use change from agriculture to forestry.

Ross Cullen
Director

Acknowledgements

The research presented in this report was supported by a number of people. Pauline Fallon assisted by providing a preliminary literature review. Helpful comments on earlier drafts were received from a number of people including: Geoff Butcher (Butcher Partners Ltd.), Dr. Parnell Trost (Ministry of Agriculture and Forestry, Dunedin), Dr. Caroline Saunders, Dr. Hugh Bigsby (Commerce Division, Lincoln University), Dr. Paul Dalziel (Economics, University of Canterbury), Dr. Mike Roche (Geography, Massey University) and Dr. Patrick Aldwell (Commerce Division, Lincoln University).

Funding for this research was provided by the Foundation for Research, Science and Technology via Forest Research Ltd. under contract number CO 4816.

Summary

A Comparison of the Employment Generated by Forestry and Agriculture in New Zealand

John Fairweather, Peter Mayell and Simon Swaffield, AERU, PO Box 84, Lincoln University, Canterbury, New Zealand.

Conclusions

- Analysis of census data on employment generated by farming and forestry showed differences both over time and by region.
- Available estimates of on-land employment for agriculture are lower, and for forestry are higher, than the New Zealand data derived from analysis of census data.
- Total employment expressed as FTEs/1,000 hectares is highest for forestry but most of it is generated by processing, which occurs in regional centres, not in rural areas as it is for agriculture.

Background and Rationale

- Work on forest sector development in the Gisborne/East Coast region requires background information on changes in land use and associated changes in rural community structures.
- A popular rural opinion is that forestry has a negative effect on rural communities and there is a need to assess the veracity of this view.

Research Objectives

- Assess land use change in forestry and agriculture in both New Zealand as a whole and the main regions, with a focus on the relationship of land use to employment.
- Review relevant literature on employment generated by farming and forestry.

Method

- Collate census data for agriculture and forestry employment in on-land and processing activities between 1986 and 1996.
- Analyse data by region.
- Express employment as FTEs/1,000 hectares.

Results

- The main results are shown in the table below.

	Agriculture			
	On-land	Processing	Indirect	Total
Wairoa District	2.6	0.5	1.4	4.5
Mackenzie District	0.4		0.6	1.5
Victoria, Australia	2.4		6.6	9.0
New Zealand	8	2		10
	Forestry			
	On-land	Processing	Indirect	Total
Wairoa District	9.4	7.7	6.2	23.3
Mackenzie District	5.2	4-10		9.2-15.2
Victoria, Australia	8.7		24.3	33.0
New Zealand	6	10		16

Chapter 1

Introduction: Background and Research Objectives

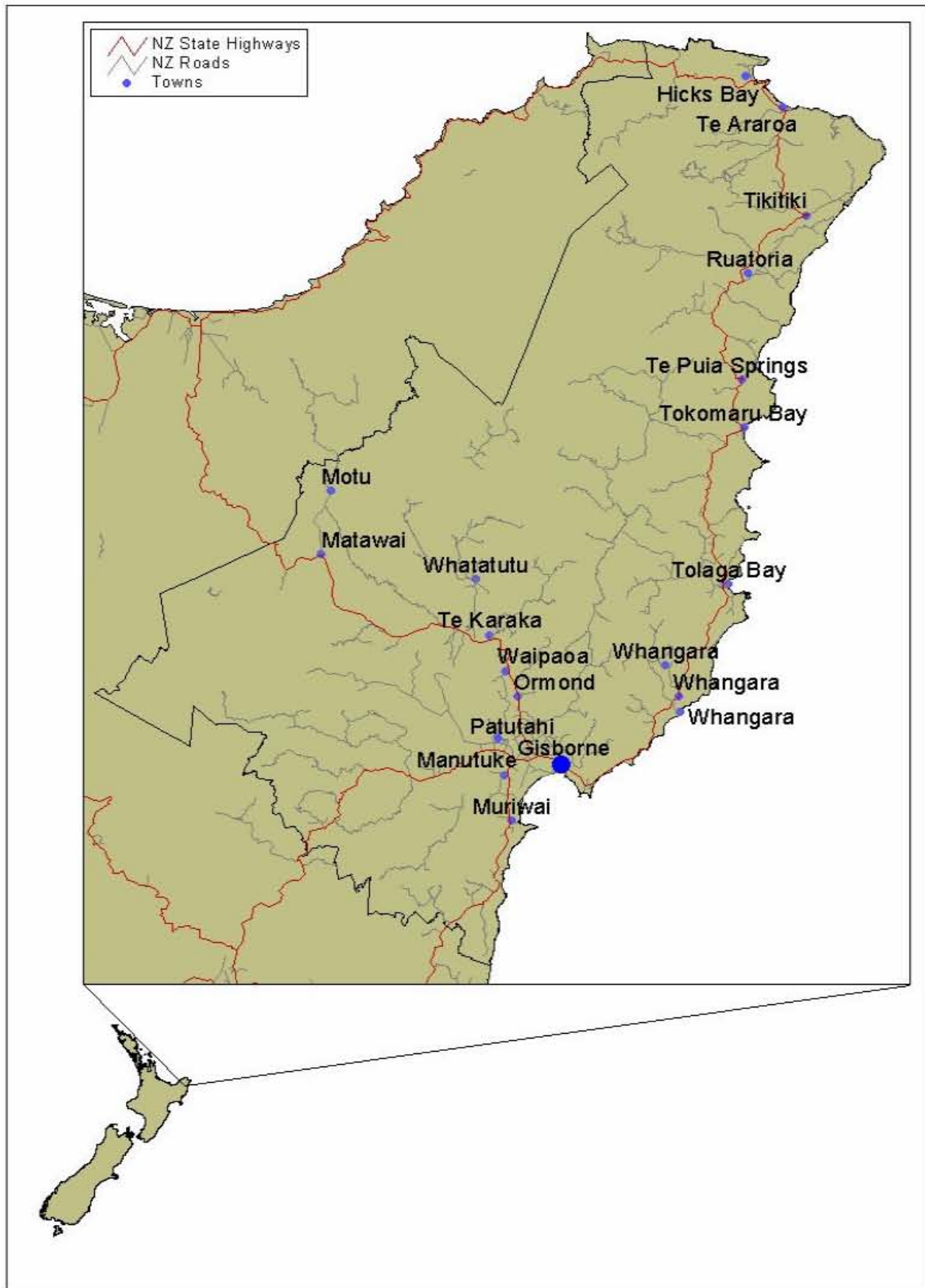
The research presented in this report is part of a broader programme of research aimed at facilitating economic and community development in the East Coast region of New Zealand. The overall Lincoln University/Forest Research Ltd. programme seeks to examine the interrelationship between market dynamics, investor motivation and constraints, and community well-being and adaptability to change in response to forest sector growth. It aims to promote adaptation to emerging markets by providing timely and useful research results relating to social and economic issues associated with forest sector development.

The primary objective of the Lincoln research was to describe relationships between recent trends in land use change and associated change in rural community structures. The main land uses considered are exotic forestry and pastoral agriculture. Rural community structures are defined in terms of a variety of social, economic and demographic characteristics. The objective of the research reported here was to assess land use change in forestry and agriculture in both New Zealand as a whole and the main regions, with a focus on the relationship of land use to employment. This report presents these results and provides an understanding of the general patterns. It provides a context to the case study of the East Coast region which examines a broad range of socio-economic data associated with land use change. The results of the case study are presented in a separate report (Fairweather et al., 2000).

The East Coast region was chosen as the focus of the study for two main reasons. First, it is a relatively isolated and economically disadvantaged region so there is a widely perceived need to generate employment. It has a history of forestry based projects, and has been the subject of significant research effort, dating back to the 1970 Report of a Technical Committee of Inquiry (Ministry of Works, 1970). The most recent of these projects has been the East Coast Forestry Scheme, which commenced in 1992 and is still in operation. Although directed at erosion control, it includes socio-economic objectives and clearly has socio-economic as well as environmental effects. Second, partly in response to this scheme, forestry land use has increased markedly in recent years, and replaced a significant proportion of hill country pastoralism. The increase in forest area has generated a number of social issues, for example, resistance from some people who prefer pastoral land uses. The region illustrates well a number of important social factors involved in the community response to land use change which will be critical in achieving maximum benefit from forest sector development. Figure 1 shows the location of the East Coast region in New Zealand.

This report is organised as follows. Chapter 2 provides a review of relevant literature and describes previous research on employment generated by forestry and agriculture. It also describes the methods of research used in this report. Chapter 3 presents the results and Chapter 4 provides a discussion and conclusion.

Figure 1: Map Showing the Study Area and Location Within New Zealand



Chapter 2

Previous Research on Employment Generated by Agriculture and Forestry, and Methods Used in this Study

2.1 Introduction

This chapter reviews literature on the relationship between land use change involving forestry and socio-economic characteristics in New Zealand and describes the method of research used in this study. The goal of this review is to summarise relevant recent research in order to develop some broad understanding of current knowledge about the effects of forestry on communities. There is a significant amount of literature on the topic of forestry and community, but not all of it is reviewed here because it covers a broad range of issues. Rather, the focus is more specifically on research that links forestry development (as a new land use) to socio-economic consequences. As we will show, much of the debate in this area relates to employment effects and this topic is the focus of attention here. However, before examining that topic the chapter begins with a more general treatment of the issues associated with land use change from agriculture to forestry, drawing from a key 1993 study. The majority of the chapter focuses on the post-1991 regional studies of forestry and community, especially that research which examines employment effects. The conclusion summarises the main points from the literature and describes the method of research used in this study.

2.2 The Socio-economic Effects of Land Use Change from Agriculture to Forestry

Rural land use change in New Zealand in recent years has been primarily associated with significant changes and developments in the two primary industries of forestry and agriculture (Houghton, King and Piper 1996). Roche (1990) provides a comprehensive overview of the history of New Zealand forestry up to 1990, highlighting the major role played by state intervention and policy in determining the timing, extent and location of forestry development. For much of its history, forestry development in New Zealand has been part of the wider process of land development, including clearance of indigenous forest and its replacement with exotic plantations. Export earnings and employment have been important policy objectives in a number of regionally-based projects, and until the economic reforms of the 1980s, central government provided a range of types of support, from the directly funded activities of the NZFS, to forestry encouragement grants.

Increasing realisation of the impact of pastoral agriculture upon soil erosion also led to forestry development projects with conservation objectives, particularly on marginal hill country, where forestry replaced agriculture as the primary land use. The Report of the Technical Committee of Inquiry into the Problems of Poverty Bay-East Cape District of New Zealand (Ministry of Works, 1970), is one example of a project aimed at land use change from agriculture to forestry, with conservation and socio-economic objectives. An historical overview of the New Zealand forest sector is included in Chapter 3. The socio-economic impact of government sponsored change in land use became the focus of several regional studies in the 1980s.

The University of Otago Consulting Group report for MAF (1993) provides a useful summary of the literature on the impact of land use change from agriculture to forestry up to 1991. The report argued that an upturn in forestry planting after 1991 revived the debate of earlier decades when there were two main views on the social and economic impacts of forestry. One view emphasised the advantages of forestry, highlighting the opportunities it offered in terms of employment and economic benefits to residents in established rural communities. The alternative view outlined the disadvantages of forest development for communities. However, few of the available reports provide up-to-date information on the relationship between forestry development and community impacts during the 1980s. In their executive summary the University of Otago Consulting Group (1993) state that:

The only reports which consider social and economic community impacts of post 1980 forest development describe East Cape (Waiapu County, now Gisborne District) and Otago (West Otago and South Otago) for early in the 1980s decade. Some indications of community issues for the early 1980s in Northland also are described in various reports. Nothing is available to report changes since the early 1980s and no studies have been conducted for the most recent phase of development, post 1991.

This lack of recent research is particularly significant because in the early 1990s exotic forestry development took on a somewhat different character to earlier decades. Although large-scale corporate-style development still took place there was also an increasing emphasis on small-scale partnerships and farm forestry projects. This shift reflected a range of factors, including a greater emphasis within New Zealand upon the need for individuals to create retirement funds; a spike in international log prices, which drew attention to the potential returns from forestry; declining returns from other primary activities, and the consequent need for farms to diversify; and changes in land use regulation, making conversion of pasture to forestry more feasible.

Anecdotal evidence reported by the Otago group suggested that because farmers began to participate more widely in the development of small-scale forestry it had the effect of changing their attitudes away from fear of forestry to a level of acceptance. There had, however, been no scientific studies of the impact of small-scale forestry on rural communities or any comparisons between the impacts of large scale and small-scale forestry developments.

The key findings from the University of Otago Consulting Group (1993) identified a number of common issues which emerged from the few forestry community case studies that had been undertaken in the 1980s. These included rural depopulation, ageing population, declining rural services and unemployment. However, there were different patterns of forestry effects on community in different areas, as illustrated by various reports.

Rural depopulation. Aldwell (1984) found that forestry had slowed the pace of depopulation in Waiapu County. The New Zealand Forest Owners' Association (NZFOA) (1984) also concluded that much rural population decline had stopped and forestry was largely responsible for this. However, the impact of Forest Service corporatisation on Tapanui, as reported by Houghton et al. (1987), definitely led to population loss.

Ageing population. The case study areas in question were generally characterised by an ageing population. This was apparent in Tapanui when older couples from farms were retiring in the township (Houghton et al. 1987). Aldwell (1984) also noted this in Waiapu

County, but forestry in the region had provided school children with holiday work, and school leavers with jobs. He therefore concluded that it was also encouraging younger age groups to stay in the area.

Rural services. Conflicting views existed concerning whether forestry contributed to closing rural services or maintaining them. Even after corporatisation in Tapanui the school rolls were relatively unaffected (Houghton et al. 1987). NZFOA (1984) concluded that forestry was reversing the trend of loss of rural infrastructure, and had created new housing and increased school rolls. However, Aldwell (1984) reported that Waiapu County people were concerned that better roading (associated with forestry development) would mean people could shop out of the district, and local services therefore would not continue.

Unemployment. Unemployment issues were prominent in many of the case study communities. Forestry was reported to obtain a high proportion of its workers from the rural areas (NZFOA 1984). Although large numbers of workers are involved in planting and harvesting of plantations, the intervening years require lower numbers of forestry labourers.

These socio-economic issues were frequently identified as major community concerns associated with conversion of agriculture to forestry. The case studies also reported a wide variety of other advantages and disadvantages associated with forestry development. Reported benefits include:

- Significant injection of spending derived from forestry employment in rural service towns (Gold and Houghton, 1985).
- Reduced erosion in hill country areas (Aldwell, 1984).
- Rural employment opportunities (Aldwell, 1984).
- Guaranteed forest community activity during harvesting (Aldwell, 1984).
- An upturn in school rolls (Aldwell, 1984).
- Forest headquarter expenditure in rural areas (Aldwell, 1984).
- Population gains in Tapanui, which replaced population losses common to many rural districts (Houghton et al., 1987).
- Forestry corporatisation has had a positive effect on new business (Houghton et al., 1987).

Reported disadvantages include:

- Changes in rural service delivery, and a threat to those seeking an 'alternative' lifestyle, away from development (Aldwell, 1984).
- Pressure on housing, and commercial and industrial land during harvesting. Pressure on associated services, and concerns whether areas will cope with expansion (Aldwell, 1984).
- Improved roading leading to greater access to distant markets, and reduce custom for the local stores (Aldwell, 1984).
- Population loss due to corporatisation (Houghton, 1987).
- Large redundancy payments to forestry workers setting up new business created animosity amongst local business people (Houghton, 1987)
- Re-employment of workers after redundancies was of local residents, and did not prevent population loss (Houghton, 1987).
- Possible decrease in housing stock in rural communities through corporatisation. These involved sell-offs to Housing Corp, and dramatic rent increases (Houghton, 1987).

- Corporatisation and redundancy fears placed families and the community under great stress (Houghton, 1987).
- Influx of highly skilled and higher paid people in to the rural community has a potential for conflict (Ministry of Works and Development and Northland United Council, 1982).

These results suggest that the effects of forest sector development are highly dependent upon particular situations. They also appear to reflect, at times, the backgrounds of the authors and the respective organisations which they represent, for example, pro- or anti- forestry groups. One key theme appears to have been the effects of Forest Service corporatisation in the mid-1980s, although Houghton (1987) noted that rural recession and high interest rates were largely responsible for the poor economic climate, not corporatisation. However, the main point is that there is little research that sought to methodically document socio-economic effects of land use change during the 1980s, especially research which adopts a New Zealand-wide perspective. It is notable that the results reported here derive largely from only three studies.

2.3 Post-1991 Assessments of Forestry and Community

In this section we report findings from several more-recent studies of the effects of forestry on communities. The material is ordered by region.

Northland. Northland has consistently experienced high levels of unemployment relative to other parts of New Zealand and over 50 per cent of Northland's unemployed were Maori (Ministry of Forestry, 1995). The Ministry of Forestry estimated that with the increasing harvests leading to forestry activity expansion, the number of people employed by forestry would increase to about 2,400 by 2010. However, even with the predicted increase in labour demand, the Ministry of Forestry predicted that unemployment will remain a major problem in Northland. The reason for this is that forestry requires people in concentrated bursts. For every ten hectares planted, about 205 working days are generated over the first seven or eight years of the crop's life, covering roading, land clearing, planting, fertilising, releasing, pruning and thinning to waste. However, there is a four to five year gap between planting and the first prune, and in many communities, local workers have had to go elsewhere after the land clearing and planting rather than wait for the trees to grow large enough to be pruned and thinned. MoF also reported that these tending operations are often carried out by contract workers from outside the district.

Scott, Park, Cocklin and Blunden (1997) conducted a study into rural sustainability in the Mangakahia Valley, Northland. The study included depth interviews with local people, who talked about the gradual acceptance of forestry as inevitable, given ongoing financial crises in the beef and sheep industries and the potential high returns from forestry. People felt a sense of powerlessness to stop the wave of forestry. The majority of those interviewed thought that forestry was not inherently a bad thing, but almost all had some concerns about it. In particular people felt that the type of land that could be planted in forestry should be regulated, to protect farm land.

Many people in the Mangakahia had spent time reflecting on the pros and cons of forestry. After a decade and a half of witnessing the emergence of forestry in the valley, people were able to talk in very specific terms about the impacts of forestry on their region. These included loss of farm land and farm families and related social issues, lack of local employment opportunities from forestry, concerns about logging trucks on already poor

roads, environmental impacts of forestry, particularly on water and wildlife, and an underlying concern that economic returns on timber as a raw commodity would not be high. Clearly, this Northland study identifies contemporary community concerns that echo those expressed in the pre-1991 research.

Southland. Houghton, King and Piper (1996) summarised information on economic and social change with regard to land use and community in three areas of rural Southland. The areas studied were Tuatapere, Otautau and Winton. State forestry operations had been replaced by small-scale family forestry as well as international corporate ownership. The Otago/Southland region was a key centre of this rapid increase in new planting by small owners in the early 1990s. An estimated 38,000 hectares of new plantings had been established since 1991. Farm properties continued to be acquired by companies for conversion to forestry.

Houghton et al. (1996) report that the 1987 restructuring of the New Zealand Forest Service had significant effects on local communities, particularly Winton and Tuatapere, which had substantial shares of the 146 state forestry jobs lost in Otago and Southland between 1988 and 1992. The rural population of Southland had decreased from 44 per cent of the region in 1951 to 31 per cent of the region in 1981 and 29 per cent in 1991. There was a significant decrease among younger people, especially those aged 20-29. The rural areas of the region, that is centres of less than 1,000 population, declined by 8.6 per cent.

Employment also declined in the rural areas of Southland from 1986 to 1991. The greatest changes were a decline in male employment (14 per cent) and a decline in full time positions. The overall decrease for rural Southland of 1,392 FTE jobs was primarily in sheep farming. In 1991 half (51 per cent) of the rural Southland population over 15 years was employed directly in agricultural production. Between 1986 and 1991, nine per cent or 704 FTE jobs were lost in this sector.

Generally this study documents demographic factors between 1986 and 1991 and finds considerable change. It provides background information only and does not go as far as linking the changes to a particular sector of primary production.

The forestry towns. Taylor, Baines and Associates completed a series of studies on resource communities in the 1990s, which included the three forestry towns of Kawerau, Murupara, and Tatapere. McClintock and Taylor (1999) summarised the results and their conclusion is included here. They argued that:

Forestry communities are vulnerable to the price cycles of wood, pulp and paper products, as well as changes in the technology and capital structure of the industry. Changes in the prices of these commodities have major social and economic effects on the communities that rely on them for primary production or processing. Major technological changes in the forestry industry have increased labour productivity substantially in planting, logging and processing, and concentrated production in fewer centres. Forestry companies have reorganised their work practices by contracting out their logging and technical support to smaller firms. Employment opportunities in the industry have been reduced for unskilled (often older) workers who have either left town or remain in the community unemployed.

Other private sector rationalisation has included banks and mercantile firms that have become concentrated in regional centres as local branches have closed in the forestry communities. Government restructuring withdrew people from rural areas at the same time as private sector rationalisation was happening, leading to a multiple effect on local economies. There was a reduction in purchasing power and a shift to spending in regional centres, where centralised retailing was being established. Thus the forestry communities were struck by the multiple effects of restructuring across several sectors.

The loss of employment from forestry, other private and state sectors has led to vacant, lower cost housing becoming available to newcomers who are often characterised by being low income, beneficiaries, single parents, unemployed or unskilled, and Maori. The forestry communities are now more socially, culturally and economically diverse, with greater levels of poverty and disparities of wealth. They have lost many key people from the "middle management" level since the mid 1980's, people who previously played strong roles in local community organisations.

Although the forestry communities recognise the need to strengthen and diversify their local economic base, they must develop alternative economic activities that are not vulnerable to commodity price cycles. In this respect tourism is far from a panacea. Similarly, added value should if possible be based on several sectors, and preferably on moving products as far from the influence of commodity prices as possible - e.g. end products such as furniture cf. timber milling. Local government is playing a vital role in developing local economic strategies.

These studies clearly located the development of the forestry towns within the context of regional and international dynamics and show how the fortunes of the towns changed in response to external influences. The results of these studies show how it is important for local regions or communities to be aware of the effects of external forces and to work with these to maximise their returns from forestry.

Overall, the post-1991 regional studies of forestry and community provide useful accounts of community response to forestry. The main themes throughout all the research are community concerns about forestry and these concerns have had varied expression. The Northland and Southland studies have close parallels to the pre-1991 research in that they refer to wide ranging effects. The research on the three forestry towns is more focused since the town is the unit of analysis.

2.4 Forestry and Employment

While there are many issues associated with forestry as a land use one of the key ones is employment. At the base of many of the community concerns is the effect of forestry on employment. Employment generated by forestry has been specifically studied with a variety of methods. This section reviews a variety of New Zealand and some Australian research. Generally, there are two approaches: ex post studies that work from existing employment data or surveys, and prospective or ex ante studies that make projections into the future based on explicit assumptions. Some research uses a combination of methods: typically input-output analyses use data on existing industry structures to make projections. All three types are considered here, starting with the first type.

Ex-post studies. Wall and Cocklin (1993) conducted a preliminary assessment of employment derived from the East Coast Forestry Project (ECFP). One of the objectives of the ECFP was to create new employment in a region characterised by high unemployment rates. The study sought to establish a baseline employment position for forestry on the East Coast, prior to the ECFP, and to isolate new employment over and above the baseline. In order to achieve this aim a variety of sources were utilised: census data, unpublished employment surveys from the Ministry of Forestry, and employment records from the ECFP tenderers and contractors. To establish a socio-economic profile of the workers, including their history, a survey of 103 respondents employed in planting was carried out. This survey was designed to determine new employment generated by the ECFP and as a means to track individuals to establish the longer-term benefits of the ECFP.

Approximately half of the respondents resided in Gisborne City, 20 per cent in Tokomaru Bay and the remainder were from various other places throughout the region. For the majority, the East Coast was their permanent home, but about 15 per cent of respondents had either moved into or within the Gisborne region for employment in planting. When asked about their plans following the completion of the ECFP, two-thirds of those who migrated to the region stated that they intended to move again, with the remaining third choosing to stay. All of those deciding to remain were originally from the Gisborne region and of Ngati Porou descent, suggesting that once the ECFP becomes established and pruning and thinning begins, one of the consequences could be the attraction of ex-Gisborne region residents back into the area.

Wall and Cocklin found it difficult to establish a reliable estimate of both the 1993 employment baseline and of the level of employment under the ECFP in its first year. The difficulties arose for several reasons:

1. The census did not provide a reliable estimate of total employment in forestry because much of the forest work was done by part time or transient workers who were unlikely to fill out the census form and say that they worked in forestry. Census data are likely to significantly underestimate actual employment.
2. Employment in planting is generated by funding from several sources. It was difficult for both the contractors and their employees to identify with accuracy how much employment can be attributed to work generated under different sources of funding. Work in planting was generated by funding under the conservation schemes, private non-subsidised funds, and through the ECFP.
3. The transient nature of the workforce adds to the difficulties of estimating with reliability the extent of employment
4. The research commenced late in the planting season, by which time some of the planting under the ECFP had already been completed.

This study of the employment effects of the ECFP found some evidence to show that the scheme supported local employment. However, difficulties in measuring forestry-related employment precluded an accurate assessment of employment generation.

Input-output studies. Input-output studies use both existing data (ex-post) and make projections based on assumptions (ex-ante). Before presenting the research results from input-output studies it is important to clarify some of the associated concepts. Input-output studies usually estimate the direct and indirect employment associated with a particular activity such as forestry. Direct employment includes production, which usually includes

silviculture and logging, and processing. Indirect employment arises from supporting businesses that increase their activity to meet the increased demand for goods and services provided by the expanding forestry activity. Beyond this is the induced effect generated by expenditure of household income derived from forestry employment. The sum of the direct and indirect effects is described as Type I impact, and the sum of direct, indirect and induced impacts is Type II. Type I multiplier refers to the ratio of (direct and indirect) impacts to the direct impact, and the Type II multiplier is the ratio of (direct, indirect and induced) impacts to direct impacts (Butcher et al., 2000). Because input-output studies usually include on-land employment and processing as direct employment, we will refer to processing in subsequent parts of the report by name, not as indirect employment, which is how it is described in some contexts. Note that input-output studies can just look at on-land employment and multipliers, without looking at processing. This means that not all input-output studies are directly comparable.

Another dimension to research of this type is the unit of analysis: some of it focuses on the local district versus the broader region, because the research need is to assess the local effects of land use change. While this is a valid question it does not address the research question of the difference in employment derived from agriculture and forestry regardless of where it occurs.

Aldwell (1982, 1984) and Aldwell and Whyte (1984) studied the direct and indirect effects of forestry in the three counties of Mangonui, Waiapu and Bruce. All three counties had substantial areas recently planted in exotic forest and locals had high expectations of the forest industry creating new jobs and diversifying the local economy. There was also the expectation that, where under-utilised capacity threatened other related industries such as transportation, forestry would provide the necessary demand for such industries to survive.

Aldwell emphasised that an important justification for afforestation in some of the more remote areas of New Zealand is regional development. He identified these areas as being characterised by net out-migration, unemployment, and a decline in some key services. Afforestation was one means of providing stable employment and incomes. Forestry development would not, however, necessarily lead to population growth. To maximise the direct and processing benefits of afforestation it was important that local residents were employed and that goods and services were purchased locally. Advocates of forestry development hoped that a substantial proportion of the processing benefits would accrue to the counties in which the forests were located. If this did occur, then some of the negative aspects of rural decline may be removed. However, Aldwell noted that centralised purchasing strategies by forestry companies and under-utilised capacity in the local economy reduce the likelihood of new jobs being generated by forestry.

The analysis showed that employment in forestry had increased substantially in the 20 years prior to 1981 in all three counties. He anticipated that the input of the forest industry into wages and salaries of employees would have some visible effect on local commercial activity. However, employment in the commercial sector had declined during the 15 years of growth in the forestry workforce. Possible reasons for the apparent lack of impact of the forestry workforce on the commercial sector were that:

- An increase in forestry employment may not have led to a real increase in spending power because workers had changed from another occupational class, such as agriculture, shearing or farm contracting.

- The forest industry was too small a contributor to the local economy to have a demonstrable effect.
- Forestry workers, with a higher disposable income than they may have had previously, were purchasing their requirements in the nearby regional centres.
- The service sector may have been substantially underemployed.

Aldwell (1984) found that under sustained yield assumptions, forestry generated about 0.11 to 0.15 FTEs per 1,000 hectares in on-land employment. Aldwell then considers the indirect effect of this forestry employment and found that forestry has a low multiplier compared to dairy farming and sheep farming. This is indicative of lower indirect and induced effects. However, the induced effect generated by the expenditure of forestry wages and salaries is almost twice the indirect effect, while the opposite is true for farming. Consequently, in absolute terms, forestry generates more service sector employment per hectare. While pastoral farming has larger multiplier values, its direct employment is only one third that of forestry. He concludes that forestry and logging are relatively effective means of employing rural dwellers. Aldwell's (1984) analysis is focused on employment in forestry silviculture and not on processing and manufacturing. An important point is that he refers to data that compares a variety of primary production industries which shows that agriculture has higher multipliers than forestry.

For the Waiapu County (the northern part of the East Coast region) study, results of the analysis indicated that the combined effect of historically derived underemployment and current high unemployment had reduced the indirect effects of forest sector growth (Aldwell 1984). Hence, despite the forest sector employing about ten per cent of the local workforce, the service sector had not shown a noticeable upward movement in activity. However, there had been an increase in county population, and if existing planting and management practices continued, it was likely that the population would increase by about 1,000 (20 per cent) as a direct result of increased forestry employment by the turn of the century.

For the Bruce County research Aldwell (1984) compared agriculture and forestry employment. Sixty per cent of pastoral farming employment was in direct employment, 30 per cent in processing and ten per cent in 'other' (sale yards, wool stores, wool scours etc). Only 16 per cent of forestry employment was in the forest with 82 per cent in processing and two per cent in other. In terms of labour per hectare, direct employment was similar for both agriculture and forestry but there was very high employment associated with forestry processing, accounting for seven times as much employment compared to agriculture. Aldwell explains this difference as being due to the large total volume of output from forestry: 500 tonnes per hectare over 30 years from forestry compared to 4.5 tonnes from pastoral farming. Finally, the data show that for total employment (forest and processing) the forest sector employs 4.5 times as many people as agriculture. The data were derived mainly from the seven properties studied. Aldwell concluded that Bruce County was likely to derive greater employment from a given area of forestry development than from a similar increase in pastoral activity. While the area of agriculture was four times that of forestry almost the same number of people were employed.

Butcher (1995) developed a regional economic model for the Wairoa District to estimate land use changes on employment and income. His report was used by King and Krausse (1995) to assess broader impacts of land use change and specifically to forecast household incomes and employment. Butcher concluded that 56,000 hectares of forestry converted from farmland would generate approximately 1,050 additional jobs and \$37 million in household income in

the District. The data below show the numbers of jobs for agriculture (derived from the estimates of the jobs lost as the land is converted from agriculture to forestry) and forestry expressed per 1,000 hectares of converted land.

Wairoa Study, FTEs per 1,000 hectares

	On-land	Processing	Indirect	Total
Farming	2.63	0.5	1.43	4.55
Forestry	9.38	7.68	6.25	23.3

Note: On-land forestry employment includes forestry, logging and log transport.

King and Krause (1995) based their estimates on a static rate of forest harvest of 1,600 hectares per year. With local processing there would be 900 additional FTEs; without local processing the increase in employment would be limited to 350 FTEs. King and Krause also considered a variety of other impacts. The net benefits to Wairoa District of the employment and income predictions made in this study were fundamentally dependent on the ability of the district to capture them. At the time of the study much of the forestry related employment (up to 75 per cent) was being carried out by contracted workers from outside the district. Effective training programmes for both prospective workers and contractors were necessary for some of these jobs to be captured by local residents.

Butcher also reported on the likely impacts of land use change in the Mackenzie/Waitaki Basin (1994). He assumed that forestry was likely to expand and would have an effect on regional employment. He estimated that sheep farming in the basin generates one Full Time Equivalent job (FTE) directly for every 3,030 stock units, with all this on-land employment occurring in the Basin. The additional impacts of farm spending and purchases of inputs make the total impact per 3,030 stock units of 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. Butcher noted that the total impact was likely to be up to 20 per cent 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 studied. The most relevant finding was that direct farming employment was 1.0 FTEs/3,030 stock units which is equivalent to 0.33 FTEs/1,000 stock units. There are 1.1 stock units per hectare on the South Island High Country (Meat and Wool Economic Service of New Zealand 1999:14) so 1,000 hectares carries 1,100 stock units, which implies 0.36FTEs/hectare. The direct employment data are shown in the table below.

Butcher concluded that forestry would generate an estimated 5.2 FTEs directly for every 1,000 hectares managed as a normal forest with a 45 year rotation, (i.e., a rotation where 22.2 hectares are harvested annually). However, not all this employment will occur in the Basin and it is probable that planting and pruning/thinning workers would come into the Basin for short periods on contract. The assumption of the study was that half of all planting, pruning and transport would be carried out by people normally resident outside the Basin. Hence on-land employment in the Basin would be 3.2 FTEs per thousand hectares in permanent rotation. Butcher considered four processing scenarios, based on three different sizes of forest estate. The scenarios gave a range of employment impacts and these are shown below.

Mackenzie Study, FTEs per 1,000 hectares

	On-land	Processing	Total
Farming	0.21		0.24
Forestry	3.2-5.2	4-10	9.2-15.2

Prospective Studies. An assessment of the State Plantation Programme in Victoria, Australia (Consultants' Report, 1989) included comparisons of employment in agriculture and softwood plantation forestry. They note the distinction between examining the impact of forestry expansion on absolute employment levels, compared to assessing employment impacts of plantations which displace agricultural activity, that is, assessing relative impacts. The study used the second approach with a focus on, first, local employment generation specifically at the 'on land' level, then a focus on broader economic activity using multipliers. The authors estimated employment per hectare of land used in production for a 'normal' forest at 30.4 person years for a 3,500 hectare forest (equivalent to 8.7 person years for 1,000 hectares of forest). The agricultural employment displaced ranged from 30.8 for dairying (8.8 FTEs/1,000 hectares) to 8.4 for wool with low productivity (2.4 FTEs/1,000 hectares). The authors concluded that forestry was a relatively more intensive land use compared with extensive agriculture. However, they went on to consider the impact of location of residence and concluded that local businesses and services would not suffer a decline in use but they acknowledged that forestry workers would live in local towns, not on the land.

For regional impacts the analysis of multipliers showed that 3,500 hectares of forestry generated about 85 jobs for forestry (24.3 FTE per 1,000 hectares) compared to dairy farming and milk products at 173 jobs (49 FTEs/1,000 hectares), and low productivity wool at 23 jobs (6.6 FTEs per 1,000 hectares). The forestry jobs rely upon an processing industry developing locally.

Victoria, Australia, FTEs per 1,000 hectares

	On-land	Processing	Indirect	Total
Sheep farming (wool)	2.4		6.6	9.0
Forestry	8.7		24.3	33.0
Dairy	8.8	49		57.8

The contrast between the effects of extensive sheep farming and dairying, both 'agriculture', and their relative effects compared to forestry, highlights the need to clarify the type of agriculture in comparative analyses.

There are two informal reports of predicted future employment from forestry in the East Coast. Aldwell, reported by the Gisborne Herald in 1999, said that the total on-land and processing employment from 100 hectares of forestry would be 96.5 for timber processing (including handling, processing and transport) compared to eight for pastoral farming. Horgan (pers. comm.) states that for 1996 to 2000 forestry on the East Coast would generate a total of 1,561 FTEs for forestry, harvesting, transport, roading and processing.

Finally, there is a recent text on the effects of plantation forestry (Maclaren 1996), which specifically addressed the issue of forestry effects on local employment. He notes that historically, agriculture was seen as the best land use in economic terms, but that now, forestry is seen as a more acceptable land use. Maclaren argues that the changes to the forest

sector make much of the pre-1980s research obsolete. On the issue of employment, Maclaren sees forestry as providing greater overall and long-term employment than for farming on the same area of land (Maclaren, 1996: p. 150). National-level data show that one person is employed for every 59 hectares for 1995, based on the age class then, which will change as the forest matures and relatively more employment will be generated. Maclaren goes on to show that agriculture employs one FTE per 73 hectares using the total of 17.3 million hectares of farming land (this figure includes forestry land). Using 13.9 million hectares as a more appropriate assessment of the total agricultural land area brings the figure down to one FTE per 59 hectares, the same as forestry.

2.5 Conclusion: Advancing Research on Employment Generation

The main objective of the research presented in this report is to describe relationships between land use change involving forestry and employment. The literature shows there are varied assessments of the employment effect of a change from agriculture to forestry, a variety of methods are used and most studies have a regional or community focus.

There have been three key employment studies. Aldwell's research found that on-land forestry employment increased as a result of forestry expansion in three regions. However, processing employment was not as high as expected. The research compared forestry to agriculture to show that forestry employed more people per unit area largely because of the significance of processing. The Wairoa research showed that forestry generated considerably more employment than farming but much of this was lost to the district. Clearly, forestry as a land use may generate employment but much of this can benefit other regions or other centres within a region. Butcher's Mackenzie study compared employment generated by farming and forestry. The forestry employment analysis provided a basis for estimating employment per unit area for a given set of assumptions about the nature and location of forestry work. Again, forestry was shown to employ more than farming once the harvesting begins and the trees are in full rotation.

A common theme of the input-output studies is their emphasis on the contingent nature of the outcome of land use change from farming to forestry. This is well illustrated by the low employment levels estimated for both farming and forestry in the Mackenzie Basin which is a low rainfall area. Another factor in contingency is the ability of a location to maximise on-land and processing employment within the locality. It is important to note that both the projective and input-output studies are based on explicit assumptions. Hence it is quite likely that different authors will make quite different estimates of forestry employment. It is also quite likely that in particular regions, forestry will have distinctive effects because of the character of the industry.

Projective input-output methods are useful for studies of regions where forestry is new, but are limited to their assumptions. An alternative method is to review historic data and assess actual employment changes associated with forestry, at least where accurate data are available. However, this approach is limited because the historic data reflect technological conditions that probably will not prevail in the future. Also it is difficult to disentangle the effects of forestry from other changes occurring over the same period. Two of the three employment studies reported above used census data. One of the studies showed that census data on employment in forestry are not an accurate reflection of total forestry employment because temporary and casual work was not fully recorded.

The key employment studies can be summarised to show the employment effects of forestry and farming. The table below collates the data for these studies and it shows how they have taken different approaches to measuring employment. Note that the table includes studies that have had different purposes and measure different things. For example, the Australian study excludes processing employment while most of the other studies include processing. Therefore it cannot be used to compare formally the different studies. However, the compilation of results does provide an indication of the range of possibilities, and it is therefore possible to make some general observations in the absence of any other source of information. The first observation is that, generally, the on-land employment from forestry has to date been estimated to be higher than the on-land employment from farming. The second observation is that the ratio of total employment (on land, processing and indirect but not induced) to on-land employment for both farming and forestry is similar at about three to one. The third observation is that for the two studies which separate it out, forestry processing employs about the same as the on-land employment. Total employment from forestry is estimated to be between three and ten times higher than farming, depending on the type of farming and its location.

FTEs per 1,000 hectares

Activity	Study	On-land	Processing	Indirect	Total
Farming	Wairoa	2.6	0.5	1.4	4.5
	Mackenzie	0.4		0.6	1.0
	Vict., Australia	2.4		6.6	9.0
Forestry	Wairoa	9.4	7.7	6.2	23.3
	Mackenzie	5.2	4-10		9.2-15.2
	Vict., Australia	8.7		24.3	33.0

Maclaren's text on the effects of plantation forestry suggests an approach to employment research that would be a departure from the studies to date. Census data could be linked to land use data to report farming and forestry employment per 1,000 hectares. Further, these data can be analysed over time and by region in order to compare employment in each sector. This approach can only represent changes to date and when future technological developments alter the employment potentials then the historic data are not an accurate indicator of future developments. Further, census data may not accurately reflect all forestry employment, particularly part time or seasonal work. However, this approach could be useful in informing us as to what has happened and it can document actual changes more accurately than relying solely upon reports from people who observe rural change.

In this report we have extended the method mentioned by Maclaren. The results are drawn from analysis of census data, and from agricultural and forestry statistics. They therefore complement the previous input-output studies. One advantage of the approach is that it enables us to compare national, regional and district patterns. We are also able to utilise recent inventories of land use and land cover, which strengthens the analysis significantly. One disadvantage of census data is that they do not necessarily include seasonal workers, that is, workers surveyed in March may not report that they work in the forestry sector in planting and silviculture which usually occurs in winter, a point emphasised by Wall and Cocklin (1993). However, agriculture (including horticulture) has seasonal work at times other than March so there is likely to be under-reporting of employment in agriculture too. In fact, given that the agricultural workforce (120,234 in 1996, see Table 8) is much larger than the forestry workforce (8,091 in 1996), it is likely that the agricultural data suffer from significant under-reporting.

Some assumptions and judgements over classifications were needed, nonetheless. The common measure of employment used was full time equivalents (FTE). We treated all part time employment as 0.5 FTE. The categories of 'on-land' employment and 'processing' employment were combined to calculate total employment. On-land agriculture includes the census categories of 'agriculture' and 'services to agriculture'; processing includes 'processing' and 'manufacturing'. On-land forestry includes 'forestry', 'logging' and 'services to forestry'; processing forestry includes 'processing' and 'manufacturing'. Note that logging refers to moving logs within the forest. Both log and livestock transport are classified in 1996 within a generic 'road freight transport' category so it was impossible to include this element of employment in the data. 'Services to forestry' includes provision of planting, fire fighting, nurseries, pest control, reforestation, plantation maintenance, pruning and thinning and conservation services. Consultants involved with log sales and provision of advice are more likely to be classified as business management services elsewhere in the industry classification. However, the total number of these people is likely to be in the order of hundreds and therefore unlikely to affect the results of this analysis.

Appendix 1 shows concordances for the New Zealand Standard Industrial Classification for 1986, 1991 and 1996 and gives detailed information about the industries categorised as on-land or processing. For the regional analysis of FTEs, data were obtained from Statistics New Zealand at the level of the territorial authority in order to amalgamate these to the Wood Supply Region boundaries used by MoF (which are different from the regional council authority areas).

The main unit of analysis was FTEs/1,000 ha. This is admittedly a crude measure of the relationship between land use and employment. Land uses within agriculture in particular have widely different intensities ranging from high country pastoralism to horticulture, for example. However, the ratio gives a very general indication of the on-land and processing employment that derives from each industry. One problem with this unit of measurement is that it does not take into account the maturity of a forest, which is a key factor in employment generation. Most agricultural production follows an annual cycle, and hence once land use is established the rate of employment per hectare is relatively constant (all other things being equal). In forestry, the crop goes through a 25-30 year cycle, and only reaches a 'steady state' of employment, at a district or regional level, once the first planting reaches maturity and is logged and replanted. Even then, an uneven age structure will result in cyclical employment patterns. Hence for regions where there has been a rapid increase in the planted area there may be little processing employment compared to a more mature region with no increase in planted area but an increase in wood available for harvest and processing. The region with a static area may have a major increase in employment while the region with increased planted area may have static employment. This would have the effect of lowering the FTEs/1,000 hectares. The contrast between the Central North Island and the East Coast is illustrative here: the former has an area-weighted average age of 14.2 years while the latter has an area-weighted average age of 10.26 years (Ministry of Agriculture and Forestry, 1999). The analysis undertaken here is therefore only a 'first cut'. Future research might usefully compare census statistics on FTEs in relation to the reported age class of the forests. This would add significant power to the overall analysis, but would also increase its complexity yet further.

Chapter 3 Results

3.1 Introduction

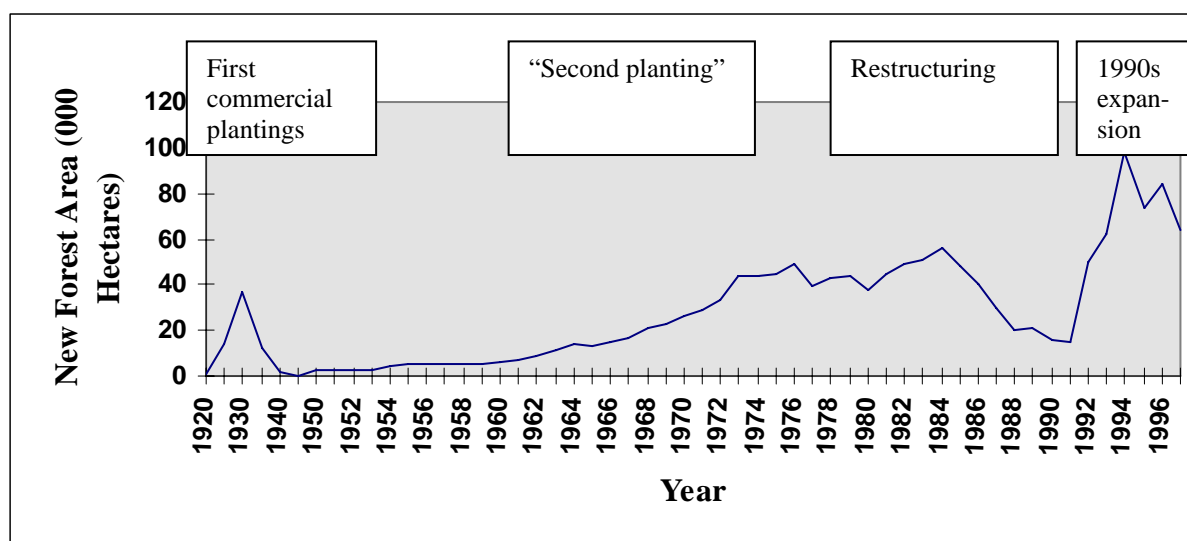
This chapter presents a statistical perspective on the New Zealand forestry industry both nationally and regionally, from which to assess the specific employment effects compared to agriculture. There are a number of stages in the analysis of forestry and agricultural employment data. The first is a general account of the expansion of the forest sector and a description of the national forest estate in terms of area, new planting area and ownership. The second is an analysis of regional variation in area, volume and type of forest in order to identify the dominant and less dominant Wood Supply Regions. The third is a comparison of forestry and agriculture employment. The analysis also examines details of on-land versus processing employment, by Wood Supply Region.

3.2 An Overview of Forest Sector Expansion

The origins of commercial forestry in New Zealand date back to the late nineteenth century. It is not the purpose nor intent of this discussion to cover this 'history'. Rather, the focus here is on New Zealand forestry during the last four decades, as it is this specific period that needs to be understood in broad terms in order to understand the statistics that follow.

Modern commercial forestry in New Zealand can be divided into three phases (Ministry of Forestry, 1993c): the 1960s to 1986, 1986 to 1991, and post 1991. Figure 2 shows the new forest area in New Zealand from 1920 to 1997, and the three phases of modern forestry can be identified by the changes in the forest area planted.

Figure 2: New Forest Area in New Zealand, 1920 - 1997



Source: MAF 1999:24.

The first stage of modern forestry was characterised by large scale replanting of commercial forests after the harvesting of the first commercial plots planted during the 1920s and 1930s. Hence this first phase became known as the period of “Second Planting”, and was a response to an accelerated demand for timber, especially from overseas markets. Replanting occurred in both established forest areas (recently harvested) and in new lands acquired by both private companies and the government, through the New Zealand Forest Service. Between 1965 and 1975 new area plantings increased from 14,000 hectares per year to 44,000, then peaked at 54,000 ha/year in 1985. In addition, the replanting of existing forest land continued during this “Second Planting” at a rate between 15 and 20,000 ha/year.

The second phase of modern forestry in New Zealand began in 1986 with a change in the taxation regime that abolished previous tax policies that encouraged commercial forestry. This decreased interest in the industry and deterred new planting by forest companies and farmers. A second factor in the decline in forestry was the state’s withdrawal from forest ownership through the abolition of the New Zealand Forest Service on 1 April 1987, and the sale of its production forests to commercial interests. This resulted in over 70 per cent of New Zealand’s forests being owned by two companies (Carter Holt Harvey and Fletcher Challenge), with the remainder owned by other private companies, individuals, and Maori trusts. Table 1 shows the current distribution of forest area by different ownership categories.

Table 1: Forest Ownership in New Zealand, 1998

Ownership category	Total Area (Hectares)	Percentage
Individual	28,223	1.7
Partnership	124,392	7.4
Central Government	54,605	3.3
State Owned Enterprise	53,815	3.2
Local Government Body	56,551	3.4
Trusts (including Maori trusts)	22,565	1.3
Registered Private Company	290,568	17.3
Registered Public Company	787,684	46.9
Unknown Ownership	260,540	15.5
New Zealand Total	1,678,943	100

Source: MAF 1999:26.

Nearly half (46.9 per cent) of New Zealand’s total forest area is owned by public companies, as shown in Table 1. Registered private companies is the second largest category with 17.3 per cent of forest ownership. The third biggest category, that of ‘unknown ownership’, comprises plantations of less than 100 hectares and would primarily fit into the categories of individual, partnership, and registered private companies. Consequently, these three categories are underestimated in Table 1. One should also note the relatively small involvement of central and local government in contemporary forest ownership, a dramatic change from the early dominance of the New Zealand Forest Service.

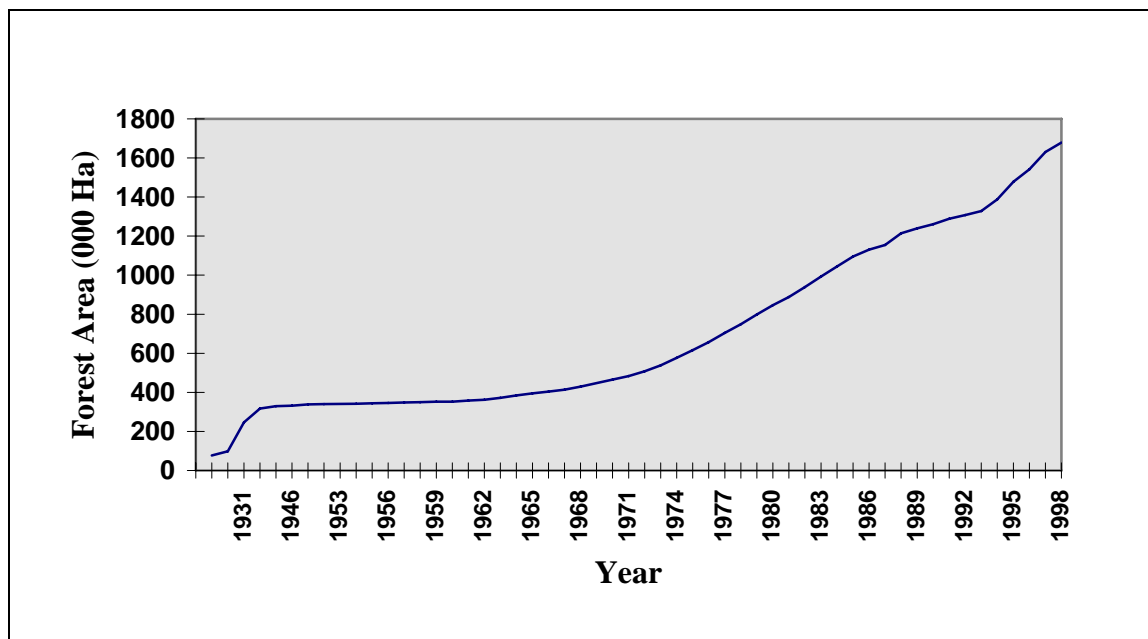
The third and current phase began in 1991 in response to changes in taxation and to a major prices ‘spike’ for logs in the international market (which was itself related to environmental issues on North America). It also coincided with the introduction of the Resource Management Act (1991) which consolidated a wide range of previous environmental management statutes, and established a new approach to rural land planning. The fundamental shift was away from land use zoning (which had tended to favour agriculture

over forestry), to a regime based on the assessment and management of the effects of land use. Thus in principle each forestry proposal should be judged on its demonstrated and likely effects, rather than by a ‘blanket’ decision of the ‘best’ use of the land. In practice, there has been a long period of transition, and forestry still attracts significant restrictions in some areas. In most locations, however, the effect of the RMA has been to open up new land use possibilities. These new and more liberal possibilities were further enabled by local government re-structuring, beginning in 1989, which led to a broader representation on planning authorities than the traditional and previously dominant agricultural sector, which had tended to display ‘anti-forestry’ sentiments in many district schemes (Fowler and Meister, 1983). In addition, rural de-population and de-employment trends, and new attitudes to forestry ownership also served to encourage new forest development in the 1990s. As in the 1960s, this current impetus has been sparked by increased international demand for timber, and the consequent higher returns from forestry investment and development.

Two years into this third phase, in 1993, the forestry industry in New Zealand had become a significant sector of the national economy. Forestry was New Zealand’s third largest export earner, following only the country’s two traditional primary exports, meat and dairy products. At this point forestry exports totalled some \$2 billion per year, or ten per cent of New Zealand’s total export earnings. In terms of volume, the forestry industry exported ten million cubic metres per year. This substantial activity directly employed 28,000 people and contributed six per cent of New Zealand’s total Gross Domestic Product (New Zealand Official Yearbook, 1993).

The net effect of gains in forest area over the three phases of modern forestry has resulted in a steady increase over time in the total forest area. Figure 3 shows this increase in forest area.

Figure 3: Total Forest Area in New Zealand, 1931 - 1998



Source: MAF 1999:25.

The forestry industry is likely to grow even further in the new millennium. The trees planted in the “Second Planting” of the 1960s are now at maturation age and ready for harvest. A

good distribution of tree ages means that this ‘boom’ should be sustained until the current plantings (i.e., those undertaken during the 1990s) reach maturity from 2020. The United Nations Food and Agriculture Organisation (FAO) estimates that world wide demand for timber will increase in future, suggesting that New Zealand timber exports should increase as importing countries look to fulfil their timber requirements.

3.3 A Regional Geography of the New Zealand Forestry Industry

For the purposes of its forestry statistics the Ministry of Agriculture and Forestry (MAF) divides New Zealand into ten “Wood Supply Regions”, or WSRs. These coincide with local statistical areas used by Statistics New Zealand in their compilation of census data. These wood supply regions are, however, not congruent with other internal administrative boundaries, such as Regional Councils. For the purposes of this study MAF’s ten WSRs are employed as the ‘regional’ units of analysis, and in some cases have been re-named for convenience. The ten Wood Supply Regions used in the collation of this data are identified in Table 2.

Table 2 provides recent statistics on the total area and standing volume of the exotic forests in each of the ten Wood Supply Regions. These values are also presented as a percentage of the New Zealand total area, and percentage of total standing volume. The Central North Island WSR is the dominant region in terms of both area and volume, with one-third of the total area and more than 40 per cent of the total volume. The Northland, Northern South Island, and Southern South Island WSRs form a second tier category, while the East Coast, Hawke’s Bay, Southern North Island, and Canterbury WSRs form a third tier group. The Auckland and West Coast WSRs are the two least important and form a category of their own. Overall, the North Island WSRs account, from a national perspective, for approximately 75% of the total.

Table 2: Area and Volume Characteristics of Exotic Forest by Wood Supply Region

Wood Supply Region (WSR)	Total Area (Hectares)	Percentage Total Area	Standing Volume (000m3)	Percentage Total Volume
Northland	191,302	11.3	45,508	13.5
Auckland	53,412	3.2	10,953	3.2
Central NI	559,719	33.3	141,772	42.0
East Coast	138,829	8.3	19,478	5.8
Hawke's Bay	119,198	7.1	22,093	6.5
Southern NI	137,387	8.2	22,991	6.8
NI Total	1,199,847	71.4	262,793	77.8
Northern SI	167,231	10	29,574	8.8
West Coast	32,607	1.9	4,859	1.4
Canterbury	107,960	6.4	15,480	4.6
Southern SI	171,298	10.3	24,914	7.4
SI Total	479,096	28.6	74,826	22.2
NZ Total	1,678,943	100	337,619	100

Source: MAF 1999:32-33; figures as at 1 April 1998.

Table 3 provides more detailed statistical information by Wood Supply Region, showing each region’s forest area by the four main species of commercial exotic plantation. Radiata Pine is by far the most dominant tree species, comprising 90.5 per cent of New Zealand’s total exotic forest area. Douglas-fir, Other Softwoods, and Hardwoods are, in comparison, rather small

categories of tree species. There is little variation between WSR in this national pattern, with all ten regions showing a considerable dominance of Radiata Pine of 75 per cent or more. The most diversified WSR is the Southern South Island, with major planting of both Douglas-fir and hardwoods. Data on recent plantings show that in 1999, 72 per cent of plantings were radiata pine, down from 91 per cent in 1992 (Trost, pers. comm.). In 1999, 19 per cent of seedling sales were Douglas-fir, up from three per cent in 1992. The planting of Douglas-fir tends to be on new sites while the majority of the radiata is used for replanting. Thus the area in Douglas-fir is rising rapidly in regions such as Southland.

Table 3: Species – Area Characteristics of Exotic Forest by Wood Supply Region

Wood Supply Region (WSR)	Radiata Pine (Ha)	Douglas-fir (Ha)	Other Softwoods (Ha)	Hardwoods (Ha)	Total Area (Ha)
Northland	187,952	0	624	2,726	191,302
Auckland	51,317	6	1,002	1,087	53,412
Central NI	507,059	25,027	5,614	22,019	559,719
East Coast	134,162	2,390	1,547	730	138,829
Hawke's Bay	112,472	3,228	1,667	1,831	119,198
Southern NI	131,854	2,041	1,830	1,662	137,387
NI Total	1,124,816	32,692	12,284	30,055	1,199,847
Northern SI	150,052	12,837	3,091	1,251	167,231
West Coast	26,567	551	2,709	2,780	32,607
Canterbury	90,195	9,205	7,194	1,366	107,960
Southern SI	128,522	25,445	6,366	10,965	171,298
SI Total	395,336	48,038	19,360	16,362	479,096
NZ Total	1,520,152	80,730	31,644	46,417	1,678,943

Source: MAF 1999:38-45; figures as at 1 April 1998.

Table 4 shows the forest area in each age category by Wood Supply Region. These data show the dramatic increase in forest planting commencing in the 1960s, so that the great majority of the total area planted comprises trees aged between one and thirty. These age classes include over 97 per cent of the total area. The sudden drop in area from 25 years on fits not only the time elapsed since the beginning of the “Second Planting”, but also the maturation age of New Zealand’s radiata plantations, of between 25 and 30 years. A small amount of old (41 - 50 years) and very old (51+ years) trees persist, and are usually areas planted not for commercial forest purposes but for land stabilisation or aesthetic reasons, and hence are not usually harvested. In future the area of older trees will increase slightly, as the larger rotation species planting in recent years approach maturity (e.g. Douglas-fir and hardwoods), although against this trend is the fact that some of these hardwoods are grown for short-rotation fibre rather than sawn timber. The age table also shows where much of the recent new plantings have occurred, with the East Coast, Hawke’s Bay, Southern North Island, Canterbury and Southern South Island all having half or more of their planted area under ten years old.

Table 4: Forest Area by Age Group by Wood Supply Region

Wood Supply Region (WSR)	1 - 10 years	11 - 20 years	21 - 30 years	31 - 40 years	41 - 50 years	51+ years
Northland	69,075	85,346	35,272	1,239	202	168
Auckland	23,128	17,019	12,311	367	245	342
Central NI	211,339	199,479	134,781	8,302	1,553	4,265
East Coast	87,160	37,055	12,597	1,886	68	63
Hawke's Bay	60,000	32,801	23,399	2,120	774	104
Southern NI	83,291	33,069	17,209	3,152	458	208
NI Total	533,993	404,769	235,569	17,066	3,300	5,150
Northern SI	70,984	52,840	39,866	2,934	309	298
West Coast	10,818	13,284	7,645	548	41	271
Canterbury	51,821	32,300	18,577	2,812	802	1,648
Southern SI	87,262	47,635	31,384	3,152	1,021	844
SI Total	220,885	146,059	97,472	9,446	2,173	3,061
NZ Total	754,878	550,828	333,041	26,512	5,473	8,211

Source: MAF 1999:34-35; figures as at 1 April 1998.

3.4 Comparing Forestry and Agriculture Employment: A National Perspective

The census figures published by Statistics New Zealand break down employment into categories. Table 5 shows total New Zealand employment in full time equivalents (FTEs) in both forestry and agriculture for 1986, 1991 and 1996. The employment figures are total FTEs, that is, they include both on-land and processing employment. The table also shows the number of FTEs per 1,000 hectares of land used in that industry.

The first point to note is the declining employment in both forestry and agriculture. From 1986 to 1996 total employment in forestry decreased by 26 per cent and in agriculture by 16 per cent. The combined total FTE decreased by 38,007 or 17 per cent of the 1986 total, and the total FTE for processing employment shows most of the overall decline was in that category (-31 per cent) rather than on-land employment (-11 per cent). Also, most of the total FTE decrease was in the first part of the period, between 1986 and 1991, for both forestry and agriculture, but forestry declined twice as much (36 per cent) as agriculture (15 per cent). In the second part of the period agricultural employment continued to decline, but forestry employment increased, no doubt reflecting the dramatic increase in plantings in the early 1990s. These employment patterns are consistent with data from the Household Labour Force Survey which show an 11 per cent decrease in primary production between 1986 and 1997 which amounted to 18,750 persons. Generally, the New Zealand economy now has fewer people employed in primary production and manufacturing and significantly more people employed in 'distribution', 'business services' and 'other services'.

Table 5 also indicates the relative size of the forestry and agriculture industries. For 1986, 1991 and 1996 employment in forestry is around 14 per cent of the combined total, while employment in agriculture is around 86 per cent of the combined total. The overall dominance of agriculture, and the decrease from 50,511 to 34,431 in processing agricultural employment accounts for much of the overall decline in processing employment. Presumably, this decrease has been significantly contributed to by restructuring in the freezing industry. Also notable is the significant absolute decline in total forestry employment, down by 8,973 persons between 1986 and 1996, despite an overall increase in

planted area. Clearly, there were many job losses in the 1980s, which have not been replaced during the replanting of the early 1990s.

The distribution of employment between on-land and processing categories shows that forestry has most of its employment in the processing category (65 per cent in 1996) and agriculture has most of its employment in the on-land category (78 per cent in 1996). Over time, both forestry and agriculture show a very slight increase in the proportion of employment in the on-land category. This possibly reflects the greater effect of economic restructuring in the economy as a whole on processing employment, where declining profitability leads directly to job losses, whereas in on-land employment, the dominance of family farms in New Zealand means that declines in profitability show up more in lower incomes.

Table 5: Employment in Forestry and Agriculture, 1986-1996

Empl. Category	Census Year	Forestry Industry				Agricultural Industry				Total FTE
		Total FTE	% Total Forestry	% Total Overall	FTE/1,000 ha	Total FTE	% Total Agriculture	% Total Overall	FTE/1,000 ha	
On-land	1986	11,253	33		9.9	133,188	73		7	144,441
	1991	5,568	25		4.8	117,531	75		7	123,099
	1996	8,901	35		5.5	120,234	78		8	129,135
	% change 1986-96	-21			-44	-10			23	-11
Processing	1986	22,929	67		20.2	50,511	27		3	73,440
	1991	16,458	75		14.1	38,700	25		2	55,158
	1996	16,308	65		10.1	34,431	22		2	50,739
	% change 1986-96	-29			-50	-32			-8	-31
Total	1986	34,182	100	16	30.2	183,699	100	84	9	217,881
	1991	22,026	100	12	18.9	156,231	100	88	10	178,257
	1996	25,209	100	14	15.6	154,665	100	86	10	179,874
	% change 1986-96	-26			-48	-16			14	-17

Sources: Census, Agricultural Statistics and National Exotic Forest Description.

Notes: 1. On-land forestry employment includes the NZSIC categories of forestry, logging and services to forestry and processing forestry includes processing and manufacturing (see Appendix 1).

2. On-land agricultural employment includes all types of farming and horticulture and processing agriculture includes all primary product processing (see Appendix 1).

Finally, we can examine employment per unit area. Looking at total FTEs/1,000 hectares, Table 5 shows that forestry employs more people than agriculture for each 1,000 hectares in production but that this declined rapidly by nearly 50 per cent, from 30 in 1986 to 16 in 1996. In contrast, employment per unit area in agriculture has increased slightly (+14 per cent) to ten FTEs/1,000 hectares in 1996. Further, most of the forestry FTEs/1,000 hectares is in processing employment, while for agriculture, most of the FTEs/1,000 hectares are in on-land employment.

These results provide a somewhat different picture from those reported in Chapter 1, where earlier studies estimated on-land forest employment per 1,000 hectares at a higher level than agriculture. What appears to have happened is that while on-land agriculture employment per unit area increased slightly between 1986 and 1996 (probably reflecting intensification and diversification of pastoral units into dairying and horticulture), on-land forestry employment per unit area dropped dramatically (presumably as a consequence of NZFS corporatisation and the sale of forests).

3.5 Comparing Forestry and Agriculture Employment: A Regional Perspective

Having established an overview for New Zealand employment in forestry and agriculture we move now to some regional comparisons. Table 6 shows total FTEs employed in forestry and agriculture for 1986, 1991 and 1996 by Wood Supply Region (WSR). The ordering of WSRs by size of forest (see earlier) does not correspond to the order determined by size of FTE as a proportion of the total. The combined total FTE for forestry and agriculture shows high levels (more than ten per cent of the total) in Auckland, Central North Island, Southern North Island (which includes Wellington), Canterbury and Southern South Island. Thus, the presence of a major centre, or in the case of Central North Island the presence of ‘forestry towns’, is associated with concentrations of employment in forestry and agriculture. This particularly reflects the importance of processing employment in the totals, as it is largely located in or close to urban centres. The trend for field workers living in towns to travel to forests on a daily or weekly basis, and the centralisation of management and support services, may also contribute to this concentration of employment.

The data showing change over time generally record decreases in FTEs in forestry (that is, the national pattern) with Auckland, Central North Island and West Coast all having large decreases. Hawkes Bay and Northern South Island have slightly increased FTEs, while East Coast and Southern North Island have slightly decreased FTEs. Total FTEs in agriculture generally have declined, especially for the East Coast (37 per cent), but have increased for Northern South Island and there has been a modest decrease for the West Coast (4.5 per cent). The Northern South Island has gained employment in both forestry and agriculture. A later table will examine changes in employment (on-land versus processing) but we note now that in the Northern South Island there has been an increase in processing employment in forestry, contrary to the national trend, and a small increase in on-land employment in agriculture. These changes reflect growth in forestry processing and in horticulture, most probably in grape growing.

In terms of the balance of employment between forestry and agriculture, Central North Island and West Coast have about one third of combined FTEs engaged in forestry while about two thirds were engaged in agriculture. The high level for the West Coast reflects the continuing dominance during the study period of state-owned and managed forests, and the particular conditions associated with the management of an indigenous forest estate. All the other regions have smaller forestry sectors, roughly at around 14 per cent of total employment. The Central North Island and West Coast also have large declines in FTEs suggesting that these two regions have undergone major employment losses due to restructuring.

Table 6: Employment in Forestry and Agriculture by Wood Supply Region, 1986-1996

Wood Supply Region	Year	Forestry Industry				Agricultural Industry				Combined	
		Total FTE	% Total	Area (Ha)	FTE/1000 Ha	Total FTE	% Total	Area (Ha)	FTE/1000 Ha	Total FTE	%NZ Total
N'land	1986	1,791	11	119,592	15	14,583	89	1,154,153	13	16,374	7.5
	1991	1,116	8	103,319	11	12,117	92	1,026,980	12	13,233	7.4
	1996	1,530	11	150,402	10	11,931	89	929,249	13	13,461	7.5
	%	-15	0	34	-36	-18	0	-19	2	-18	0
A'land	1986	6,171	17	38,724	159	30,069	83	940,244	32	36,240	16.6
	1991	3,840	14	59,816	64	24,363	86	851,526	29	28,203	15.8
	1996	4,050	14	80,132	51	24,174	86	714,038	34	28,224	15.7
	%	-34	-3	125	-71	-20	3	-24	6	-22	-0.9
Cent NI	1986	14,544	34	476,718	31	27,624	66	2,332,656	12	42,168	19.4
	1991	9,330	29	497,464	19	23,241	71	1,742,335	13	32,571	18.3
	1996	9,024	28	534,772	17	22,926	72	2,002,136	12	31,950	17.8
	%	-38	-6	15	-46	-17	6	-14	-3	-24	-1.6
E Coast	1986	621	11	57,874	11	5,217	89	670,649	8	5,838	2.7
	1991	186	5	68,290	3	3,756	95	618,409	6	3,942	2.2
	1996	594	15	129,125	5	3,273	85	671,922	5	3,867	2.1
	%	-4.3	4	139	-60	-37	-4	0	-37	-34	-0.6
H Bay	1986	1,137	7	63,007	18	15,228	93	1,069,465	14	16,365	7.5
	1991	879	6	67,563	13	12,816	94	917,727	14	13,695	7.7
	1996	1,215	9	103,101	12	12,528	91	891,836	14	13,743	7.6
	%	6.9	2	72	-38	-18	-2	-17	-1	-16	0.1
S NI	1986	2,709	8	73,577	37	33,045	92	2,696,100	12	35,754	16.4
	1991	1,644	6	56,082	29	27,672	94	2,298,599	12	29,316	16.4
	1996	2,676	9	111,539	24	26,841	91	2,001,059	13	29,517	16.4
	%	-1.2	1	65	-40	-19	-1	-26	9	-17	0
N SI	1986	1,557	15	117,047	13	8,577	85	1,560,677	6	10,134	4.7
	1991	1,290	14	123,766	10	8,235	86	1,102,360	8	9,525	5.3
	1996	1,662	15	153,867	11	9,147	85	1,050,805	9	10,809	6
	%	6.7	0	36	-22	6.6	0	-33	58	6.7	1.3
W Coast	1986	1,134	39	26,095	44	1,794	61	1,771,147	10	2,928	1.3
	1991	678	31	27,147	25	1,542	69	415,472	4	2,220	1.2
	1996	732	30	30,032	24	1,713	70	342,367	5	2,445	1.4
	%	-35	-9	14	-44	-4.5	9	-81	-50	-16	0.1
C'bury	1986	2,526	10	62,406	40	22,659	90	3,295,096	7	25,185	11.6
	1991	1,668	8	61,728	27	20,022	92	3,021,469	7	21,690	12.2
	1996	1,896	8	94,784	20	20,781	92	2,594,818	8	22,677	12.6
	%	-25	-2	62	-53	-8.3	2	-21	16	-10	1
S SI	1986	1,992	7	97,982	20	24,903	93	4,690,676	5	26,895	12.3
	1991	1,395	6	102,371	14	22,470	94	4,126,390	5	23,865	13.4
	1996	1,830	8	154,512	12	21,351	92	3,665,667	6	23,181	12.9
	%	-8.1	1	68	-45	-14	-1	-22	9	-14	0.6
Total	1986	34,182	16	1,133,022	30	183,699	84	20,180,863	9	217,881	100
	1991	22,026	12	1,167,546	19	156,231	88	16,121,267	10	178,257	100
	1996	25,209	14	1,542,266	16	154,665	86	14,863,897	10	179,874	100
	%	-26	-2	43	-48	-16	2	-26	14	-17	0

Source: Census, Agricultural Statistics and National Exotic Forest Description.

Note: These data are based on the ANZSIC level 5 for 1996 and this was applied retrospectively to the NZSIC87, level 5, and NZSIC75, level 5 at the level of the territorial authority to ensure a consistent basis to the classification. See Appendix 1 for concordances.

Of the five regions which dominate in terms of combined total FTEs for forestry and agriculture, the FTEs/1,000 hectares for forestry is much higher than the national figure (16) for Auckland (51), West Coast (24) and Canterbury (20), while for Central North Island (17) the FTEs/1,000 hectares is very similar to the New Zealand figure. These four regions have

well-established wood processing industries which enlarges the number of FTEs associated with the forest area. Also, for the five dominant regions the FTEs/1,000 hectares for forestry exceeds the FTEs/1,000 hectares for agriculture by a factor of at least three. In contrast to the five dominant regions, there is a group of regions with FTEs/1,000 hectares at lower than the national average (16) including: Northland (10), East Coast (5), Hawkes Bay (12) and Northern South Island (11). For all of these WSR's, except for Northern South Island, the low FTEs/1,000 hectares is matched by the FTEs/1,000 hectares for agriculture. For Northern South Island, the agriculture FTE is lower than the forestry FTEs/1,000 ha. Generally then, these are regions which have about 10-15 per cent of total employment in forestry and 85-90 percent in agriculture but generate roughly equivalent employment per hectare of land use.

The one remaining region not described in the above terms is the West Coast. Its combined total employment share for forestry and agriculture is the lowest of all regions of New Zealand. However, forestry is most dominant, including 30 per cent of total primary industry employment in 1996, the highest in New Zealand. The FTEs/1,000 hectares is second only to Auckland, clearly exceeding the agriculture FTEs/1,000 hectares. These data no doubt reflect the continuing dominance during the study period of state-owned and managed forests. There would have been considerable employment in indigenous forests which have not been included in the forest areas reported here, since the data are based on the national exotic forest description.

Table 7 shows the size of the on-land and the processing employment in forestry for 1996. The simplest method of analysis is to compare the regional figure with the national figure. Northland, East Coast, Northern South Island and West Coast all have forestry with high levels of on-land employment. This largely reflects the expansion of new plantings during the study period, although as noted above, the West Coast is something of a special case. The processing employment shows Auckland and Canterbury to exceed the national level, with Central North Island, Hawkes Bay, Southern North Island and Southern South Island to be very similar to the national level.

Another way to examine the regional data is to focus on employment generated by on-land and processing activity respectively. Tables 8 and 9 show these data, by region, for forestry and agriculture and for 1986 to 1996. For New Zealand as a whole there has been a 21 per cent decline in on-land forestry employment while the area in forestry has increased by 43 per cent. The regional analysis shows that for on-land forestry employment, Central North Island closely tracks the national trend, as would be expected given its dominance, but that there is significant variation around this trend in some of the other regions. Southern North Island records the only absolute increase in on-land employment, although Northern South Island is also unusual with only a modest 4.2 per cent decline, compared with the national average of 21 per cent.

Table 7: On-land and Processing Forestry Employment by Wood Supply Region, 1996

Forestry Industry Sub-Category	Northland	Auckland	Central NI	East Coast	Hawke's Bay	
On-land FTE	738 48 %	513 13 %	3,417 38 %	384 65 %	438 36 %	
Processing FTE	792 52 %	3,537 87 %	5,607 62 %	210 35 %	777 64 %	
Total FTE	1,530	4,050	9,024	594	1,215	
Forestry Industry Sub-Category	Southern NI	Northern SI	West Coast	Canterbury	Southern SI	WSR Total
On-land FTE	906 34 %	831 50 %	429 59 %	552 29 %	693 38 %	8,901 35 %
Processing FTE	1,770 66 %	831 50 %	303 41 %	1,344 71 %	1,137 62 %	16,308 65 %
Total FTE	2,676	1,662	732	1,896	1,830	25,209

Source: Census.

Also, for New Zealand as a whole, on-land FTEs/1,000 hectares were broadly similar for forestry and agriculture, although over time forestry has decreased significantly while agriculture has increased slightly. Auckland and East Coast both demonstrate much higher than average declines in FTEs/1,000 hectares. In Auckland the figure drops 64 per cent from a particularly high figure in 1986 (16.3 FTEs/1,000 hectares compared with the national average of 9.9 FTEs/1,000 hectares), to come close to the average in 1996 (5.9 FTEs/1,000 hectares vs. 5.5 FTEs/1,000 hectares). For the East Coast, however, the particular focus of this overall study, employment per 1,000 hectares also drops significantly (67 per cent) but does so from a figure close to the national average in 1986 (8.3 FTEs/1,000 hectares vs. 9.9 FTEs/1,000 hectares) to only 2.7 FTEs/1,000 hectares in 1996 (half the national average). East Coast also shows the highest percentage increase in planted area in the whole country going from 57,874 hectares to 138,248 hectares, a gain of 139 per cent.

One other region stands out markedly from the national profile. Although the trends are similar over the study period, West Coast records much higher than average FTEs per 1,000 hectares throughout, still at 14.4 FTEs/1,000 hectares in 1996.

Turning to the agriculture on-land employment for New Zealand as a whole there has been a modest decrease in employment of 9.7 per cent and a decline in area of 26 per cent. East Coast and West Coast again stand out as markedly different. East Coast is the only region that does not show a significant decrease in land in agricultural production over the study period. This is despite having the largest relative increase and one of the largest absolute increases in forest land in the country. The static agricultural land area combined with the increased forestry area suggests that if land was being converted from agriculture to forestry, then other land was taken into agriculture at the same rate. East Coast is also the only region in which on-land agriculture FTE/1,000 hectares declined (by 20 per cent) over the period, showing relatively less intensification and diversification than elsewhere.

The West Coast is unique in its profile, with a dramatic decline in land in agricultural production, with only a modest absolute decline in FTEs, and hence a dramatic percentage

increase in FTEs/1,000 hectares. This only serves to bring the region closer to the national average, however. The absolute increases in FTEs in Hawkes Bay and Northern South Island are also notable, probably corresponding to intensification in viticulture and horticulture.

Turning to the processing employment by region, for New Zealand as a whole, processing FTEs/1,000 hectares was about five times higher for forestry compared to agriculture in 1996, although in 1986 it was about eight times higher. Table 9 shows Northland, East Coast and Northern South Island to have particularly low FTEs/1,000 hectare compared with the national average, although they all also show absolute increases in FTEs over the study period (as does Hawkes Bay), compared to an overall national decline. The low figure per unit area reflects the relative immaturity of the forest estate, although the absolute increases show the effects of the earlier expansion during the 1960s and 1970s. Processing agriculture FTEs/1,000 hectares are markedly lower than the national figure for East Coast and West Coast. East Coast also shows the most dramatic decline over the study period, losing nearly 70 per cent of the processing jobs.

Table 8: On-land Employment in Forestry and Agriculture by Wood Supply Region, 1986-1996

Wood Supply Region	Year	Forestry Industry				Agricultural Industry				Combined Total	
		FTE	% Total	Area (Ha)	FTE/1000Ha	FTE	% Total	Area (Ha)	FTE/1000Ha	FTE	% NZ Total
N'land	1986	1,032	8	119,592	8.6	12,426	92	1,154,153	10.8	13,458	9.3
	1991	489	4	103,319	4.7	10,584	96	1,026,980	10.3	11,073	9.0
	1996	738	6	159,973	4.6	10,623	94	929,249	11.4	11,361	8.8
	%	-28	-2	34	-47	-15	2	-19	6	-16	-0.5
A'land	1986	630	3	38,724	16.3	20,403	97	940,244	21.7	21,033	14.6
	1991	252	1	59,816	4.2	17,415	99	851,526	20.5	17,667	14.4
	1996	513	3	87,272	5.9	17,259	97	714,038	24.2	17,772	13.8
	%	-19	0	125	-64	-15	0	-24	12	-16	-0.8
Cent NI	1986	4,704	17	476,718	9.9	23,403	83	2,332,656	10	28,107	19.5
	1991	2,697	12	497,464	5.4	19,467	88	1,742,335	11.2	22,164	18.0
	1996	3,417	15	549,552	6.2	19,302	85	2,002,136	9.6	22,719	17.6
	%	-27	-2	15	-37	-18	2	-14	-4	-19	-1.9
E. Coast	1986	483	12	57,874	8.3	3,453	88	670,649	5.1	3,936	2.7
	1991	150	5	68,290	2.2	2,676	95	618,409	4.3	2,826	2.3
	1996	384	12	138,248	2.7	2,733	88	671,922	4.1	3,117	2.4
	%	-20	0	139	-67	-21	0	0	-20	-21	-0.3
H Bay	1986	510	6	63,007	8.1	8,610	94	1,069,465	8.1	9,120	6.3
	1991	201	2	67,563	3	8,061	98	917,727	8.8	8,262	6.7
	1996	438	5	108,606	4	9,150	95	891,836	10.3	9,588	7.4
	%	-14	-1	72	-51	6.3	1	-17	27	5	1.1
S NI	1986	903	4	73,577	12.3	24,279	96	2,696,100	9	25,182	17.4
	1991	354	2	56,082	6.3	21,183	98	2,298,599	9.2	21,537	17.5
	1996	906	4	121,395	7.5	20,847	96	2,001,059	10.4	21,753	16.8
	%	0.3	0	65	-39	-14	0	-26	16	-14	-0.6
N SI	1986	867	11	117,047	7.4	7,230	89	1,560,677	4.6	8,097	5.6
	1991	438	6	123,766	3.5	7,089	94	1,102,360	6.4	7,527	6.1
	1996	831	10	159,762	5.2	7,848	90	1,050,805	7.5	8,679	6.7
	%	-4.2	-1	36	-30	8.5	1	-33	63	7	1.1
W Coast	1986	522	26	26,095	20	1,512	74	1,771,147	0.9	2,034	1.4
	1991	327	20	27,147	12	1,269	80	415,472	3.1	1,596	1.3
	1996	429	24	29,855	14.4	1,395	76	342,367	4.1	1,824	1.4
	%	-18	-2	14	-28	-7.7	2	-81	356	-10	0
C'bury	1986	780	5	62,406	12.5	15,441	95	3,295,096	4.7	16,221	11.2
	1991	273	2	61,728	4.4	14,688	98	3,021,469	4.9	14,961	12.2
	1996	552	4	100,871	5.5	15,072	96	2,594,818	5.8	15,624	12.1
	%	-29	-1	62	-56	-2.4	1	-21	23	-4	0.9
S SI	1986	822	5	97,982	8.4	16,431	95	4,690,676	3.5	17,253	11.9
	1991	387	2	102,371	3.8	15,099	98	4,126,390	3.7	15,486	12.6
	1996	693	4	164,692	4.2	16,005	96	3,665,667	4.4	16,698	12.9
	%	-16	-1	68	-50	-2.6	1	-22	26	-3	1
Total	1986	11,253	8	1,133,022	9.9	133,188	92	20,180,863	6.6	144,441	100
	1991	5,568	5	1,167,546	4.8	117,531	95	16,121,267	7.3	123,099	100
	1996	8,901	7	1,620,226	5.5	120,234	93	14,863,897	8.1	129,135	100
	%	-21	-1	43	-44	-9.7	1	-26	23	-11	0

Source: Census, Agricultural Statistics and National Exotic Forest Description.

Table 9: Processing Employment in Forestry and Agriculture by Wood Supply Region, 1986-1996

Wood Supply Region	Year	Forestry Industry				Agricultural Industry				Combined Total	
		FTE	% Total	Area (Ha)	FTE/1000Ha	FTE	% Total	Area (Ha)	FTE/1000Ha	FTE	% NZ Total
N'land	1986	759	26	119,592	6.3	2,157	74	1,154,153	1.9	2,916	4
	1991	627	29	103,319	6.1	1,533	71	1,026,980	1.5	2,160	3.9
	1996	792	38	159,973	5	1,308	62	929,249	1.4	2,100	4.1
	%	4	8	34	-21	-39	-8	-19	-26	-28	0.1
A'land	1986	5,541	36	38,724	144.8	9,666	64	940,244	10.3	15,207	20.7
	1991	3,588	34	59,816	60	6,948	66	851,526	8.2	10,536	19.1
	1996	3,537	34	87,272	40.5	6,915	66	714,038	9.7	10,452	20.6
	%	-36	-2	125	-72	-28	2	-24	-6	-31	-0.1
Cent NI	1986	9,840	70	476,718	20.6	4,221	30	2,332,656	1.8	14,061	19.1
	1991	6,633	64	497,464	13.3	3,774	36	1,742,335	2.2	10,407	18.9
	1996	5,607	61	549,552	10.2	3,624	39	2,002,136	1.8	9,231	18.2
	%	-43	-9	15	-50	-14	9	-14	0	-34	-0.9
E. Coast	1986	138	7	57,874	2.4	1,764	93	670,649	2.6	1,902	2.6
	1991	36	3	68,290	0.5	1,080	97	618,409	1.7	1,116	2
	1996	210	28	138,248	1.5	540	72	671,922	0.8	750	1.5
	%	52	21	139	-38	-69	-21	0	-69	-61	-1.1
H Bay	1986	627	9	63,007	10	6,618	91	1,069,465	6.2	7,245	9.9
	1991	678	12	67,563	10	4,755	88	917,727	5.2	5,433	9.9
	1996	777	19	108,606	7.2	3,378	81	891,836	3.8	4,155	8.2
	%	24	10	72	-28	-49	-10	-17	-39	-43	-1.7
S NI	1986	1,806	17	73,577	24.5	8,766	83	2,696,100	3.3	10,572	14.4
	1991	1,290	17	56,082	23	6,489	83	2,298,599	2.8	7,779	14.1
	1996	1,770	23	121,395	14.6	5,994	77	2,001,059	3	7,764	15.3
	%	-2	6	65	-40	-32	-6	-26	-9	-27	0.9
N SI	1986	690	34	117,047	5.9	1,347	66	1,560,677	0.9	2,037	2.8
	1991	852	43	123,766	6.9	1,146	57	1,102,360	1	1,998	3.6
	1996	831	39	159,762	5.2	1,299	61	1,050,805	1.2	2,130	4.2
	%	20	5	36	-12	-4	-5	-33	33	5	1.4
W Coast	1986	612	68	26,095	23.4	282	32	1,771,147	0.2	894	1.2
	1991	351	56	27,147	12.9	273	44	415,472	0.7	624	1.1
	1996	303	49	29,855	10.1	318	51	342,367	0.9	621	1.2
	%	-50	-19	14	-57	13	19	-81	350	-31	0
C'bury	1986	1,746	19	62,406	28	7,218	81	3,295,096	2.2	8,964	12.2
	1991	1,395	21	61,728	22.6	5,334	79	3,021,469	1.8	6,729	12.2
	1996	1,344	19	100,871	13.3	5,709	81	2,594,818	2.2	7,053	13.9
	%	-23	0	62	-53	-21	0	-21	0	-21	1.7
S SI	1986	1,170	12	97,982	11.9	8,472	88	4,690,676	1.8	9,642	13.1
	1991	1,008	12	102,371	9.8	7,371	88	4,126,390	1.8	8,379	15.2
	1996	1,137	18	164,692	6.9	5,346	82	3,665,667	1.5	6,483	12.8
	%	-3	6	68	-42	-37	-6	-22	-17	-33	-0.3
Total	1986	22,929	31	1,133,022	20.2	50,511	69	20,180,863	2.5	73,440	100
	1991	16,458	30	1,167,546	14.1	38,700	70	16,121,267	2.4	55,158	100
	1996	16,308	32	1,620,226	10.1	34,431	68	14,863,897	2.3	50,739	100
	%	-29	1	43	-50	-32	-1	-26	-8	-31	0

Source: Census, Agricultural Statistics and National Exotic Forest Description.

Chapter 4 Conclusion

4.1 Summary

The primary objective of this research was to describe relationships between recent land use changes and their affect on employment in New Zealand. This study focussed mainly on the relationship between land use change and employment (expressed as FTEs/1,000 hectares) for New Zealand and the regions.

The results give an overview of exotic forest sector expansion in terms of three phases, and document the steady growth of the industry. Regional data for Wood Supply Region (WSR) showed that there are four levels of regional activity: Central North island dominates; Northland, Northern South Island and Southern South Island comprise a second level of regions with significant areas and volumes: the remainder form a third tier except for Auckland and West Coast which are two regions with very small areas and volumes. Radiata pine is the dominant species.

In terms of absolute employment, agriculture employs about six times more people than forestry. Despite some recent growth of the forest sector, the comparison between 1986 and 1996 shows that the dominant feature is overall absolute decline in employment for both forestry and agriculture. Overall, forestry employment (FTEs) has declined by a greater percentage than agriculture (although by less in absolute terms). However, the decline in processing FTEs has been similar in both sectors. The main contrast is in the greater decline of on-land employment in forestry. This no doubt reflects the dramatic restructuring of ownership which took place during the study period. In terms of FTEs/1,000 hectares, forestry is higher than agriculture (16 to ten) with most in processing. Agriculture has most in the on-land category.

Analysis of FTEs regionally show that Auckland, Central North Island, Southern North Island, Canterbury and Southern South Island dominate total FTEs for the sum of forestry and agriculture. While forestry FTEs have declined nationally they have increased slightly for Hawkes Bay and Northern South Island. Agricultural FTEs have decreased everywhere except for Northern South Island. Combining FTEs with land area in production, the analysis suggests that for New Zealand as a whole in 1996, on-land employment was broadly similar for forestry and agriculture. Forestry employment per unit area has declined over time, while agriculture has increased slightly. This overall increase in agriculture, however, disguises significant variation by region.

Regional analysis showed considerable variation in employment, depending upon the particular profile of forestry and agriculture in the different regimes. One important feature was the positive effect of the presence of larger urban centres and their associated infrastructure in raising employment per unit area for these regions. It demonstrates the important spatial variation and concentration of economic activity within modern primary production. The effect is more marked in forestry than in agriculture. Further, several regions stand out as markedly different from the national profile and trends. Significantly for this study, one of these regions is the East Coast, which has considerably lower on-land and

processing employment per unit area in both forestry and agriculture than the national average.

The picture is quite different in processing employment per unit area. At the beginning of the study period, 1986, forestry processing FTEs/1,000 hectares were some seven times higher than agriculture processing. By 1996 it was five times as high. This decline disguises similar rates of decline in both forestry and agriculture processing employment. However, the rapid expansion of the planted area in forestry shifts the per unit area figures significantly.

In the first part of the study provided a summary of the estimates of farming and forestry FTEs/1,000 hectares reported in previous studies. These assessments are shown in Table 16 and compared to the results of this study. The previous locally calculated estimates of on-land FTEs/1,000 hectares for agriculture are lower than the New Zealand average described in this study. The same is true for the total agriculture FTEs/1,000 hectares, except for the estimate for Victoria, Australia. The latter study included multiplier effects so it is to be expected that the estimate would be high. The New Zealand datum of ten FTEs/1,000 hectares does not take into account any indirect employment derived from farming.

Table 10: Prior Estimates and Current Findings Comparing Forestry and Agricultural Employment

	Farming			
	On-land	Processing	Indirect	Total
Wairoa District	2.63		-1.43	-4.55
Mackenzie District	0.4		0.63	1.47
Vict., Australia	2.4		6.6	9.0
New Zealand	8	2		10
	Forestry			
	On-land	Processing	Indirect	Total
Wairoa District	9.4	7.68	6.25	23.3
Mackenzie District	5.2	4-10		9.2-15.2
Vict., Australia	8.7		24.3	33.0
New Zealand	6	10		16

Conversely, the previous estimates of forestry on-land and total employment in FTEs/1,000 hectares are higher than the New Zealand total we have described (with the exception of the Mackenzie estimate). Again, the New Zealand datum in the table above is exclusive of indirect employment. The forestry processing estimates from previous studies approximately match the New Zealand data: the estimates show processing at slightly lower than on-land employment while the New Zealand data show it to be significantly higher.

It is entirely to be expected that the available estimates for Wairoa and the Mackenzie are different from the New Zealand figures because they reflect the situation in those regions and it is unlikely that they would be the same as a national average. However, to date they have been the only estimates available and our analysis shows that they are not good indicators of the general situation.

The New Zealand data show that, on balance and not including the indirect or induced effects, total employment per 1,000 hectares generated by forestry is greater than agriculture. Since much of the forest area is now maturing then it is reasonable to expect that total

employment per 1,000 hectares will increase in future as relatively more wood matures and is processed. The important feature of these forestry employment data is that they show that most employment is generated in processing which occurs in regional centres. Therefore the majority of forestry employment is not associated with the planted area. In contrast, most of the total agriculture employment is in the on-land category and therefore the majority of farm employment is associated with the land used for agriculture.

These characteristics of employment generated by each land use mean that as land use changes from agriculture to forestry, the employment associated with the land use shifts geographically and becomes more concentrated in urban centres. An important note here is that this concentration is not necessarily localised, and processing employment may in fact be located beyond the region if logs are 'exported' to other regions. The earlier research shows that this can happen. Finally, analysis of the national data by regions showed that the East Coast has a markedly different profile from the national average, and from most other regions. Employment generated by forestry in the East Coast is still at a low level, despite the extensive recent plantings.

4.2 Discussion

These findings have a number of possible implications. First, we have documented at a national and regional level the employment changes within the forestry sector during the 1980s, and compared their effects with changes in the agricultural sector over the same period. Both sectors lost a large number of jobs both on-land and in processing between 1986 and 1991. During the next five year period (1991-96) agricultural processing employment continued to fall, forestry processing stabilised, and there were gains in on-land employment in both sectors, most markedly in forestry. This reflected diversification of agriculture and expansion of forest plantings.

By combining the employment data with land use statistics, we have also tracked the relationship of these changes in employment with land use change, nationally and regionally. This provides a more substantial basis for future discussions and policy formation than has hitherto been available. We have also provided a basis for comparison of the effects of change in two sectors that are frequently seen as competing land uses. Although the policy environment of the past 15 years has been decidedly against either government influence over land use, or regional development, there are currently signs of some resurgence of interest in the opportunities for selective encouragement by government. These analyses provide some useful background information for any such future action. The national and regional perspective also provides a context into which the results of more locally based studies can be placed.

Second, by analysing regional variation in these employment and land use relationships, we have highlighted some further spatial effects of structural change in the New Zealand economy during the 1980s, complementing the work of Le Heron and Pawson (1996). The analysis shows significant divergence between some regions and the overall national patterns and trends, and convergence in others. Both the relationships between employment and land use, and between forestry and agricultural employment differ significantly according to the regional circumstances. Important variables include the sub-sectoral make up of agriculture, the maturity of the forestry estate, and the presence of significant urban centres and associated infrastructure. Each affects the way in which land use changes between forestry and agriculture are expressed in employment.

Third, at a more detailed level, the relatively low on-land employment effects of forestry showed by the analysis indicate that policy promoting or responding to forest expansion must devote attention to the social organisation of forestry. This is not a new observation. Robb et al. (1970) drew attention to the importance of social factors in the acceptance of conservation forestry projects on the East Coast. A number of studies (including those reported in Chapter 1) have highlighted community concerns about the social effects of forestry. Our analyses confirm that the on-land benefits can be overstated easily. Presently, most forestry work is performed on a contract basis with workers located in regional centres, which differs markedly from the pattern of agricultural on-land employment. This in turn has socio-economic consequences, the details of which are further explored in the second report on the East Coast project (Fairweather et al., 2000).

Finally, the regional comparisons provide a context into which the detailed East Coast study can be placed. They show that the East Coast differs markedly from the national profile and trends of forestry and agriculture employment, and its relationship with land use, and is unlike any other region. Some dimensions of these differences will be explored in the following report.

In drawing out these implications, we should emphasise that by focussing on past land use change and comparing farming and forestry we are not implying that one or other land use is better in any absolute sense. Clearly, land use change occurs in large part in response to price signals, and movement from pastoral farming to forestry reflects economically rational decisions and the local impact of the international market dynamics. However, the data provided here inform us as to the social and economic consequences of these changes and this awareness should inform and guide decision making and policy both regionally and locally. The differences between on-land and processing employment in forestry and agriculture have consequences for the location and character of rural population change and community development. Awareness of this may prompt or support investigation of different policy options.

Bibliography

This bibliography is provided, in addition to the following reference list, because a wide range of sources were used for many of the tables presented in the report but they have not been specifically cited.

Ministry of Forestry (1986): Statistics of the Forests and Forest Industries of New Zealand to 1985 (Thirteenth Edition) Wellington: Ministry of Forestry, 1986.

Ministry of Forestry (1988a): Statistics of the Forests and Forest Industries of New Zealand to 1987 (Thirteenth Edition) Wellington: Ministry of Forestry, 1988.

Ministry of Forestry (1988b): A National Exotic Forest Description System (1986) Wellington: Ministry of Forestry, March 1988.

Ministry of Forestry (1991): New Zealand Forestry Statistics 1991 (First Edition) Wellington: Ministry of Agriculture and Forestry, July 1991.

Ministry of Forestry (1993a): New Zealand Forestry Statistics 1993(Second Edition) Wellington: Ministry of Agriculture and Forestry, April 1993.

Ministry of Forestry (1993b): National Exotic Forest Description: 1992 National and Regional Wood Supply Forecasts (First Edition) Wellington: Ministry of Forestry, April 1993.

Ministry of Forestry (1993c), The Forestry Sector in New Zealand, Wellington: Ministry of Forestry.

Ministry of Forestry (1995): A National Exotic Forest Description 1994 (Eleventh Edition) Wellington: Ministry of Forestry, April 1995.

Ministry of Forestry (1996a): National Exotic Forest Description: Regional Yield Tables 1995 (Second Edition) Wellington: Ministry of Forestry, May 1996.

Ministry of Forestry (1996b): New Zealand Forestry Statistics 1995 (Third Edition) Wellington: Ministry of Forestry, June 1996.

Ministry of Forestry (1996c): A National Exotic Forest Description 1995 (Twelfth Edition) Wellington: Ministry of Forestry, June 1996.

Ministry of Forestry (1996d): National Exotic Forest Description: National and Regional Wood Supply Forecasts 1996 (Second Edition) Wellington: Ministry and Forestry, October 1996.

Ministry of Agriculture and Forestry (1998a): New Zealand Forestry Statistics 1997 (Fourth Edition) Wellington: Ministry of Agriculture and Forestry, May 1998.

Ministry of Agriculture and Forestry (1998b): A National Exotic Forest Description 1997 (Fourteenth Edition) Wellington: Ministry of Agriculture and Forestry, May 1998.

Ministry of Agriculture and Forestry (1999): A National Exotic Forest Description 1998, Wellington: Ministry of Agriculture and Forestry.

Statistics New Zealand (1999): Customised output data for Census86, Census91, Census96

Statistics New Zealand: Supermap2 and Supermap3

REFERENCES

- Aldwell, P.H.B. (1982) "Impacts of Large Scale Forestry on Settlement Patterns in Waiapu County", *Planning Quarterly* 68, pp 6-14.
- Aldwell P.H.B. (1984), Direct and Processing Effects of Expanding Forestry in Three New Zealand Counties: An Input-Output Based Approach". The Australian and New Zealand Section Regional Science Association, pp. 272-294.
- Aldwell P.H.B. and Whyte J.B. (1984) "Impacts of Forestry Sector Growth in Bruce County, Otago: A Case Study". *New Zealand Journal of Forestry* 29 (2) pp 269-295.
- Anderson D. (1996) "Social Impacts of Land Use Change". Discussion Paper No. 144, Agribusiness and Economics Society, Lincoln University, Canterbury.
- Butcher G.V. (1997) "Regional Income and Employment Impacts of Farming and Forestry in the Mackenzie/Waitaki Basin". Research Report No. 235, Agribusiness and Economics Research Unit, Lincoln University, Canterbury.
- Butcher, G. (1995) From Farming to Forestry in Wairoa. Unpublished report, Butcher Partners, Christchurch.
- Butcher, G; Fairweather, J. R.; Simmons, D. G. (2000), "The Economic Impact of Tourism on Rotorua". Report No. 17, Tourism and Research and Education Centre, Lincoln University
- Cocklin C. and Wall M. "Contested Rural Futures: New Zealand's East Coast Forestry Project". Department of Geography, University of Auckland, New Zealand.
- Collins, J; McGregor, F.; Novis, J. (1988), A National Exotic Forest Description System. Ministry of Forestry, Wellington.
- Consultants Report (1989), State Plantations Impact Study. Report prepared for the Steering Committee, by the Farm Planning and Land Management Faculty of Agriculture and Forestry, University of Melbourne.
- Fairweather, J. R.; Mayell, JP. J.; Swaffield, S. R. (2000), Forestry and Agriculture on the New Zealand East Coast: A Comparison of Socio-economic Characteristics Associated With Land Use Change. AERU Research Report No. 247, Lincoln University.
- Farnsworth M.C. (1983) "The Social Impact of Forestry Development in Northland" *New Zealand Journal of Forestry* 28 (2) pp246-254.
- Fielder M.R. (1985) "Forestry and People: A case study of community and workforce attitudes towards Aupori Forest. Masters in Forestry Science". University of Canterbury, Christchurch.

- Fowler D. E., and Meister A. D., 1983 Rural planning and forestry: formulation of policy at county level. Discussion Paper in Natural Resource Economics No .7 Massey University.
- Gold U. and Houghton R. (1987) Bruce “County Forestry Employees Household Spending Patterns”, Business Development Centre, University of Otago, Dunedin.
- Grant R. K. (1979) “Managing the Regional Impact of Forest Development Programmes” New Zealand of Forestry 24 (1) pp 198-204.
- Houghton R. (1987) “Household spending Patterns of Forest Sector Workers”, Bruce County, Otago. Contributed Papers to the forestry Section 56th ANZAAS Congress, Massey University, Palmerston North.
- King J.M. and Krausse M.K. (1995) “The Impacts of Land Use Change In Wairoa”. Ministry of Agriculture and Fisheries and Landcare Research New Zealand Ltd.
- King, J. M.; Krausse, M. K. (1995), The Impacts of Land Use Change in Wairoa. Unpublished Report, Landcare Research Limited, Hamilton.
- Le Heron R. and Pawson E. (1996) “Changing Places: New Zealand in the Nineties”. Longman Paul, Auckland.
- Le Heron R.B. and Roche M.M. (1984) “Exotic Afforestation and Land Use Policies in New Zealand” 1960-1984 Studies in Rural Change 10, Department of Geography, University of Canterbury, Christchurch.
- Le Heron R.B. and Roche M.M. (1985) “Expanding Exotic Forestry and the extension of a Competing use for Rural Land in New Zealand”, Journal of Rural Studies 1 (3) pp. 211-229.
- Maclaren, J. P. (1996), Environmental Effects of Planted Forests in New Zealand. FRI Bulletin No. 198, New Zealand Forest Research Institute, Rotorua.
- McClintock W. (1998) “Resource Community Formation and Change: A Case Study of Murupara”. Working Paper 7, Taylor Baines and Associates.
- McClintock, W. and Taylor, N (1999), Forestry Communities in Transition. New Zealand Journal of Forestry 44(1): 29-34.
- Meat and Wool Economic Service of New Zealand (1999), The New Zealand Sheep and Beef Farm Survey, 1997-98. Box 5179, Wellington.
- Meister A.D. (1987) “The Changing Emphasis of Rural land Use. Is there anything new under the sun?” New Zealand Journal of Surveying, February 1987.
- Ministry of Agriculture and Forestry (1999), A National Exotic Forest Description: as at 1 April 1998.
- Ministry of Agriculture and Forestry (2000), A National Exotic Forest Description: as at 1 April 1999.

- Ministry of Forestry and Te Puni Kokiri “Maori Forestry on Tai Tokerau”.
- Ministry of Forestry, (1993), The Forestry Sector in New Zealand. Ministry of Forestry, Wellington.
- Ministry of Works (1970), Wise Land Use and Community Development. Water and Soil Division, for the National Water and Soil Conservation Organisation, Wellington.
- Neuman, A. (1992), A National Exotic Forest Description: as at 1 April 1991. Edition 8. Ministry of Forestry, Wellington.
- New Zealand Forest Owners' Association, (1984) Forestry and the Rural Community: Wise Land Use: A Background Report on Social and Regional Aspects of Forest Development in Rural New Zealand. Wellington.
- New Zealand Official Yearbook (1998), Statistics New Zealand, Wellington.
- Newsome, P.F.J. 1987: The Vegetative Cover of New Zealand. Water & Soil Miscellaneous Publication No. 112, 1987, 153p and 2 map sheets. ISSN 0110-4705.
- Nuttall R.E. (1980) “The Impact of Exotic Forestry on Maori Land in Northland: A point of View”. New Zealand Journal of Forestry 26(1) pp. 112-117.
- Parore T. (1987) “Social and Economic Perspectives on Forests and Agroforestry: Socio-Economic Impacts of Forestry on Maori Land: Opportunities and Constraints Contributed Papers to the Forestry Section 56th ANZAAS Congress”, M.M. Roche and R. Hodders (eds.) Massey University, Palmerston North.
- Robb J. H., Gibson M., Burch W. R. (1970) A Note on Social Aspects of Conservation Problems in the Poverty Bay-East Coast District. Appendix III in: Wise Land Use and Community Development. Report of the Technical Committee of Inquiry into the Problems of the Poverty Bay East Coast District of New Zealand, NWSCO, Wellington.
- Wellington : Water and Soil Division, Ministry of Works for the National Water and Soil Conservation Organisation, 1970.
- Scott K., Park J., Cocklin C. and Blunden G. (1997) “A Sense of Community: An Ethnography of Rural Sustainability in the Mangakahia Valley, Northland”. Occasional Paper 33, Department of Geography, University of Auckland.
- Smith B. & Wilson P. (1984) “The Public’s Evaluation of Land Use Options in two New Zealand Regions”. New Zealand Journal of Forestry, pp. 249-268.
- Smith B. and Makin K. (1982) “Forestry and Community New Zealand Journal of Forestry” 27 (1) pp 122-129.
- Smith B. and Wilson, P. (1982) “Attitudes to Growth and Development in New Zealand’s Far North”, New Zealand Journal of Forestry 27 (1) pp 101-121.

Smith D. (1987) “The Social and Economic Implications of Alternative Land Uses Involving Pastoral Farming and Forestry in Northland”, Masters in Philosophy Massey University 1987.

Wall M. and Cocklin C. (1993) “Preliminary Employment Findings: East Coast Forestry Project”. Department of Geography, University of Auckland, New Zealand.

White P. (1993) “The bottom line for Maori involvement in forestry”.

(NZSIC75) Forestry Industry	1991 (NZSIC87) Forestry Industry	1996 (ANZSIC96) Forestry Industry
<p style="text-align: center;">Forestry</p> <p>12101 Forestry 12109 Services to Forestry</p> <p>12201 Felling and Cutting of Trees and Bush Hauling of Logs 12209 Other Logging</p> <p style="text-align: center;">Processing</p> <p>33111 Sawmills 33112 Planing, Preserving, and Seasoning Timber</p> <p>33133 Chipmills 33119 Sawmills, Planing, and Other Woodmills (nec)</p> <p style="text-align: center;">Manufacturing</p> <p>33116 Plywood, Veneer, and Board 34110 Pulp, Paper, and Paperboard 34121 Corrugated Board</p> <p>34122 Manufacture of Paper Bags and Sacks 34199 Pulp, Paper, and Paperboard Articles (nec)</p>	<p style="text-align: center;">Forestry</p> <p>12101 Forestry 12109 Services to Forestry</p> <p>12200 Logging and Other Timber Felling 12200 Logging and Other Timber Felling</p> <p style="text-align: center;">Processing</p> <p>33111 Sawmills 33112 Planing, Preserving, and Seasoning Timber</p> <p>33133 Chipmills 33119 Sawmills, Planing, and Other Woodmills (nec)</p> <p style="text-align: center;">Manufacturing</p> <p>33116 Plywood, Veneer, and Board 34110 Pulp, Paper, and Paperboard 34121 Corrugated Board</p> <p>34122 Manufacture of Paper Bags and Sacks 34199 Pulp, Paper, and Paperboard Articles (nec)</p>	<p style="text-align: center;">Forestry</p> <p>A030100 Forestry A030300 Services to Forestry A030200 Logging A030200 Logging</p> <p>A030200 Logging</p> <p style="text-align: center;">Processing</p> <p>C231100 Log Sawmilling C231300 Timber Resawing and Dressing C232900 Wood Product Manufacturing (nec) C231200 Wood Chipping C231100 Log Sawmilling C231300 Timber Resawing and Dressing</p> <p style="text-align: center;">Manufacturing</p> <p>C232100 Plywood and Veneer Manufacturing C232200 Fabricated Wood Manufacturing C233100 Pulp, Paper, and Paperboard Manufacturing C233200 Solid Paperboard Container Manufacturing C233300 Corrugated Paperboard Container Manufacturing C233400 Paper Bag and Sack Manufacturing C233900 Paper Product Manufacturing (nec)*</p>

1986 (NZSIC75) Agricultural Industry	1991 (NZSIC87) Agricultural Industry	1996 (ANZSIC96) Agricultural Industry
<p style="text-align: center;">Agriculture</p> <p>Cropping 11161 Principally Cropping 11162 Predominantly Cropping with Sheep 11163 Predominantly Cropping (nec) 11199 Farming Not Otherwise Defined (50%) 11330 Game Propagation</p> <p>Dairy 11111 Principally Dairy Farming - Town Milk 11112 Principally Dairy Farming - Other Supply 11113 Predominantly Dairy Farming with Sheep 11114 Predominantly Dairy Farming with Sheep 11115 Predominantly Dairy Farming (nec)</p> <p>Livestock 11116 Principally Pig Farming 11117 Predominantly Pig Farming 11121 Principally Sheep Farming 11122 Predominantly Sheep Farming with Dairy 11125 Predominantly Sheep Farming (nec) 11123 Predominantly Sheep Farming with Beef 11124 Predominantly Sheep Farming with Cropping 11131 Principally Beef Farming 11132 Predominantly Beef Farming with Dairy 11134 Predominantly Beef Farming (nec)</p>	<p style="text-align: center;">Agriculture</p> <p>Cropping 11161 Principally Cropping 11162 Predominantly Cropping with Sheep 11163 Predominantly Cropping with Other 11199 Other Farming (nec) (50%)</p> <p>Dairy 11111 Principally Dairy Farming - Town Milk 11112 Principally Dairy Farming - Other Supply 11119 Predominantly Dairy Farming with Other</p> <p>Livestock 11148 Pig Farming 11121 Principally Sheep Farming 11129 Predominantly Sheep Farming with Other 11123 Predominantly Sheep Farming with Beef 11124 Predominantly Sheep Farming with Cropping 11131 Principally Beef Farming 11139 Predominantly Beef Farming with Other</p>	<p style="text-align: center;">Agriculture</p> <p>Cropping A012100 Grain Growing A016930 Crop and Plant Growing (nec) A012100 Grain Growing A012200 Grain-Sheep and Grain-Beef Cattle Farming A016930 Crop and Plant Growing (nec) A012100 Grain Growing A012200 Grain-Sheep and Grain-Beef Cattle Farming A016930 Crop and Plant Growing (nec) A016930 Crop and Plant Growing (nec) A015920 Livestock Farming (nec) [excl Beekeeping]</p> <p>Dairy A013000 Dairy Cattle Farming</p> <p>Livestock A015100 Pig Farming A012400 Sheep Farming A012400 Sheep Farming A012400 Sheep Farming A012300 Sheep - Beef Cattle Farming A012400 Sheep Farming A012500 Beef Cattle Farming A012500 Beef Cattle Farming</p>

<p>11133 Predominantly Beef Farming with Sheep</p> <p>11141 Mixed Livestock Farming</p> <p>11142 Horse Breeding</p> <p>11143 Deer Farming</p> <p>11144 Goat Farming</p> <p>11147 Small Animal Breeding</p> <p>11145 Broiler Production</p> <p>11146 Other Poultry</p> <p>11197 Beekeeping</p> <p>11199 Farming Not Otherwise Defined (50%)</p>	<p>11133 Predominantly Beef Farming with Sheep</p> <p>11141 Mixed Livestock Farming</p> <p>11142 Horse Farming and Breeding</p> <p>11143 Deer Farming</p> <p>11144 Goat Farming</p> <p>11147 Small Animal Breeding</p> <p>11145 Chicken Raising</p> <p>11146 Eggs and Poultry Production</p> <p>11197 Beekeeping</p> <p>11199 Other Farming (nec) (50%)</p>	<p>A012200 Grain-Sheep and Grain-Beef Cattle Farming</p> <p>A012500 Beef Cattle Farming</p> <p>A012200 Grain-Sheep and Grain-Beef Cattle Farming</p> <p>A012200 Grain-Sheep and Grain-Beef Cattle Farming</p> <p>A012300 Sheep - Beef Cattle Farming</p> <p>A015920 Mixed Livestock</p> <p>A015200 Horse Farming</p> <p>A015300 Deer Farming</p> <p>A015990 Livestock Farming (nec) [excl Beekeeping]</p> <p>A014100 Poultry Farming (Meat)</p> <p>A015930 Beekeeping</p> <p>A015990 Livestock Farming (nec) [excl Beekeeping]</p> <p>A016930 Crop and Plant Growing (nec)</p>
<p>Horticulture</p> <p>11181 Market Gardening</p> <p>11184 Tomato Growing</p> <p>11189 Fruit and Vegetable Growing (nec)</p> <p>11182 Citrus Orchards</p> <p>11183 Orchards Other than Citrus</p> <p>11185 Mushroom Growing</p> <p>11186 Grape Growing and Vineyards</p> <p>11187 Berry Fruit Growing</p> <p>11191 Tobacco Growing</p> <p>11192 Hop Growing</p> <p>11193 Flower Growing</p> <p>11194 Orchid Growing</p> <p>11195 Plant Nurseries</p>	<p>Horticulture</p> <p>11151 Vegetable Growing (including Tomatoes)</p> <p>11171 Citrus Fruit Growing</p> <p>11172 Pipfruit Growing</p> <p>11173 Stonefruit Growing</p> <p>11174 Kiwifruit Growing</p> <p>11154 Cultivated Mushroom Growing</p> <p>11176 Grape Growing</p> <p>11175 Berryfruit Growing</p> <p>11152 Tobacco and Hop Growing</p> <p>11153 Flower Growing</p> <p>11155 Plant Nurseries</p>	<p>Horticulture</p> <p>A011300 Vegetable Growing</p> <p>A011910 Citrus Growing</p> <p>A011500 Apple and Pear Growing</p> <p>A011600 Stonefruit Growing</p> <p>A011700 Kiwifruit Growing</p> <p>A016920 Cultivated Mushroom Growing</p> <p>A011400 Grape Growing</p> <p>A011920 Berryfruit Growing</p> <p>A016910 Tobacco and Hop Growing</p> <p>A011200 Cut Flower and Flower Seed Growing</p> <p>A011100 Plant Nurseries</p>

Services	Services	Services
11211 Bush Clearing and Scrub Cutting 11212 Fencing 11213 Drain and Ditch Maintenance 11219 Land Improvement Services (nec) 11239 Horticultural Contracting Services (nec) 11250 Other Agricultural Contracting Services (nec) 11250 Other Agricultural Contracting Services (nec) 11221 Herd Testing 11222 Sheep Shearing 11223 Livestock Holding Services 11229 Livestock Contracting Services (nec)	11211 Scrub Cutting 11212 Fencing 11259 Other Agricultural Contracting Services (nec) 11251 Agricultural Consultants 11221 Livestock Improvement Services 11222 Shearing Services 11223 Livestock Holding Services 11229 Livestock Contracting Services (nec)	A021900 Services to Agriculture (nec) A021900 Services to Agriculture (nec) A021900 Services to Agriculture (nec) L785500 Business Management Services A021900 Services to Agriculture (nec) A021200 Shearing Services A021900 Services to Agriculture (nec) A021900 Services to Agriculture (nec) A021900 Services to Agriculture (nec) A014100 Poultry Farming (Meat) A014200 Poultry Farming (Eggs) A021900 Services to Agriculture (nec) A021900 Services to Agriculture (nec) A021900 Services to Agriculture (nec) A021300 Aerial Agricultural Services A021900 Services to Agriculture (nec) A021300 Aerial Agricultural Services A021900 Services to Agriculture (nec)
11231 Crop Cultivation 11232 Crop Harvesting 11233 Grain Drying and Seed Dressing 11241 Aviation Topdressing 11242 Groundspread Topdressing 11243 Aviation Spraying 11244 Groundspread Spraying	11231 Crop Cultivating Services 11232 Crop Harvesting 11233 Grain Drying and Seed Dressing 11241 Aviation Topdressing 11242 Groundspread Topdressing 11243 Aviation Spraying 11244 Groundspread Spraying	A021900 Services to Agriculture (nec) A021900 Services to Agriculture (nec) A021900 Services to Agriculture (nec) A021300 Aerial Agricultural Services A021900 Services to Agriculture (nec) A021300 Aerial Agricultural Services A021900 Services to Agriculture (nec)
Processing	Processing	Processing
31111 Meat Export Works 31112 Other Abattoirs and Rural Slaughter Houses 31113 Meat Packers and Cannery 31116 Game Packers 31119 Slaughtering, Preparing, and Preserving Meat (nec) 31115 Poultry Slaughter Houses 31119 Slaughtering, Preparing, and Preserving Meat (nec) 31114 Ham, Bacon, and Smallgoods 31119 Slaughtering, Preparing, and Preserving Meat (nec) 31121 Co-Operative Dairy Factories 31124 Factories Manufacturing Dairy Products 31129 Manufacture of Dairy Products (nec) 31122 Milk Processing Plants	31117 Livestock Slaughtering 31115 Poultry Slaughtering 31114 Ham, Bacon, and Smallgoods 31125 Dairy Products 31122 Milk Bottling	C211100 Meat Processing C211200 Poultry Processing C211300 Bacon, Ham, and Smallgood Manufacturing C212100 Milk and Cream Processing C212900 Dairy Product Manufacturing (nec) C212100 Milk and Cream Processing

31123 Ice-Cream Factories 31130 Canning and Preserving Fruit and Vegetables 31161 Grain Milling 31169 Grain Mill Products (nec) 31210 Food Products (not classified above)	31123 Ice-Cream 31130 Fruit and Vegetable Processing 31161 Grain Milling 31169 Grain Mill Products (nec) 31219 Other Food Products (nec) 31219 Other Food Products (nec) 31219 Other Food Products (nec)	C212200 Ice-Cream Manufacturing C213000 Fruit and Vegetable Processing C215100 Flour Mill Product Manufacturing C215200 Cereal Food and Baking Mix Manufacturing C217900 Food Manufacturing (nec)
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------