NSW WESTERN REGIONAL ASSESSMENTS

STAGE 2

Nandewar

Regional Impact Analysis

Final report
March 2006

NAND 13

RESOURCE AND CONSERVATION ASSESSMENT COUNCIL

NSW WESTERN REGIONAL ASSESSMENTS	STAGE
Nandewar	**2**

Regional Impact Analysis

Centre for Agricultural and Regional Economics, Armidale, NSW

Project Number NAND 13

RESOURCE AND CONSERVATION ASSESSMENT COUNCIL

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Preface

CARE Pty Ltd expresses thanks to those staff in the (former) DIPNR who have provided guidance and support for this project. Members from other government agencies and non-government organisations also assisted with information and comments.

The micro-modelling of voluntary conservation options on farms and sawmilling operations in this study were made possible because of the input from a number of individuals. These include the managers of the cypress mill in Bingara, the coordinators and landholder members of Landcare groups in Inverell, Manilla, Bingara and Tamworth and the Namoi Catchment Management Authority.

CARE Pty Ltd would like to acknowledge their input which included the provision of confidential and detailed business data and their experiences with and perceptions of conservation programs on farms in the region.

The importance of accessing accurate farm-level information in assessing the performance of conservation programs on farms should not be under-estimated. In addition to providing an estimate of changes to farm financial performance, the interaction with landholders adds significant credibility to the consultation process. It indicates an appreciation of the fact that conservation mechanisms must be undertaken within the context of a farm business operation and the program acceptance and uptake is heavily influenced by the financial realities of running that business.

Project Summary

The purpose of this project was to develop the capacity to assess the impact of selected conservation measures on the Nandewar regional economy. Those conservation measures may involve public lands, and so have effects through forestry and other visitation and recreation activities on those lands, and private lands where the conservation actions will be voluntary and may impact on business activity.

The work involved two stages:

- Developing the structure of the analytical models; and
- Building the models to be ready to analyse selected conservation options.

The analysis of options was to be carried out in part through additional work and by assisting with the development of in-house analytic ability and use of the models. The latter has been developed in terms of the regional impact models, but the micro models are not yet sufficiently developed in terms of particular conservation measures and operational routines for that to be a realistic possibility.

The overall structure of the analytic models involves two main components that are linked in various ways. The first part is the micro models that are constructed for farming operations and timber milling. These are designed to assess how conservation measures on farms may impact on operations including farm production and financial performance, and how changes in the wood supply may impact on timber milling.

The regional impacts are assessed using input-output models. These models describe the economic characteristics of the regional economy, thereby providing a context within which the changes may be considered. The models also enable the estimation of the flow-on effects that are generated from changes in a particular industry through the estimation and use of appropriate multipliers. Thus, it is possible to estimate how a particular change may impact (directly and indirectly) on the regional economy.

The choice of two levels of models rather than a single more complex macro model has been made on the basis of the relatively low cost of development, and the potential to include a more detailed set of descriptors about the way the affected businesses operate and respond to change than can be achieved in a single model. For this study, a number of farm models have been developed to span the range of farming types common to the Nandewar region and the milling of cypress pine timber. At the regional level, two input-output models have been constructed: the Upper Nandewar based around Inverell and the Lower Nandewar based around Tamworth.

The input-output models have also been projected to 2011 to provide a perspective on trends in the development of those regions. That will allow all of the assessment process to be considered in terms of trends. In addition to being able to assess how an option may impact on the economy as it is now, it becomes possible to consider how actions to change the adoption of various conservation measures over time will impact on an economy that is also changing.

The links between the models are made through two mechanisms. First, the micro model results need to be aggregated to the regional level. For farming, this is provided through the identification of the main farming types and the use of Geographic-information systems (GIS) that allow an assessment of the extent to which the various farming types occur in the region. Second, the information from the micro models is structured into a format that enables the representation of those farming types in the input-output model to be modified (output and input costs) so that the regional impacts can be assessed.

Within this report, information is presented on the micro models for farming and saw milling, the regional input-output models including the projected models that reflect an 'in-house' developed scenario, and the impact of the forestry-based activities in the region. Much of this work is of a capacity-building and demonstration nature.

Farm models have been developed that span the predominately grazing areas of most of the Nandewar region with varying mixes of land types, enterprises and production potential. A further model for the Liverpool plains has been developed to include the high intensity cropping of the suitable areas along with the grazing of lighter soils and slopes. Those models have been applied to an operation involving the development of private native forestry, and for an actual demonstration conservation program on the Liverpool Plains.

The regional models provide a perspective on the two sub-regional economies that extends the information provided in the socio-economic profile (NAND 12) prepared by Hassall and Associates (2004). The information reveals the Upper Nandewar region as highly dependent on primary industry and its processing. The regional economy has not been growing during the 1990s, but appears likely to see some growth to 2011 such as that embedded in the projected model. In part, that growth will be a catching up of some of the low growth and reductions that occurred in the 1990s under difficult farming conditions, a national recession and the restructuring of some government operations. However, the Upper Nandewar regional economy is unlikely to become much less dependent on primary industries and so conservation measures that may impact on those industries need to carefully crafted and assessed.

The Lower Nandewar region includes Tamworth and enjoys some of the benefits of including the regional centre for the Northern region. The economy is more diverse than the Upper Nandewar region, but it is still dominated by primary product production and processing even though the products are sourced from a wide area. That dependence was reflected in the low growth in the 1990s when rural industries performed poorly. It seems likely that this region will secure significant growth in the 2000s that will strengthen and diversify the economy.

The forestry-based industries in the Nandewar region are modest with most of the output and employment being generated by the range of downstream manufacturing of wood products. However, over the region, all of the forestry, milling and wood products activities contribute around one per cent to the regional economy. Some of those activities are based on wood supplies from outside of the Nandewar region. There is likely to be an increase in the contribution of forestry activities in the Nandewar region as a spill-over from the development of the softwood plantations to the east of the region and the sawmilling operation being developed in Quirindi.

An analysis of the private land with forest cover indicates that there is some potential for private native forestry in the region. That will require additional silviculture management to improve growth rates and timber quality, as well as an appropriate operating and regulatory environment. The considerations indicated potential production from private land of possibly 100,000m^3, but only after some decades of improved management. At that level in 2011, that production would have the potential to add around one per cent to gross regional product.

Note:

The micro models have been applied to demonstrate a farm conservation program and a private native forestry operation. The regional models provide detailed information on the economic structure of the region and the economic significance of the existing timber industries in the region. An illustration of the potential contribution of private native forestry to the regional economy is also included.

Minerals exploration and production, and other important economic opportunities in the Nandewar region, are explored in a separate economic project: *NAND12 Development Opportunities in the Nandewar Bioregion*. Mineral exploration and production in Nandewar may be relatively modest (compared to other NSW regions) but the relative importance of these activities is considered to be high and increasing.

1 BACKGROUND

1.1 THE NANDEWAR BIOREGION ASSESSMENT

The Nandewar Bioregion assessment is part of the Western Regional Assessment process to investigate conservation opportunities across lands of all tenure types. This will include consideration of the use of public lands, while programs to achieve conservation outcomes on private lands will be voluntary. The assessment involves exploring methods and approaches that have the potential to assist management with conservation measures on all land tenures. The Nandewar study area is shown in **Figure 1-A**.

1.2 THE PROJECT OBJECTIVES

The objectives of the project are to:

- Identify the impacts that proposed changes in land use management may have on the regional economy;
- Provide a framework for analysing commercial responses to changes in land use;
- Provide estimates of the direct and indirect impacts of changes in timber supply.

To fulfil these objectives, the project involves constructing both micro level models and regional models.

The micro level models are designed to assess how changes may impact on individual firms that are affected by proposed changes to natural resource management. The micro models include farm models that are representative of the main farming types in the region. There is also a model for a cypress pine sawmill that is the main timber milling operation in the region.

The regional modelling is linked to the micro level models and is designed to assess the impacts of the changes at the regional level. The Nandewar region has two major nodes or commercial centres, Inverell and Tamworth. As a result, the regional impacts will be assessed within two input-output models that are related to those centres. These are based on Local Government Areas (LGA) as that is the structure for the data used in compiling the tables and at the same time covers most of the Nandewar Study area.

- The Upper Nandewar region includes the Inverell and Bingara LGAs.
- The Lower Nandewar region includes the Tamworth, Parry, Manilla, Nundle and Barraba LGAs.

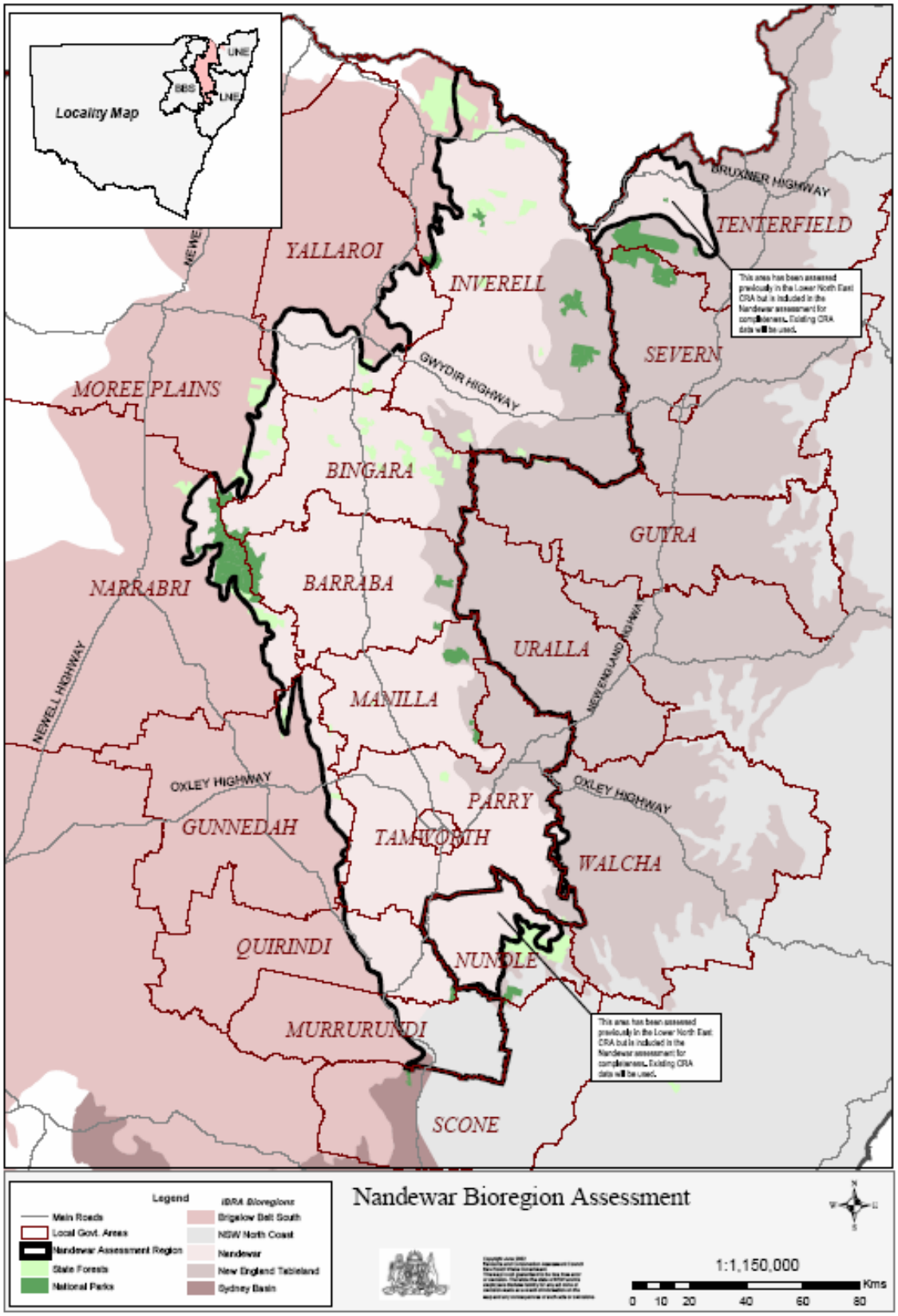

FIGURE 1-A: The Nandewar Bioregion

The Nandewar Study area includes parts of Tenterfield, Quirindi, Murrurundi, Gunnedah, Narrabri, Moree Plains and Yallaroi LGAs. In most cases, only small portions of those LGAs are involved. These have been included in the Brigalow Belt South Bioregion assessment, the Upper North East CRA and the Lower North East CRA.

At this stage, this report does not include any assessment of impacts related to particular industries or conservation options as they have not been determined to allow the analysis of specific proposals. The impacts of the existing forestry operations in the Nandewar region will be assessed although they are a small part of the regional economy.

As an illustration of the application of the model, some consideration has been given to the possibility of developing a private native forestry industry in the region. The existing native forest on private land is generally not managed for forestry production and seems to have only low to medium potential. However, the considerable areas of forest cover on private land revealed by the mapping indicates that some potential exists in both cypress and eucalypt production. The micro models and regional models have been used to provide an illustration of the application of the models and to estimate what the forestry potential might be under a range of scenarios.

1.3 OUTLINE OF THE STUDY

The structure of this report is in three parts. The next part (Section 2) includes an outline of the micro-level modelling that will be used to assess how changes in policy may impact on the commercial operation of land. Those models cover a range of farming types and localities and the milling of Cypress pine which is the main timber milled in the region.

The second part (Section 3) includes the development of the input-output tables that are used to develop a profile of the regional economy and to assess the impacts of any changes related to conservation. These impacts will be based on the estimated effects on commercial operations estimated in the micro models and aggregated to the regional level. This work should be considered in parallel to the socio-economic profile prepared as a separate report (Hassall and Associates, 2004).

The third part (Section 4) will include the assessment of impacts associated with current forestry operations in the region. There is also an assessment of the potential private native forestry industry in the region with the regional impacts estimated using the projected input-output table in 2011.

A summary of the whole study is provided in the final section.

2 MICRO MODELLING

2.1 INTRODUCTION

The micro modelling is focused on two components. The first is the modelling of farm operations in the region to assess the likely impact of options for conservation measures on farms. Those impacts would need to be assessed in terms of both environmental outcomes and the financial implications assessed on a whole farm basis. The farm modelling also includes consideration of private native forestry operations on farms. The Nandewar area includes large areas with significant tree cover that in a number of situations would allow this development if the operating environment is conducive to the development.

The second is related to the forestry and milling operations that exist in the region. There is only a small amount of harvesting and milling of native timbers in the region with only one substantive cypress mill in Bingara and a small hardwood mill in Bendemeer. There are a number of small milling operations in some locations and on some farms using both fixed and portable mills.

2.2 WHOLE FARM MODELLING OF CONSERVATION OPTIONS

2.2.1 Introduction

The purpose of these whole-farm models is to provide an analytical tool to estimate the impacts of farm conservation options on farm business performance. The scope of these conservation options could range from simple cash grants to assist with fencing or tree planting, to the commencement of new enterprises (eg. private native forestry) which might include some significant capital investments (eg. purchase of a portable sawmill) through to a complete change in farm enterprise mix (eg. switching from cropping to grazing). The farm models are structured to have the capability to integrate a full range of enterprise revenues and costs with business capital and financing arrangements.

2.2.2 Farm model structure

Model development makes use of the Vensim™ software to construct annual simulation models. These models can be run over any number of years by simply varying the chosen simulation period in the software. The models also have the capability to incorporate

stochastic (uncertain) variable such as rainfall and its impact on enterprise yields, though this feature has not been used in the simulations presented here.

The models require a number of inputs including:

- Farm carrying capacity in terms of dry sheep equivalents (DSEs)
- Livestock proportions in terms of DSEs
- Livestock production inputs – weaning, culling and death rates, wool production
- Areas of crops planted
- Expected yields and prices
- Enterprise variable costs
- Overhead costs and financing arrangements
- Asset and liability situation

A separate spreadsheet module has been developed to simulate private native forestry (PNF) enterprises. This module requires information on the area of forest to be managed, the thinning and harvesting regime employed, products produced and costs, and timber prices. It can be used to simulate selling timber at a stumpage price, or sawing the timber on-farm and selling a sawn product.

The business cost and revenue implications of the PNF activity then feed into the Vensim™ whole-farm model and influence the farm business performance.

The timber module also allows the simulation of the effect of thinning on livestock carrying capacity under the thinned forest areas. These changes in carrying capacity flow into the whole-farm model allowing stock numbers to change over time.

Model outputs include:

- Farm enterprise production levels (Gross Value of Agricultural Production (GVAP))
- Farm input costs (fixed and variable)
- Farm gross margin (enterprise revenues less variable costs)
- Farm net income (farm gross margin less overhead costs and depreciation)
- Farm business return (farm net income less operator labour and finance costs)
- Farm return to equity (farm business return as a percentage of farm equity)

An overview of the general model structure is provided in **Figure 2-A** and some more detailed discussion of the model components follows.

Livestock modules

Separate modules have been set up for cattle and sheep enterprises. These modules include dynamic livestock inventories to allow for changes in farm carrying capacity (eg. due to forest thinning). Stock numbers can be built up either through natural breeding or by additional purchases. As a result, stock sales will vary according to changes in herd or flock numbers. Sales of young stock are essentially used as the key variable to reflect these changes (i.e. if flock/herd numbers are to be increased, more young stock will be kept to reach the target number, fewer will be sold).

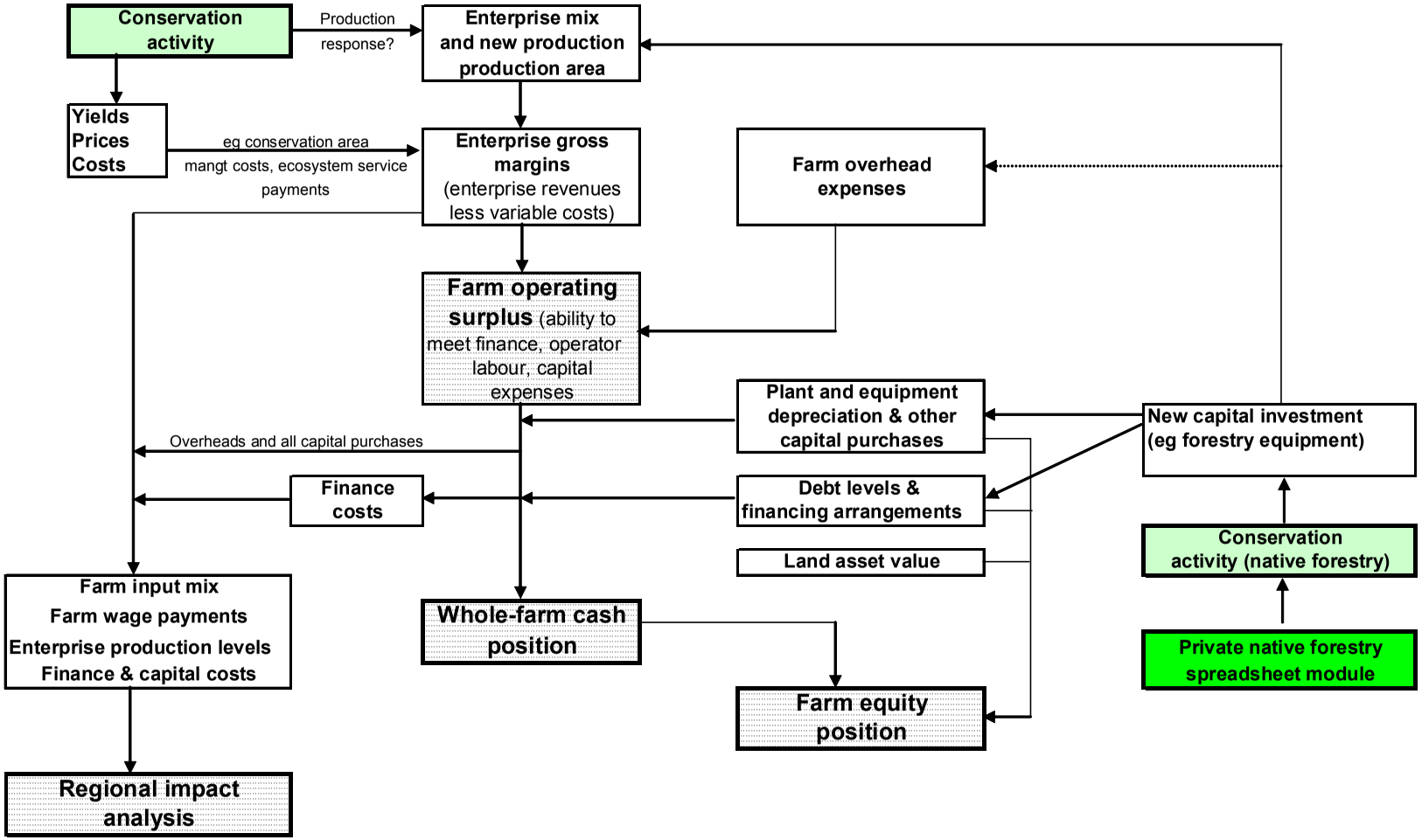

FIGURE 2-A: Structure of Nandewar Farm Models

This module also includes important parameters such as livestock weaning, culling and death rates. There is also a separate module to cater for the costs and returns from livestock enterprises. In this module, information is entered on livestock variable costs, sale prices and wool cuts. All of the input data in these modules have been collected from participating landholders.

Crop modules

As cropping appears to be a relatively minor activity in the Nandewar region, cropping is treated in a simple manner. Crop areas are fixed annually (in other models, they have been allowed to vary in response to irrigation water availability and soil moisture). Crop yields have been set such that they vary with seasonal (summer and winter rainfall).

Revenue and costs module

This module combines information on livestock numbers, sales and purchases, wool production, livestock prices, livestock variable costs, crop areas grown, crop yields, crop prices and crop variable costs to estimate total revenues for the farm. Price and variable cost data have been derived from data supplied by participating landholders.

Information from this module is used to estimate financial parameters such as the whole-farm gross margin. The module also includes information on overhead and financial costs and income from asset disposals.

Other costs module

Because the models are whole-farm in nature, a number of other costs are calculated:

- Loan interest and principal payments – based upon opening loan values and information on interest rates and principal repayments elicited from landholders;
- Overdraft interest – the model tracks the farm net cash flow position and charges overdraft interest on any negative balances;
- Depreciation costs – a depreciation rate (supplied by the landholder) is applied to the opening value of any plant and equipment each year; and
- Other asset values – in order to estimate a return to equity figure in the farm models, a land value has been elicited from the landholder and is added to the other farm assets (plant and equipment, cash on hand etc). Land values have been held constant. This enables a comparison of how return to equity on the original asset values changes as farm production is impacted by various conservation options.

Conservation options

The model has the capacity to include range of farm conservation options including:

- Setting aside land in conservation areas and any resulting changes in stock carrying capacity;
- The costs (stewardship costs) of managing conservation areas;

- Payments for conservation activity (eg. ecosystem services payments, grants for fencing etc.);
- Costs and revenues associated with private native forestry;
- Major changes in farming enterprises are modelled by changing enterprise levels (or perhaps adding new enterprises). Any changes in capital investment, financing, etc can be added;
- The provision of low interest loans can be added; and
- Rate rebates can be modelled by reducing farm overhead costs.

In modelling some of the more dramatic changes to the farming business, it may also be necessary to account for changes in farm labour requirements by adjusting overhead costs or perhaps the variable costs associated with activities that are contracted out.

2.2.3 Model Outputs

Farm models can be run for two scenarios:

1. A base run (i.e. prior to any voluntary conservation activity); and

2. A post-conservation activity run.

The same summer and winter rainfall sequences are used in each run to allow a valid comparison of cropping outcomes. Key outputs used in the analysis include:

- Crop and livestock production (numbers, areas, yields, sales)
- Gross value of production
- Farm costs, revenues and net cash flows
- Farm gross margin = total enterprise incomes less total variable costs
- Net farm income = farm gross margin less overhead and depreciation costs
- Farm business return = net farm income less operator labour and interest costs
- Farm return to equity = Farm business return/farm equity level (i.e. net assets)

These measures allow an analysis of the following:

- How farm production levels change (in areas and value)
- How farm net cash flow changes
- If the farm is able to meet financial commitments and pay a return to the owner
- What return the farm is making on its assets

2.2.4 Model Validation

All computer simulation models represent simplifications of reality. As such, there is an inherent risk that their behaviour and output may differ significantly from what is observed in the real world.

To reduce this risk, the individual farm models developed during the study have been built in collaboration with individual farm managers. At the individual farm level, data of a more confidential nature (eg. production levels, yields and farm financial parameters) were collected via an individual landholder data sheet.

2.2.5 Nandewar Farming Systems

Hassall & Associates (2004) identified five key farming systems in the Nandewar Region as follows:

1. Mixed Farming and Grazing – sheep (lambs and wool), beef and dryland cereal crops, with the cropped area generally less than 10% of the farm. Pastures are native to semi-improved.

2. Productive Grazing – productive soils, beef, fat lamb and fine wool production. Higher quality native and improved pastures.

3. Heavily Timbered, Limited Grazing – less productive soils, limited agriculture, poorer quality native grasses.

4. Grazing – unsuitable for broad scale cropping, beef, fat lamb and medium wool production. Small areas may be cropped for forage, cropping generally less than 5% of farm area.

5. Specialist Cropping – around the edges of the Nandewar study area, dominated by broad acre dryland cropping generally including wheat, barley and sorghum.

To gather data for the models and opinions on voluntary conservation options, landholder meetings arranged through local Landcare coordinators were held in Inverell, Manilla and Bingara. This resulted in three sets of whole farm data being supplied. The meetings revealed that in reality, most farms consist of a combination of systems 1-4 above, with different areas of the farm representing the various grazing and cropping systems, rather than the entire farm being representative of just one system. None of the farms which supplied data were currently operating cropping enterprises, though this can readily be added to the models. Many of the farmers indicated there had been a shift out of cropping in favour of grazing as cropping was viewed as less profitable and less sustainable on some country. This was particularly the case around Bingara and Inverell.

Of the farms which supplied data, one (Manilla area) only operated a small beef cattle enterprise. The other two (Inverell and Bingara areas) ran both cattle and fine wool producing enterprises.

Data have also been sought from a specialist cropping farm in the Quirindi area to simulate the other major farming system in the region and to examine the effects of a significant voluntary land use change via the NSW Environmental Services Program. This involves the conversion of a large area of cropped land to perennial pasture and trees, largely for salinity control but also with some conservation areas for biodiversity enhancement.

This model will involve simulating a more dramatic change from cropping to grazing activity, in contrast to the grazing systems above where the changes modelled essentially involve low productivity timbered portions of the farm.

To estimate the regional impacts, the farm results have to be aggregated to the regional scale. This is planned to be based on information that matches the above farming systems or land use types to the appropriate regional GIS maps indicating land use, land type, vegetation and others as appropriate. Those maps were not available to us at the time of this report.

2.2.6 Some sample results

Although the brief for this project was limited to developing the whole-farm modelling tools, we felt it would be useful to demonstrate how the models could be used with examples from two farming systems.

At the time the models were ready for use, the linked projects in the Nandewar Bioregion Assessment had not provided us with any specific voluntary conservation options to be examined. Therefore, based upon our own knowledge of various options/schemes, generic material on conservation schemes provided by Hassall and Associates and feedback from landholders, we used two models to analyse some hypothetical schemes and the current DIPNR Environmental Services program, both of which have objectives beyond just biodiversity conservation. These examples are outlined below.

Example 1 – Forest Reserve and Private Native Forestry.

Using a model based on the information supplied from a case study farm, simulations have been run to illustrate the effects on the farm business performance of several hypothetical voluntary conservation options. The financial simulations were run over a 21 year timeframe.

Key assumptions

The case study farm has the following key physical characteristics:

- The farm is located in the Inverell region of the Nandewar
- Total farm area = 1,200 ha
- Arable area = 350 ha (but no cropping is carried out)
- Grazing area = 633 ha
- Area under woody native vegetation = 56ha (and this area does not currently contribute to farm livestock carrying capacity)
- Area under native grassland = 161 ha
- Livestock numbers = 1,200 ewes, 1,200 wethers, 180 cattle (breeders)

The four conservation options examined for this farm were based around options for the 56 ha of forested area. At present, this area is essentially a de-facto conservation reserve as the

landholder does not use it for agricultural production. It would undoubtedly incur some costs in terms of feral animal control, etc. but it is assumed that these are minor in the context of the entire farm. The conservation options included:

1. Setting the area side as a reserve with no grazing and incurring reserve establishment and maintenance costs. These costs were based on work performed in Tasmania (CARE, 1997) which examined the costs of establishing reserves on private land. One–off reserve establishment costs were $202/ha and included fencing, fire breaks and feral animal control. There were also on-going maintenance costs of $26.45/ha which included fencing repairs, fire breaks, feral animal and weed control. Here, we have assumed that these costs are in addition to those already incurred on this area, which may be over-estimating the costs to some extent.

2. As above, but with the landholder being fully reimbursed for establishment and maintenance costs of the reserve.

3. Rather than a reserve, operating the 56 ha as a private native forestry (cypress pine) operation, selling timber at stumpage prices and getting some additional grazing in the thinned forest. Key assumptions here were:

- Selectively harvest the entire (56 ha) block in the first year extracting 5m^3 per ha of merchantable cypress at a stumpage rate of $30/$m^3$;
- Non-commercially thin half (28 ha) of the block during the harvesting operation and non-commercially thin the remainder at a rate of 2 ha per year (i.e. after 15 years, the entire block will have been thinned);
- Commercial thinning of these areas can commence 50 years after the non-commercial thin (but this is beyond the time-frame of the analysis carried out here);
- Non-commercial thinning costs are $400/ha (based on data from recent Greening Australia thinning trials in the Inverell region); and
- Additional carrying capacity under thinned trees was 1.5 DSE/ha, which lasted for 10 years after thinning until canopy closure precluded additional grazing.

4. As for the private native forestry operation above, but purchasing a mobile mill ($15,000) to produce and sell green-sawn timber on-farm at $450/$m^3$ to local markets. It is assumed the landholder does their own harvesting (costs $81/ha) and milling (costs $57/$m^3$) and mill recovery is 60%.

For the baseline situation, it is assumed that farm production levels are maintained ‘as is’ in the absence of a dedicated 56 ha voluntary reserve or a farm forestry operation.

It has been argued that without reserves of this nature and their biodiversity values, the long-term sustainability of the farming system is likely to decline. We are yet to be presented with concrete evidence that this is the case. Similarly, we have not been presented with evidence that a reserve of any size in this area would make a positive contribution to regional biodiversity. Indeed, landholders in the Nandewar Region (and this is supported on some sites by Greening Australia thinning trials) indicate that excluding these cypress forests from

active management (i.e. thinning) may reduce their biodiversity value and lead to a loss of groundcover and increased soil erosion.

Therefore, for this case study example, the stable baseline assumption would seem to be a reasonable one. In fact, given on-going productivity gains in agriculture and the increasing uptake of new conservation/biodiversity-oriented grazing systems such as cell grazing in the region, it would be possible to argue for an increasing financial baseline along with improved biodiversity on some grazing farms. This is supported by recent research into productivity growth in Australian agriculture (Mullen, 2002).

Results

The following charts show the impact of the four conservation options on key business performance parameters.

From **Figure 2-B**, it is clear that, even though setting aside 56 ha as a reserve does not reduce livestock numbers, there are costs associated with the reserve which impact negatively on net farm income. If these are reimbursed, net farm income returns to the pre-reserve (baseline) level. However, the private native forestry option allows small increases in net farm income due to timber income and the small increase of livestock carrying capacity under thinned forest. Operating a sawn timber enterprise is more profitable than selling at stumpage prices.

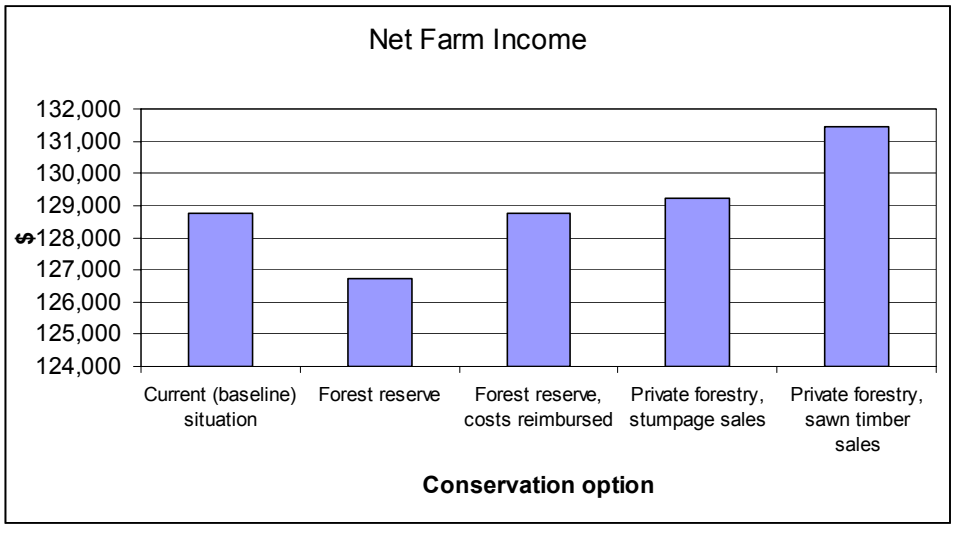

FIGURE 2-B: Net Farm Income (21 year averages)

In general however, the average differences in net farm income are small, only a few thousand dollars. This is in part due to the fact the while the sawn timber private native forestry operation produces a large cash surplus in the first year of the simulation, no additional cash surplus is generated in following years and averaging over the 21 year period reduces the net farm income result.

For the stumpage sales from the private native forestry operations, the thinning costs outweigh the revenue from timber sales, but average net farm income is slightly higher than the forest reserve options due to lower stewardship costs and the additional livestock carrying capacity under the thinned forest. This situation is illustrated in the cash flow chart (**Figure 2-C).**

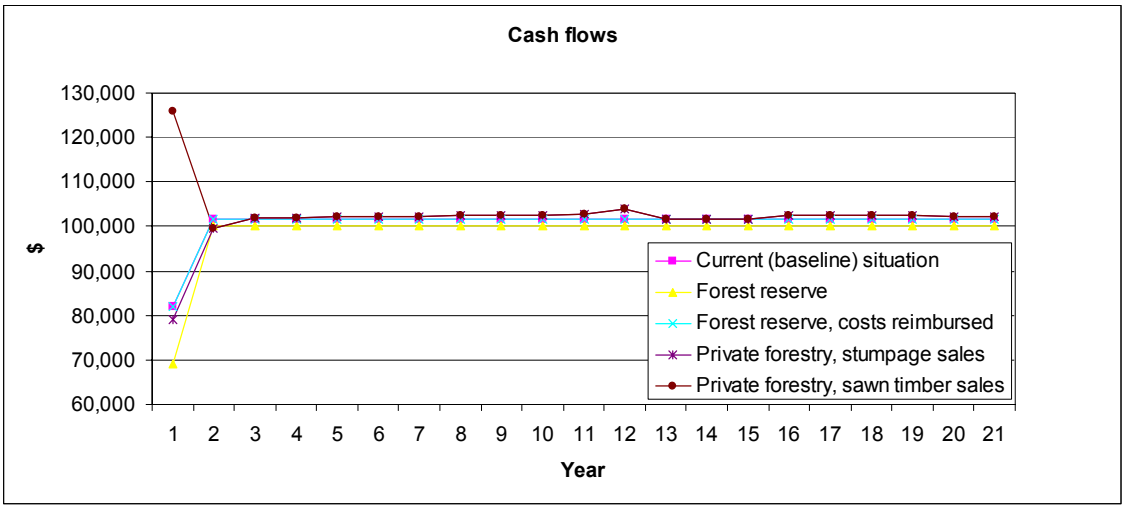

FIGURE 2-C: Net Cash Flows

For all options, the cash flow in the first year was negatively impacted upon by an opening overdraft balance and overdraft interest. However, the overdraft is eliminated by the second year of the analysis. In the first year of the analysis, the private native forestry option with sawn timber sales is clearly superior in terms of net cash flow due to the additional net revenues from timber sales. The forest reserve with no cost reimbursements is the least desirable cash flow option, due to the establishment costs of the reserve.

After the first year, all options are quite similar in cash flow terms throughout the entire period, though slightly higher for the private native forestry options due to additional livestock sales, a result of the small increases in carrying capacity.

Average livestock number increase slightly under the private native forestry options. This is due to the additional carrying capacity under the thinned cypress from additional pasture growth **Figure 2-D**. It is assumed that these extra stock are sourced via natural increase (i.e. more young stock are retained to build up numbers).

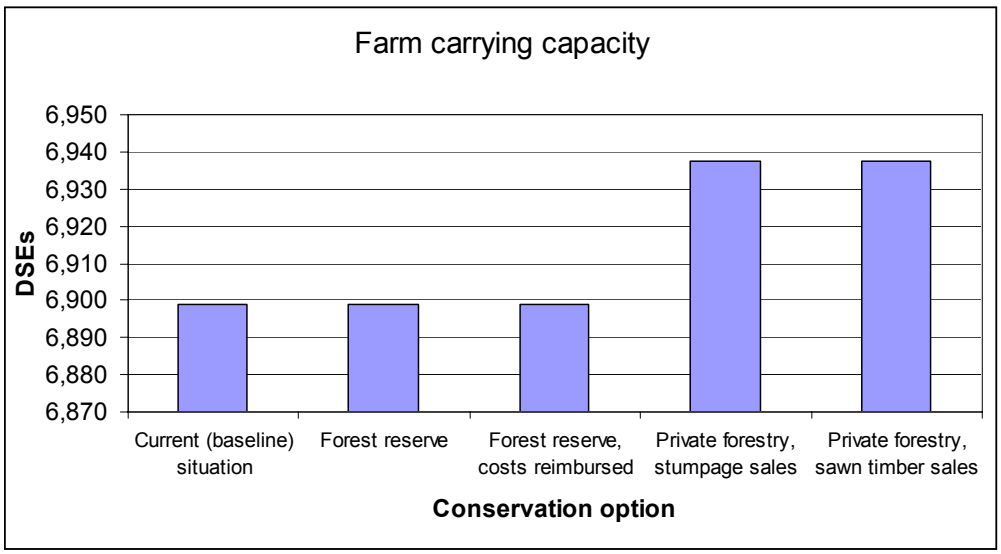

FIGURE 2-D: Farm Carrying Capacity (21 year averages)

Average revenues **Figure 2-E** are significantly higher under the sawn timber option due to the large inflow of income from the initial harvest in the first year of the model (this income is more than sufficient to offset in investment in a portable sawmill). Timber revenues in subsequent years is zero however, as it takes 50 years after the initial harvest/thinning to produce further commercial timber.

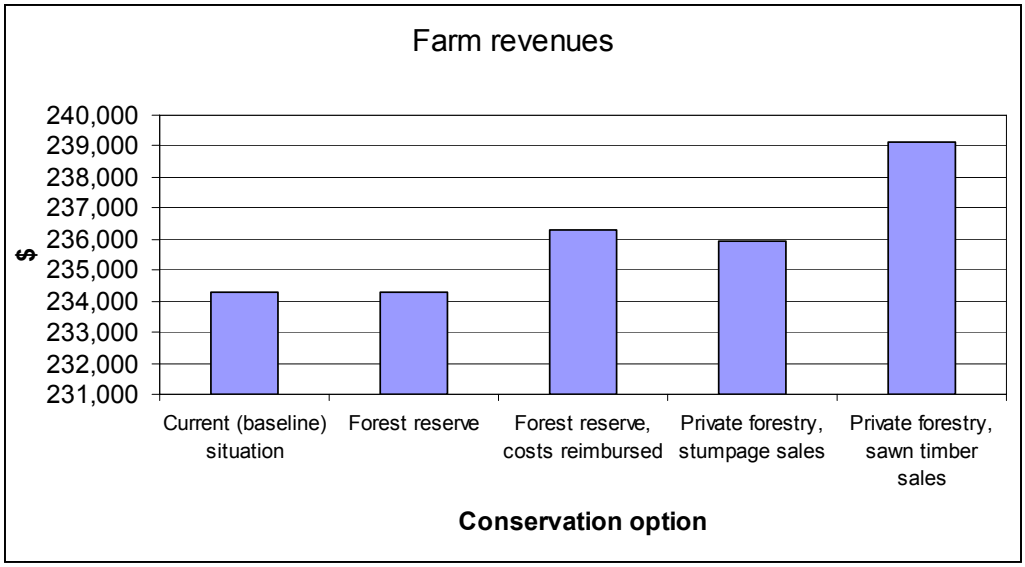

FIGURE 2-E: Farm Revenues (21 year averages)

Average farm costs **Figure 2-F** are slightly higher under the reserve options due to establishment and maintenance costs, and under the private native forestry options due to timber harvest/management costs and investment in a portable mill.

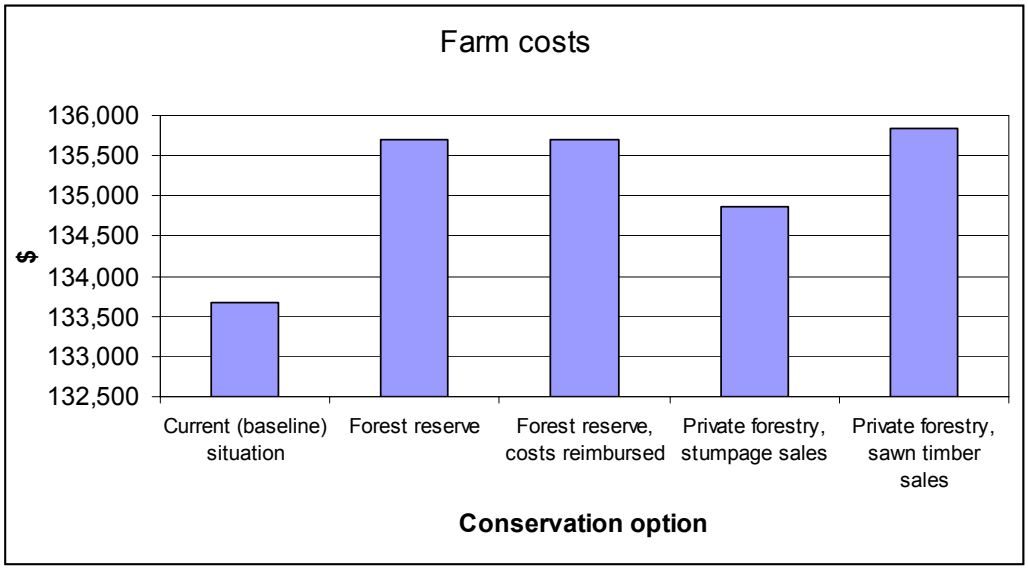

FIGURE 2-F: Farm Costs (21 year averages)

Income from livestock (stock and wool sales) are higher under the private native forestry options due to the increased carrying capacity on the thinned cypress areas **Figure 2-G**.

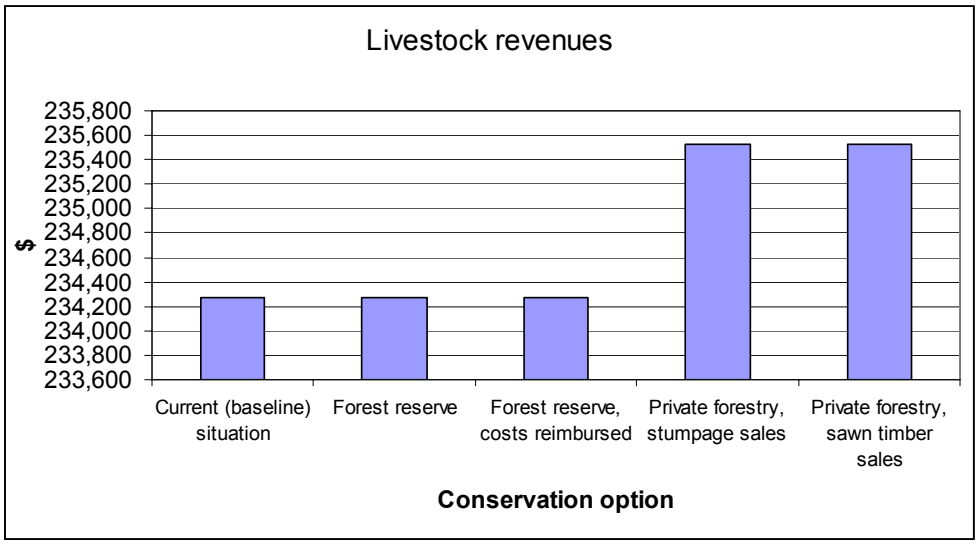

FIGURE 2-G: Livestock Income (21 year averages)

In general, the impact of all these options on the performance of the farm business is quite small. The private native forestry options produce more favourable results than the reserve options due to additional timber and livestock income (as opposed to simply being reimbursed for stewardship costs).

Example 2 – The Environmental Services Scheme

Additional data were obtained from a landholder in the Quirindi area who is a participant in the DIPNR Environmental Services (ES) Pilot Scheme. This scheme aims at securing various conservation outcomes by funding significant land-use change on farms. The scheme represents a far more substantial change in the farming system than has been achieved under many other voluntary conservation programs.

Enterprise level data from the farm and the cost implications of the land use change were added to a generic model of a Liverpool Plains dryland cropping operation (see Jackson 1998 for model details) to simulate the financial impacts of land use change.

Key assumptions and changes on this farm include:

- The farm is located in the Quirindi area, just on the western edge of the Nandewar study area;
- Total farm area is 1,458 ha of which 928ha is arable (cropping) land;
- Current farm enterprises consist of a sorghum-wheat-barley rotation on 384 ha of highly productive black soil country, wheat and barley production (mainly for grazing, but some grain harvested) on less productive, sloping red soil country (159ha) and a breeder cattle enterprise of 147 cows plus 140 trade steers;
- Cropping on the red soil country is deemed to be marginal and contributing to a salinity hazard at the break of slope which threatens the productive black soil areas;
- Under the ES scheme, the 159 ha of red soil country and 15ha of black soil country will be converted to perennial pasture for grazing (lucerne and Rhodes grass). This is mainly to address the salinity issue;
- A native hardwood plantation has been established at the top of the red soil country, 50 ha of native pasture converted to a reserve, riparian zone tree planting undertaken, native pastures improved and weed control increased. These changes are largely aimed at biodiversity improvement as well as contributing to salinity amelioration (the trees) and pasture sustainability;
- Various watering and fencing improvements have also been undertaken to make the new farm plan workable at a total cost of around $106,000. It is assumed that these costs are met from existing cash flow (extending the overdraft if required), rather than funded by adding to the farm's long-term loan;
- Farm overhead costs were set at $80,655 (taken from the generic model);
- Opening farm debt was assumed to be $150,000 (from the generic model) with annual principal payments of $10,000 and an interest rate of 8.5%;
- An opening overdraft of $50,000 is assumed with an interest rate of 10.25% (from the generic model);
- Gross margins for farm enterprises are taken from landholder estimates of $165/ha for red soil crops, $526/ha for the black soil rotation and $14/DSE for both cattle enterprises; and
- Breeding cows have a DSE rating of 13 DSE per head, trade steers a rating of 9.

The plan results in a reduction in cropping production from year 1 of implementation, but an incremental rise in livestock carrying capacity over 5 years as perennial pastures become increasingly productive. Watering, fencing and pasture establishment costs are incurred in stages over the 5 year period of the ES scheme.

Under the scheme, the landholder sought funding for the pasture establishment costs (at a total cost of $260/ha). Other costs will be borne by the landholder (mainly capital costs of fencing and watering systems, as well as the opportunity cost of lost production).

Again, we have assumed that the baseline financial performance can be maintained in the absence of the conservation scheme, given the lack of evidence provided about the impacts of biodiversity on farm productivity.

This may be a less reasonable assumption for the salinity issue in this example however. Although the salinity hazard had not yet impacted negatively on the black soil crop production, the landholder perceived this as a future risk, suggesting a declining baseline may be appropriate. As discussed above, this may be offset by general improvements in farm productivity and other changes to farm management systems.

Even so, it is acknowledged that a steady baseline may under-estimate the value of conservation activities involving salinity amelioration on this farm This is an issue that would require further investigation or perhaps a sensitivity analysis in a more comprehensive study. Again, no quantitative evidence was provided that a failure to maintain biodiversity on this farm would result in productivity decline.

Results

The following results are taken directly from the Vensim™ model which was developed for a generic farm which contained the same enterprise mix as the Environmental Services farm. Unlike the results for Example 1 which were outputted from Vensim™ as data tables, then graphed as averages in Excel™, the charts below show actual annual results directly from Vensim™.

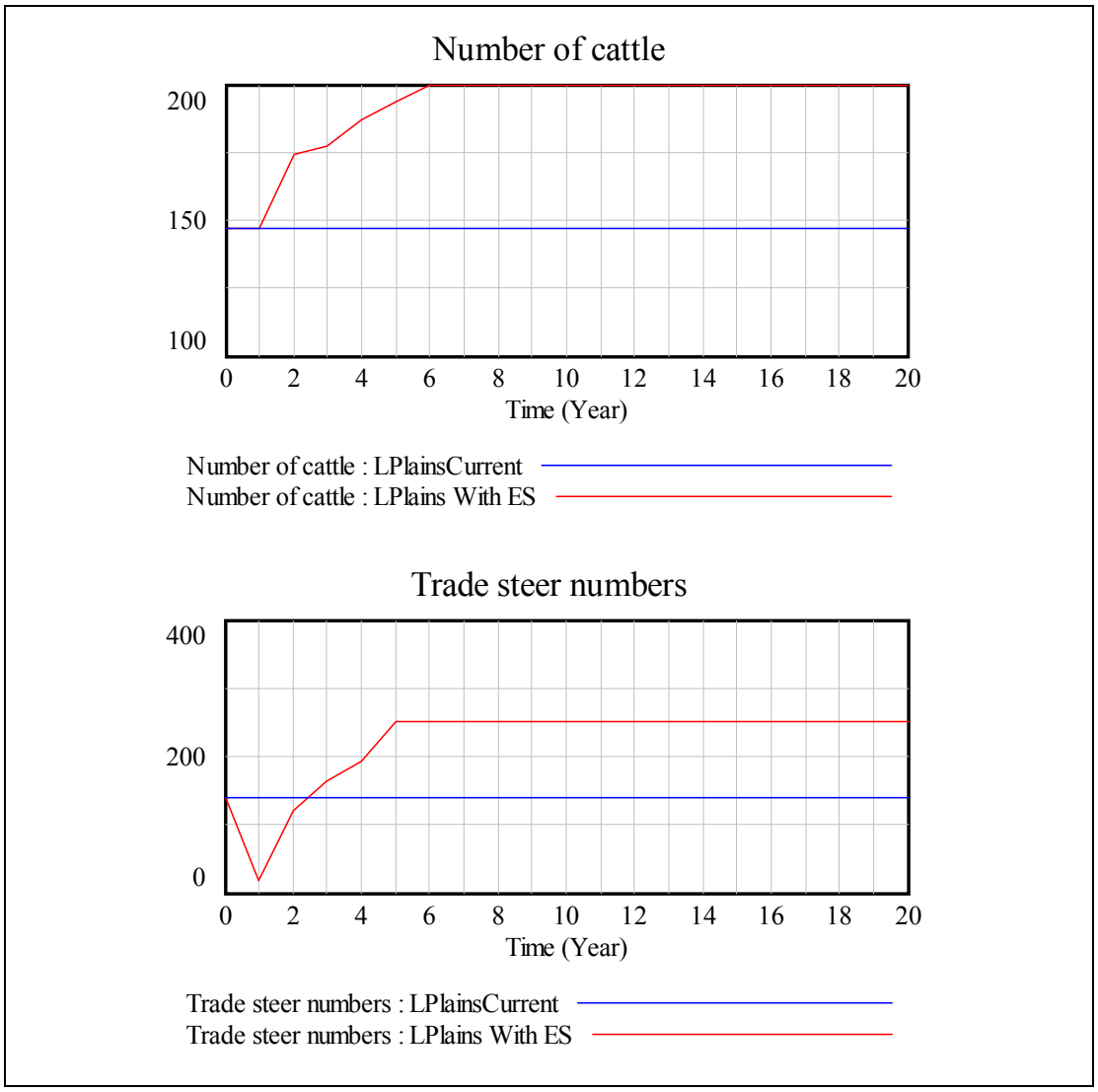

FIGURE 2-H: Change in Cattle & Trade Steer Numbers under the Environmental Services Program

Figure 2-H reflects the land use change from cropping to grazing. Livestock carrying capacity increases over a five year period as perennial pasture production increases. Crop production falls by 159ha on the red soil and 15ha on the black soil. Initially, trade steers are reduced to allow cow numbers to be maintained as in year 1 of the scheme. Farm DSE capacity actually falls initially, but in later years, both cow and trade steer numbers increase then stabilise by years 5-6 as improved perennial pasture production reaches its potential.

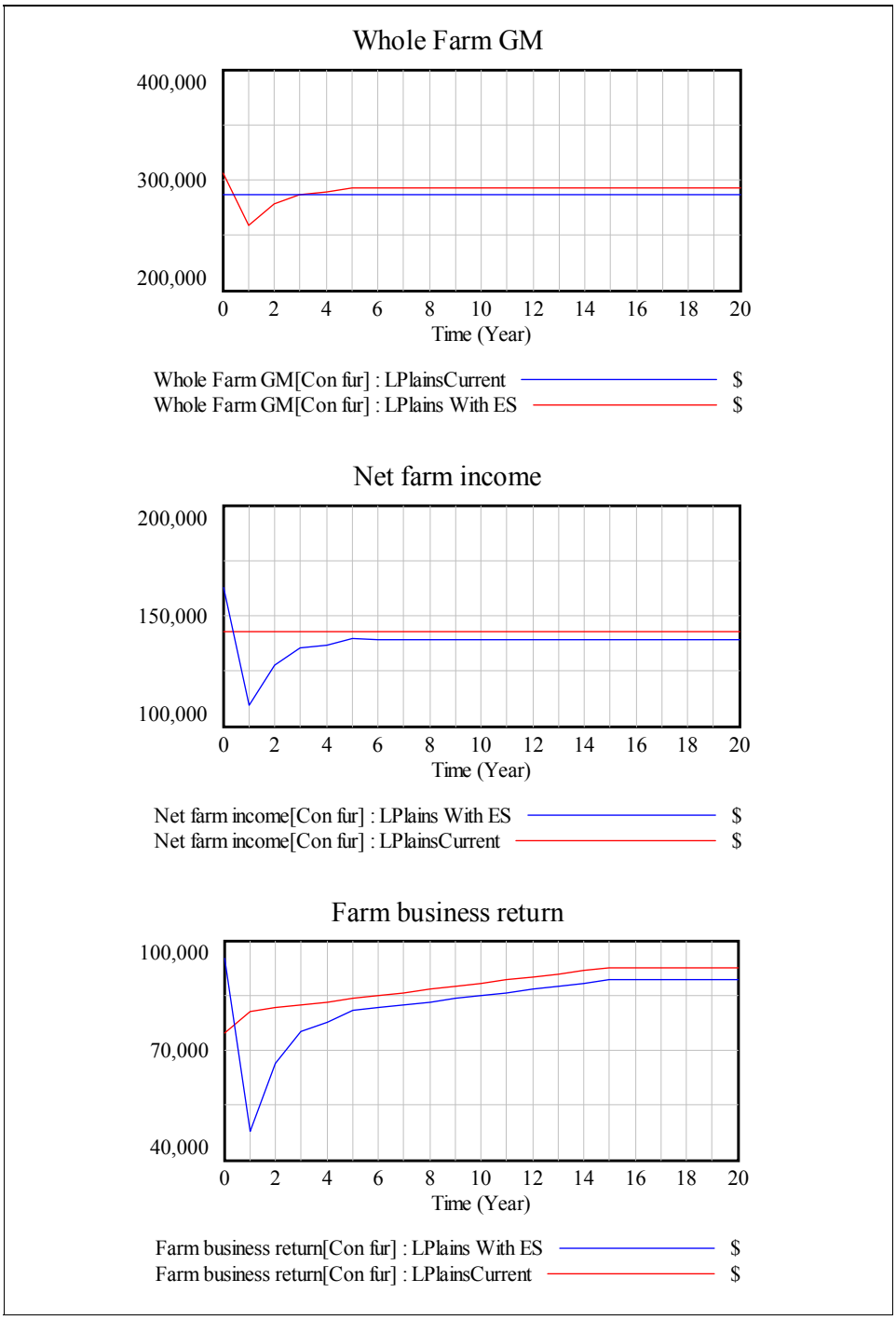

FIGURE 2-I: Farm Financial Performance Indicators

Figure 2-I illustrates how key financial indicators change under the scheme. Farm gross margin (i.e. enterprise revenues less enterprise variable costs) initially falls under the scheme because the loss of the cropping gross margin is not offset by increased grazing gross margins. However, by year 4, additional stock carrying capacity overcomes this deficit and the farm gross margin post-scheme stablise at about $6,000 per year higher than for the current situation.

Net farm income (farm gross margin less overhead costs and depreciation) follows a similar trend to farm gross margin, however continues at a slightly lower level ($3,000 lower) with the Environmental Services scheme changes because of the increased depreciation costs (around $9,000) on the additional fencing and watering infrastructure added under the scheme. The depreciation cost is not offset by the increased farm gross margin. However, this result is strongly influenced by the depreciation rate assumed, which in this case was 9% as per the generic model (Jackson 1998). Farm business return (net farm income less operator labour costs and finance costs) also follow a similar trend for the same reasons and from year 5-6 onwards, are around $3,000 per year lower with the scheme in place.

It should also be noted that wear on cropping machinery and labour requirements will be reduced with less cropping and this has not been costed. This cost reduction may well be sufficient to leave the farm business in a better financial position in terms of farm business return after the Environmental Services changes.

In this example, the changes to the farm enterprise mix are substantial, the potential to avoid future private costs (i.e. damage to the profitable black soil country) is large but the financial impacts are relatively small once the new enterprise mix has stabilised.

It is difficult to place a dollar value on the public benefits of participation in the scheme, but the potential benefits include maintaining water quality in the creek at the break of the slope, biodiversity benefits in the conservation and re-afforested areas and increased carbon sequestration from the forest.

2.3 VOLUNTARY CONSERVATION - ISSUES FOR CONSIDERATION

Farmer perceptions

Discussions with landholders in the Nandewar region during the data collection process revealed a number of consistent opinions on voluntary conservation issues. These opinions and farmers perceptions are summarised below to provide some clues on how conservation measures on farms might be structured.

Farmers report that there is already a significant level of unfunded conservation happening on farms. Many farms have areas of heavily timbered land (largely native species) which is mostly unsuitable for agricultural activity, with the exception of some occasional grazing. In some cases, these areas are subject to normal fire/weed/pest control measures but are largely left as conservation areas. Some landholders felt this aspect of their farm operations was not given due recognition.

Reliance on a regulatory approach to on farm conservation is meeting with considerable opposition from the community. Landholders have spent a significant amount of time engaged in consultation processes, only to have plans reached by consensus markedly modified. Their faith in the consultative process has been greatly eroded.

The notion of 'land lock-up', that is areas set aside for reservation, without ongoing management under a pure regulatory approach is also causing concern. In the Nandewar region some sites have the potential for rapid cypress pine proliferation, and farmers are concerned that this could lead to increased soil erosion as canopy closure precludes groundcover growth. Weed, fire and pest problems are also an important issue and landholders were keen to stress the need for on-going management of conservation areas. All groups strongly expressed the need for changes to land management to achieve conservation outcomes as opposed to 'land lock-up'.

Funded programs were viewed more favourably than a straight regulatory approach. However the appeal of the incentive mechanisms was quite variable. In particular, rate rebates were not a preferred option as they were generally small in monetary terms and there are concerns about eroding local council rate bases.

The inflexibility of some funding arrangements was also highlighted. In some cases, funds had to be expended by a certain date and this was perceived as impractical where seasonal conditions were poor for activities such as tree planting. A strength of the Liverpool Plains Land Management Committee (LPLMC) tendering scheme that has been identified is that it runs over a five year period and conservation activity can be matched to seasonal conditions without loss of funds. It was also pointed out that this scheme had a higher level of accountability than some others did.

Competitive bidding processes were also favoured as they provided scope for including the opportunity cost of lost production in the funding provided, while ensuring that conservation outcomes were high due to the ranking of the conservation benefits of the bids. This imparts a notion of cost effectiveness of which landholders were receptive.

Operators of bidding schemes have noted that there is some difficulty in securing highly productive land under the bidding process, because the opportunity cost of lost production is too high (Jim Thompson, DIPNR, personal communication 2004).

The issue of the scale of conservation activity was raised, in the context of questionable environmental outcomes. There was a suggestion of tokenism attached to some activities, particularly small scale tree plantings. There is a view that this funding should be used to address a serious environmental problem on perhaps a single farm, or a number of farms to produce better value for money.

The imposition of conservation covenants on land titles was also not a favoured option because the notion of being 'locked into' conservation activity is perceived as a potential obstacle to selling the property.

At one of the meetings, the option of managing cypress pine forests for timber production was discussed. Landholders felt this activity was economically marginal and indeed research at both CARE and Greening Australia supports this notion. With on-farm value adding (i.e. producing sawn timber), the economics of the enterprise improves significantly. However, current legislative uncertainties over private native forestry are acting as a disincentive for both forest management and investment in on-farm sawmilling equipment.

The increasing complexity of the paperwork required for voluntary conservation agreement funding was also noted. Landholders involved in the LPLMC tender process noted the relative simplicity of the administrative procedures for that program.

Many landholders questioned the focus of the Nandewar assessment being biodiversity. They felt that soil and water conservation issues rated as far more important in terms of their business operations. Some expressed the opinion that looking after the health of the soil would go a long way to preserving biodiversity.

An over-emphasis on tree planting was also raised. Some felt funding to assist with farm infrastructure development or even low interest loans to increase the size of sub-economic holdings would do more for farm sustainability than tree planting.

Some lessons from WA

While salinity control is not a key issue in the Nandewar study area at present, there are pertinent lessons to be learned from the WA salinity investment experience which may be relevant. Many of these have been summarised in a series of papers by David Pannell, an economist at the University of Western Australia. Some of the key findings are listed below (see www.general.uwa.edu.au/u/dpannell for full papers).

These lessons are presented here, not in the context of comparing salinity risk in the Nandewar to WA, but in the broader context of highlighting economic issues which must be considered in any proposed voluntary (or enforced) conservation initiative.

Does market failure exist?

The rationale for government intervention in some environmental issues is questionable. A valid rationale for intervention is market failure – that is, the private sector is under-investing in conservation activities which would lead to a net benefit to society were they undertaken. However, economic analysis of interventions for salinity amelioration in WA suggests that market failure does not exist in many cases because:

- The benefits of amelioration accrue mainly on farm (i.e. are private benefits) and the off-farm (public) benefits are minimal and so;
- The incentive payments made to farmers to undertake conservation activity are often in excess of the public benefits achieved.

The other condition to satisfy the market failure rationale is that the public benefits from intervention should exceed the public costs.

Moreover, the existence of market failure may still not be a justification for government intervention. Two further criteria are of relevance:

- That intervention does not result in regulations which make things worse, not better. Some landholders have argued that SEPP46 is an example as it stimulated a rush of land clearing that might otherwise not have occurred.
- That administrative costs do not swamp the benefits.

The need for profitable land-uses

The scale of land use adoption required to solve many environmental problems is large, too large to be achieved from the public purse. Panell argues that rather than using funds inefficiently on small scale measures that are not improving problems significantly, those funds could be better spent on developing new agricultural production systems which both alleviate the problems and are profitable.

Key asset protection versus a catchment approach.

In NSW, natural resource management planning revolves around catchment scale plans. Water Sharing Plans, Native Vegetation Plans and Catchment Management Blueprints have all been developed and have all been modified to varying degrees. Pannell argues that the catchment scale is the wrong scale to start with. Rather, to ensure cost-effective public expenditure, we should be targeting key asset protection. Funding should be prioritised toward high value assets (eg highly productive black soils in the Liverpool Plains portion of the Nandewar region which are under threat from rising water tables) to ensure maximum cost efficiency of expenditure. Evidence from WA suggests that the most effective interventions occur at a local rather than a catchment scale.

In a similar vein, he points out that planning does not equal adoption. And adoption on a broad scale is more likely where landholders see a strong relationship between the conservation activity and the farm business/farm asset performance.

Conservation of native biodiversity

Native vegetation conservation schemes in NSW seem to suffer from many of the pitfalls highlighted above.

The broad definitions applied to biodiversity (and its conservation) provide no real guidance on which biodiversity projects should take precedence over others. The current mode of operation for biodiversity conservation appears to be based on the concept that all biodiversity is of equal importance and all conservation is valuable, rather than providing supporting evidence on which biodiversity components are of more or less importance;

The lack of evidence on how different management options will contribute to improved biodiversity. The philosophy currently in favour seems to be that any native system will improve biodiversity and more is better. This is clearly not the case for cypress forests in the Nandewar which reach lock-up stem densities. It has also been shown to be inaccurate for exotic pine plantations on farms in the Northern Tablelands region as far as insect biodiversity is concerned (see Australian Landcare 2004).

The danger in an open-ended approach to biodiversity conservation is the risk of spending large sums of public money for minimal or unquantified biodiversity gain. At the same time, there may be negative impacts on the profitability of farming businesses and regional economies.

Most economists would hold the view that the benefits of voluntary conservation options aimed at biodiversity conservation should exceed the costs. While others would reject this as ‘economic rationalism’, there remains the inescapable fact that public (and private) funds

are limited and should be spent in a cost-effective manner. Funds directed to projects which achieve no real biodiversity gains could be better spent on hospitals, schools or roads.

The challenge for the scientific community to is prioritise biodiversity conservation targets and to indentify clearly the management options which will deliver important biodiversity benefits.

Sustainability

'Sustainable farming systems' is a commonly used, but poorly defined and largely unmeasurable term in conservation policy circles. Ecologists use it in the context of generating a farming system which has no negative impacts on the environment and allows the farm to maintain its productivity indefinitely. However, this ignores that fact that the farm must be financially and socially 'sustainable'.

If, in the pursuit of conservation objectives, farming operations are modified to an extent where the system cannot support itself financially, it is clearly not a sustainable farming system, though it might become a sustainable biological system, supported by the tax payer. But even then, the question needs to be asked, is this system truly 'sustainable' (self-supporting) if it is relies upon external funding?

Sustainability in the context of a farm business is an illusive concept which seems to detract from the important task of making continual, incremental improvements to the way farms are managed. There is no 'silver bullet' solution that will suddenly make a farm 'sustainable'. However, as scientific and farming knowledge improves, it is possible to make changes to the system to improve its environmental and financial performance.

And the majority of the farming community is extremely receptive to these changes. If it can be demonstrated that the changes make a measurable improvement to the environment, they may be adopted even if they impact negatively on other aspects of the business. If they can be shown to improve both the environment and farm business performance, they will be adopted far more enthusiastically and on a scale that may produce large environmental gains.

Concluding comments

The above discussion is neatly summarised by the following statement:

> "a major requirement for a policy intervention to be efficient is that it recognises and explicitly identifies, or has a process for revealing, the cost-benefit trade-offs" (Productivity Commission 2003 pp.18).

This statement highlights a weakness with many of the policy interventions seen to date in the natural resource management area. Scientific knowledge appears to be insufficient to quantify accurately many of the costs and benefits and so the trade-offs are difficult to assess. In terms of biodiversity issues, the key scientific data lacking usually includes:

- The sort of biodiversity that is most critical in different areas;
- The level of conservation intervention required to ensure adequate biodiversity is preserved;
- Critical minimal threshold levels which, if passed, lead to irreversible biodiversity loss;

- How different management options contribute to achieving the required level of biodiversity;
- The extent to which productive and conservation activities can co-exist.

The result may be second best where any conservation activity is deemed to be good and the cost-effectiveness is unquestioned.

2.4 MILL MODELLING

2.4.1 Introduction

A further aspect of the Nandewar assessment relates to the impact of conservation on public land to timber industry supplies. At present, there is only one mill in the Nandewar region that sources cypress pine timber from the public estate. This mill sources around half of its cypress logs from the Nandewar study area and half from the Brigalow Belt South bioregion.

This mill has been upgraded following considerable investment by the mill partners in 2002. It included a sawmill upgrade and the installation of kilns, planning and end-matching equipment, allowing the operation to produce value-added cypress boards. These boards are exported to Japan (40% of production) and sold into markets in Sydney, Melbourne and Brisbane (60%).

Presently, due to the bioregion assessments and moratoriums on cypress logging, State Forests can only supply around 6,000m^3. The mill owners feel that there is some scope to access a further 1,000m^3 from private property, though at present throughput remains at 6,000m^3.

2.4.2 Sawmill model details

As with the farm models, a model of this sawmilling operation was developed using the Vensim^{TM} software to simulate the annual physical and financial parameters of the business.

The models require a number of inputs including:

- Sawlog supply to the mill (it is possible to separate this into public and private supplies)
- Product output mix (this is essentially end-matched boards and a range of by-products including sawdust, chips and shavings which are sold to various markets
- Product recovery rates
- Product prices
- Mill variable and overhead costs
- Labour costs and requirements
- Finance costs
- Payments to partners

Model outputs include:

- Sawmill gross margin (enterprise revenues less variable costs)
- Sawmill net income (farm gross margin less overhead costs and depreciation)
- Sawmill business return (farm net income less payments to partners and finance costs)

The key parameters which can be varied to show the impact on business performance include:

- Log throughput
- Product recovery
- Product prices
- Labour requirements

2.4.3 Some sample results

The key variable of importance for this study is the log supply into the mill. Two different scenarios have been run for comparison. These are:

- With the current throughput of 6,000m^3. Although this is less than the 8,900m^3 that the mill was designed for (which required an additional five staff who have since been made redundant), improvements in mill sawing efficiency have now made the business a profitable entity at the lower throughput level;
- With a reduction in throughput to 5,000m^3 and a staff of eleven (note that it is impossible to produce end-matched boards with any less staff than eleven).

The results of this analysis are shown in **Figure 2-J**. This indicates that under the current arrangements with a log supply of 6,000m^3, the business is meeting its operating costs and financing costs, and returning a payment to the mill owners. Where the log supply is further reduced to 5,000m^3, the financial performance of the operation is significantly reduced.

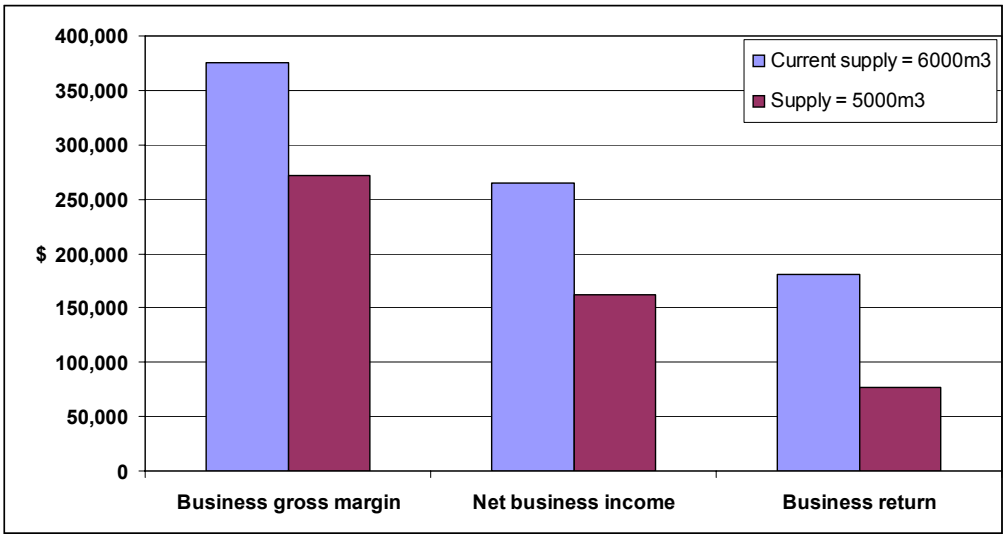

FIGURE 2-J: Financial Impact of Reduced Log Supplies

3 Regional Models

3.1 INPUT-OUTPUT MODELS

Input-output models are an established part of the system of national accounts structure and are integral to the estimation of Gross National Product (GNP). The input-output tables detail the interindustry trade that occurs among industries in an economy. The tables are constructed on a 'double entry' system that ensures that the supply of product from any industry has to be equal to the use of the products of that industry including any exports and imports. For details on the Australian models and input-output models generally, see ABS (2001) (Cat No 5209.0).

The input-output table has an important role in describing some characteristics of an economy, in particular the nature and intensity of interindustry trade. A subsistence economy where all business/household entities are self-sufficient, will have no interindustry trade. As economies develop, the level of interindustry trade increases as businesses and households specialise and trade with other entities for the supplies that they need. The consistent development of input-output tables under a set of conventions makes it possible to compare these characteristics of an economy at different points of time and to compare economies in a consistent way. For this study, input-output tables are used to describe certain characteristics of the Nandewar region economy.

The interindustry linkages are the basis of flow-on effects that occur when one industry has an impact on other industries. Those flow-on impacts will operate through:

- Changes in the demand for inputs by the affected industry; or
- Changes in their production that will impact on the downstream marketers, handlers and users of the product.

The model is structured in a way so that it is mathematically possible to estimate those effects through the use of 'multipliers'. Larger multipliers indicate that there is a high level of interindustry trade among the affected industries. This is an analytical application of input-output models to estimate the flow-on effects from a change in production in a specific industry.

The multipliers are calculated on the basis of a number of assumptions. The most important are:

- A linearity assumption that implies that any change has proportionate effects throughout the economy so that there are no substitutions among inputs and products. That applies

to both inputs used in production and goods and services used in consumption. This assumption may not be critical over a range of types of change and effects of prices in the production effects as it often takes time to adjust production systems. There is a general concern that production systems involve a set of fixed costs that do not change in response to short-run adjustments in production. In consumption, the same effect occurs in relation to discretionary and non-discretionary expenditures on goods and services. Multipliers are mostly regarded as reflecting long-run effects after all of the adjustments have occurred. In that case the linearity assumptions need to be viewed in a context of possible structural changes that may occur in the industry or economy.

- A set of homogeneity assumptions that mean all of the entities in the specified sectors are the same in terms of production technology, products produced, goods consumed, etc. This is probably the most critical assumption given that the modern economy is comprised of such a multitude of differentiated products and production systems. These are aggregated into 106 sectors or groups that are intended to be similar within those groups. As a result, there is an important initial task in any impact analysis to make an assessment of whether the 'average' structure that appears in the sector to which an industry belongs is appropriate for the analysis. If it is not, then a separate sector needs to be compiled.

- There is no consideration of market effects in the input-output model and all results are based on real changes in production of goods and services. There can be a range of price effects that may influence outcomes including changes in input prices, product prices, wages and interest rates. Exchange rate changes may also be an important factor in price changes. If the issues to be analysed are related to price changes, then some type of model that allows consideration of the effects of price changes is required. In this case, price effects would be considered initially in the micro models and the results from the micro models are then used in the regional input-output models to assess regional impacts.

The use of input-output models in the Nandewar analysis is justified in a number of ways.

1. The input-output models can be readily compiled relative to other types of models that include market effects.

2. It is debatable whether a set of linked micro and regional models might provide better results that that provided by general equilibrium models where it is difficult to specify accurately the particular characteristics of the local supply industries and markets. This might be the case when the price effects that are of most interest lies in subsidies and other support given at the micro level for a change to conservation-focused production systems. The information that is possible within a micro model would be difficult to replicate in a general equilibrium model.

3. In assessing regional impacts, many of the industries that will be affected are likely to be a small proportion of the total market for that industry so that any price effects are likely to be small.

4. From a regional adjustment perspective, it is often desirable to consider the likely adjustments in a structure that does not include macroeconomic effects from changes such as exchange rates and interest rates. That enables the real linkages that exist in the region to be identified and responses made to possible adjustments through flow-on effects. Changes in interest rates and exchange rates may ameliorate those effects by coincidence or they may reinforce those effects as they are determined by factors independent of the region.

A combined micro and regional modelling approach is considered suitable to this task as it is relatively low cost and provides a high level of flexibility in application to deal with the range of conservation options that may be evaluated in this process.

The changes that are being considered will have implications that extend over several years. In that case, the changes will tend to be part of a long-run process of growth and change. As a result, some consideration has been given to planing the likely effects into a context of development over the next decade. This has involved consideration of past trends and other factors that appear likely to influence the future development of the regional economy. This leads to providing projections of likely change up to 2011. The nature of those changes will be a combination of both national trends and local factors. Within the macro modelling approach, emphasis is given to the role of macro factors. In the approach adopted here, emphasis is given to local factors. However, in a fully developed consultative model of the approach used here, it is expected that a balance would be achieved between the role of macro factors and local factors. The approach could involve developing a number of scenarios of future trends.

The application described here is essentially a demonstration of the general method and the data used to construct a projected input-output table. The process is able to be refined in specific applications in the following ways:

- By focusing most effort on the industries that are to be analysed;
- Consultation with key businesses in the various industries about their expected growth;
- Reference to studies that have projected the level of production, productivity growth and employment in various industries at any level (national, state and regional); and
- The incorporation of regional demographic trends and factors that may result in changes in those trends.

The intensity of the processes of analysis and consultation can be varied depending on the needs of the analysis. Alternately, it might be possible to develop a set of scenarios that span the range of possible outcomes. For this study, only one set of projected data and input-output table has been prepared. However, the structure makes it relatively easy to change the various assumptions used to develop an alternate projection. That would be done to meet the specific requirements of the study. At the time of compiling this report, those specifics have not been developed. The table that is produced is based on a set of information and knowledge that is described in the following sections for each of the regions.

3.2 THE NANDEWAR MODELS

The two region input-output-models have been compiled with the same structure, data sources and assumptions. In the following sections, there is a brief overview of the structure of the two sub-regions based on the input-output tables and related data. This serves to provide a context in which to consider changes that may impact on the economy.

3.3 THE UPPER NANDEWAR REGION

3.3.1 Population and Employment

A detailed socio-economic profile of the Nandewar region is provided in the Hassall (2004) report. As context, some summary information is provided in **Table 3-A** and **Table 3-B**. The main points from these tables are:

- Population has been declining over most of the period and especially in the first half of the 1990s;
- Employment has increased in the second half of both the 1980s and 1990s, with the latter involving an increase in the share of the population in employment (a reduction in unemployment);
- The share of the population in employment is below 43.5% for NSW as a whole. This is likely to be associated with the different age profile of the population as shown in **Figure 3-A;**

TABLE 3-A: Population and Employment Summary, Upper Nandewar Region

Census Year	Total Employment	Total Population	Employment Share of Population	Average Annual Change Between Census Years	
				Employment	Population
			%	%	%
1976		18,650			
1981	7,246	18,400	39.4		-0.27
1986	6,580	18,360	35.8	-1.91	-0.04
1991	6,622	18,460	35.9	0.13	0.11
1996	6,215	17,575	35.4	-1.26	-0.98
2001	6,568	17,256	38.1	1.11	-0.37

TABLE 3-B: Employment by Industry Group, Upper Nandewar Region

Industry	1981	1986	1991	1996	2001
Primary	2141	1891	1719	1477	1463
Manufacturing	623	408	394	515	557
Utilities and building	643	488	509	452	468
Services	3839	3792	4000	3772	4083
Total	**7246**	**6579**	**6622**	**6216**	**6571**

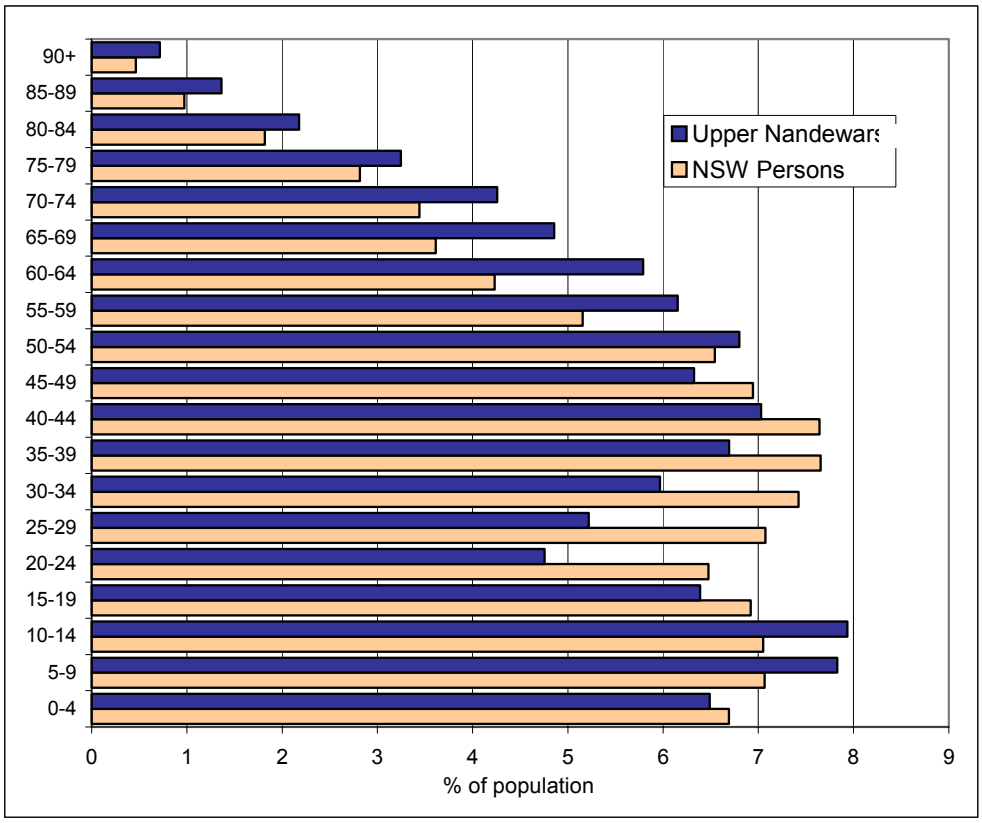

FIGURE 3-A: Age Profile of the Population, Upper Nandewar Region and NSW

- The trend in employment has been dominated by the loss of jobs in primary industry while there has been slower growth in services employment than has occurred in NSW;
- The manufacturing employment has fluctuated with changes in the meat processing industry which is the dominant employer. This has been supplemented by the production of pet food in recent years; and
- There has been a considerable loss of jobs in utilities and building associated with the rationalisation of the electricity distribution industry and the low level of building activity. The latter has resulted from low population growth and generally difficult times for the rural industries through most of the 1990s.

3.3.2 The Upper Nandewar Economy

The Upper Nandewar region is a relatively small region economy. In 2000-01, the following measures were estimated from the aggregated input-output table shown in **Table 3-C**.

Gross region product	$412m
Employment	7,151
Exports (from the region to all destinations)	$203m
Imports (to the region from all sources)	$337m
Household income from employment	$189m
Household expenditure	$376m

TABLE 3-C: Aggregated Input-output Table, Upper Nandewar, 2001($m)

	Ag Forestry Fishing	Mining	Manufacturing	Utilities	Building	Trade Acommodation	Business Services	Public Personal Services	TOTAL	H-hold Exp	O.F.D	Exports	Total
Ag/Forest/Fish	7791	4	40650	1	17	226	23	77	48788	1509	500	33794	84590
Mining	45	230	781	35	327	78	81	121	1699	33	826	13277	15834
Manufacturing	4426	1166	18231	314	3178	5333	2636	1508	36792	19690	7656	126006	190145
Utilities	384	13	2026	557	44	728	1057	727	5537	6231	391	381	12540
Building	239	28	13	7	23	188	1296	86	1881	0	30349	0	32230
Trade/Accommodati	5063	1008	9136	459	1796	7115	5487	3112	33176	73613	9450	29307	145546
Business Srvs	5463	1495	16076	697	2955	22809	25492	7680	82668	72787	5632	297	161383
Public/Personal Srvs	108	176	667	39	60	659	1180	2384	5272	22534	72785	13	100604
TOTAL	23518	4120	87580	2108	8399	37136	37254	15695	215812	196397	127589	203074	742872
H-hold Income	42069	3434	20788	2761	10669	45161	19728	44533	189143	0	0		189143
O.V.A.	2907	4204	19922	4860	4705	21586	81380	23994	163558	53193	6501		223251
Imports	16096	4076	61855	2810	8457	41663	23021	16382	174360	126118	36686		337165
TOTAL	84590	15834	190145	12540	32230	145546	161383	100604	742872	375709	170776	203074	1492431
Employment	1331	55	677	50	466	2091	764	1717	7151				

The 2000-01 year was about an average year in terms of agricultural production although that was an improvement over the poor years of most of the 1990s. Prices were on the increase and the drought effects were only beginning. In aggregate terms, the region is a typical rural-based economy. There is a high proportion of exports from the region in gross regional product. However, this is less than all imports that is dominated by the import of consumer goods. Household expenditure is well above earnings from employment (including an imputed wage to self-employed persons).

Recently available data for 2000-01 from the ABS (Cat No 6524.0) highlights the weak household income position indicated in the input-output table. Average weekly household income in Bingara was $562 and for Inverell was $639 compared to a NSW average of $895. Further, the combined household income included 21 per cent from social welfare payments compared to an average of 10 per cent in NSW.

The trends in the Upper Nandewar economy over the 1981 to 2001 period are shown in **Figure 3-B**. This chart shows the overall trend in relation to the trend in NSW. The blue shaded portions indicate the change in employment that would be required if the Upper Nandewar region was changing at the same rate as NSW. In each of the five-year periods, the growth rate in the Upper Nandewar has been below that of NSW. The extent to which the change in employment is below the NSW level is shown as the 'local effects' that are shaded yellow. The second half of each of the 1980s and 1990s has been best, while the first half of each of those decades has resulted in substantial losses in employment.

Figure 3-B indicates that the period 1996 to 2001 was one of substantial growth for the Upper Nandewar region. There was an increase of 353 jobs that contrasts with a loss of 407 jobs in the previous five years. That represents a total turnaround of 760 jobs. Some of that was a recovery of the severe drought conditions that occurred in the early to mid 1990s in the region and there has been an expansion into some new business opportunities (see below).

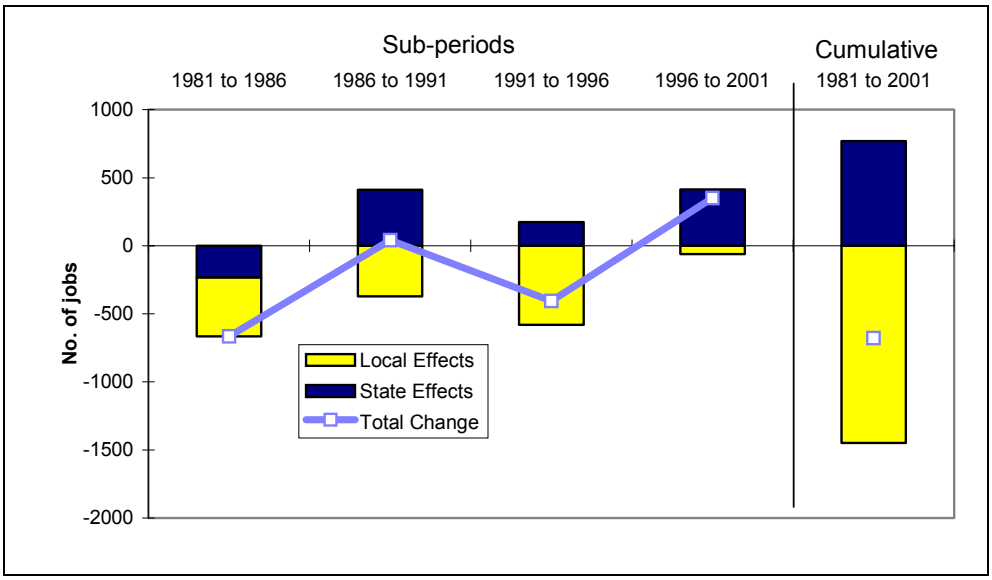

FIGURE 3-B: Employment Change in the Upper Nandewar Region, 1981 to 2001

The change in employment in the 1990s is indicated in **Table 3-C** on an industry basis. The first half of the 1990s was one of significant net losses in employment reflecting the poor seasonal conditions, low commodity prices and the effects of an overall recession in the economy. There were employment losses in agriculture, utilities, trade, construction and a range of service industries. Most growth was associated with the redevelopment of meat processing, residential building and community care.

The situation in the late 1990s indicated strong performances in the building and trade sectors, some areas of manufacturing and some business and personal services. These reflected the improved conditions that occurred in this period, although the region's growth was still well below that for NSW as a whole.

The trend in employment in the 1990s on an industry basis relative to NSW is shown in **Figure 3-D**. This figure indicates the difference between the local change and the NSW change for each of the industries shown over the two five-year periods. Those industries on the left of the '0' line are industries that lost employment relative to NSW, while those to the right increased employment relative to NSW. These are used as indicators of whether the industry in the region is losing or increasing its share of the NSW industry, measured in terms of employment.

In the first half of the 1990s, there were large losses of employment in wholesale and retail trade, accommodation and restaurants, education along with small losses in many other

industries. The main gain was in employment in meat processing. In the second half of the 1990s, the large growth occurred in other construction and wholesale trade (mostly meat and related to meat processing), other food processing (olives, and pet food manufacturing) and other manufacturing (mostly metal fabrication and machinery), along with some small gains in other industries. On the other side of the equation, there were losses in employment share in broadacre farming, utilities (electricity distribution), residential building, public administration and education, along with small losses in several industries

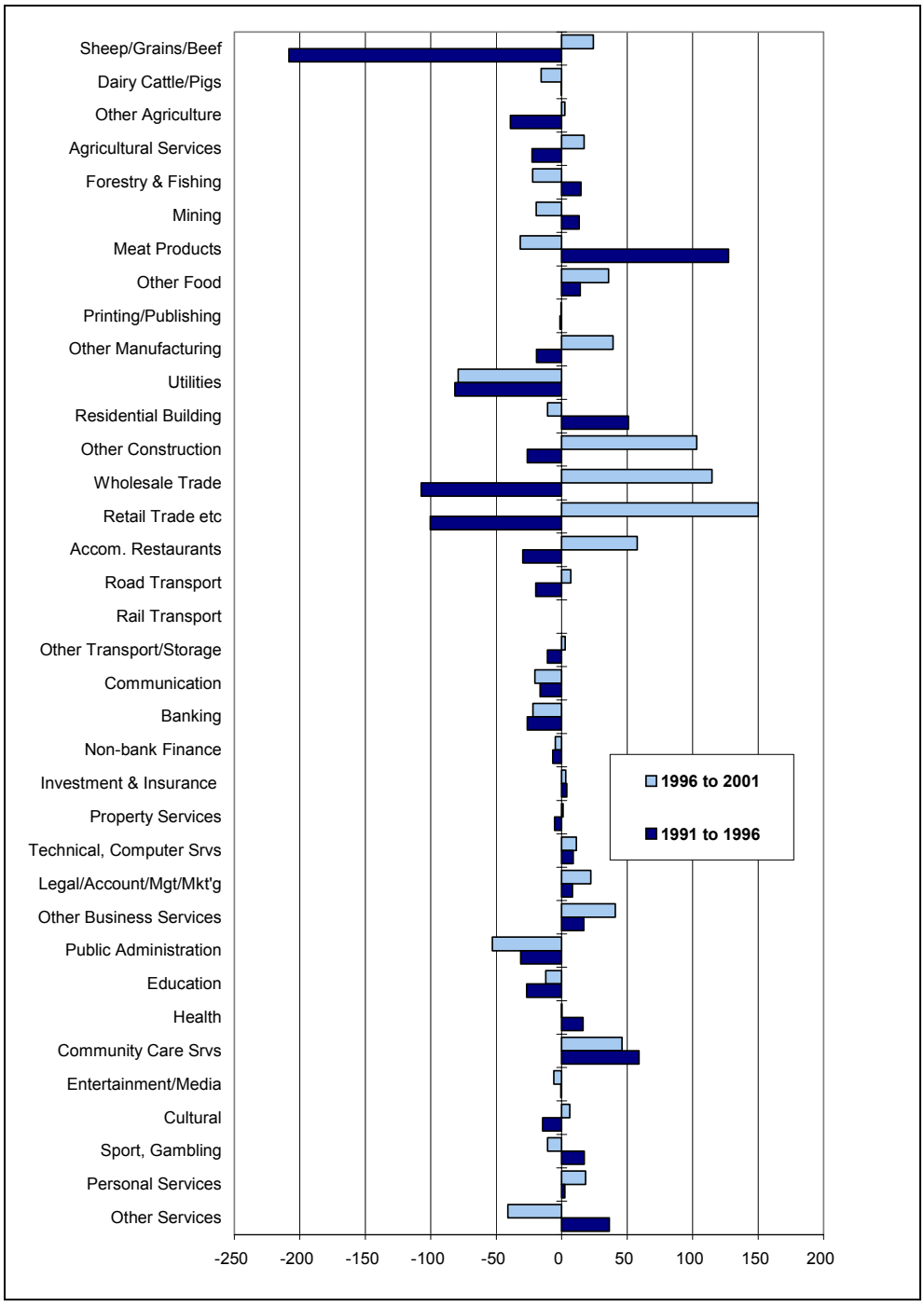

FIGURE 3-C: Employment Change, Upper Nandewar Region, 1991 to 2001

It is notable that the Upper Nandewar region (Inverell) has not experienced much growth in the service industries over the 1990s. The level of service provision is indicated by population/employment ratios (the number in the population serviced by an employee in the relevant service industry. Over all service industries, the average for the Upper Nandewar is 4.4 (each service industry employee services 4.4 people). This is much lower than the NSW average with is 3.0. On a service industry basis, the level of service in the Upper Nandewar can be expressed relative to the NSW average level as shown in Figure 12. A value of 100 indicates that the level of service is at the same level as for NSW. This level or more is achieved only in wholesale trade, mechanical repairs and community care. In all other services, the level is below the NSW level and for many of the 'business services' (transport to other business services the level is mostly less than one-half of the NSW level.

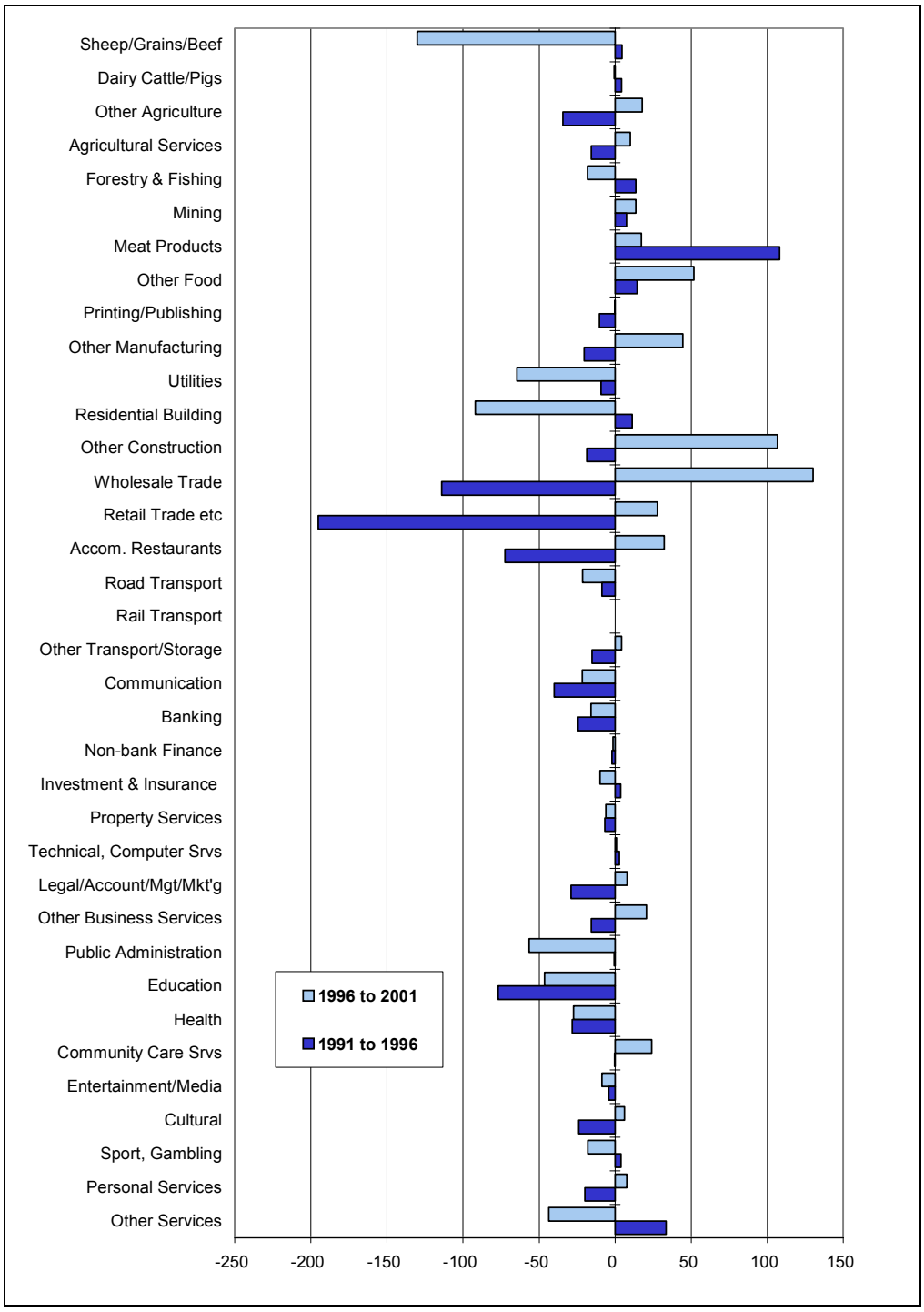

FIGURE 3-D: Local Effects on Employment, Upper Nandewar Region, 2001

The weakness in business services is highlighted by the percentage of employment that is in the industries from transport to other business services as these have a major role in supporting the development and operation of businesses. Most of the other services tend to be focused on providing services to people and households. In the Upper Nandewar, 10 per cent of employment is in business services compared to the NSW average of 24 per cent.

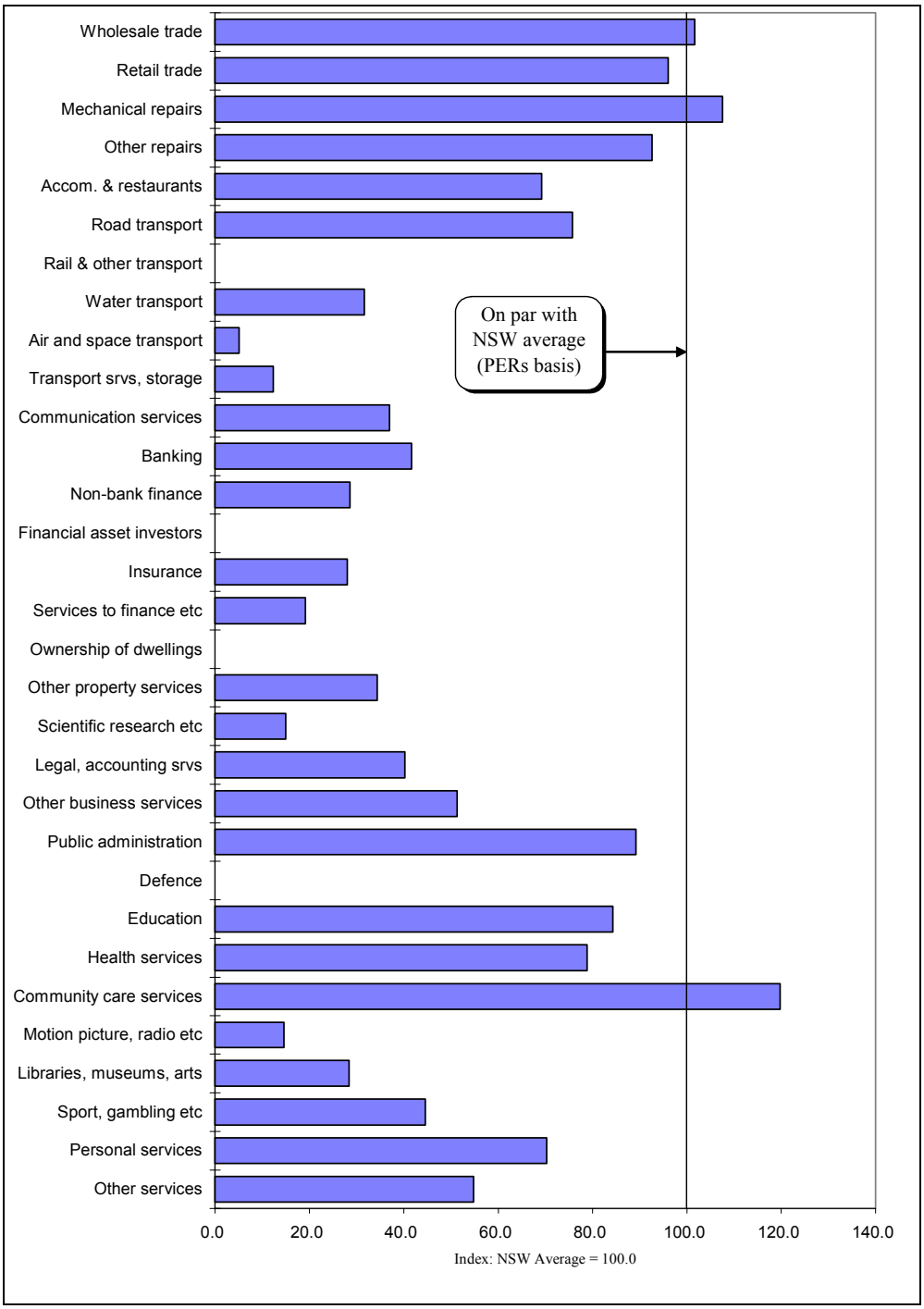

FIGURE 3-E: Service Delivery Indexes, Upper Nandewar Region, 2001

The Location Quotients (LQs) provide an indication of the relative importance of industries in the local economy relative to the national economy. These are useful in portraying an aspect of the diversity or specialisation of the economy, and of trends over time. The LQs for the Upper Nandewar region are shown in **Table 3-D** indicate a growing importance of livestock, especially cattle to the region. There has also been an increasing importance in processing agricultural products as shown by meat processing, pet food manufacturing (other

food products) and olive oil processing. On the other hand, electricity distribution has been an important activity but now is operating at the national average of 1.0. Note that most of the business services are significantly less than 1.0. The sawmilling industry is shown to be small and declining relative to the early 1990s, while forestry activities have declined to 3 people in 2001.

TABLE 3-D: Location Quotients, Upper Nandewar

	LQs					Employment
Ranked Sectors by 2001	1981	1986	1991	1996	**2001**	**2001**
Beef cattle	11.0	9.3	11.1	13.3	**31.0**	593
Sheep	5.8	6.8	12.5	13.2	**11.5**	367
Other mining	8.7	4.0	6.2	3.9	**8.2**	50
Meat and meat products	5.4	4.1	3.3	7.0	**7.5**	229
Oils and fats	0.0	0.0	0.0	0.0	**5.8**	8
Services to agric.; hunting	5.0	6.6	4.8	3.5	**4.8**	71
Other food products	0.2	0.0	0.0	0.8	**3.8**	81
Pigs	7.0	5.1	4.6	2.8	**3.6**	11
Grains	3.8	7.6	6.0	8.7	**3.2**	240
Sawmill products	1.5	1.2	2.1	2.4	**1.6**	18
Agricultural, mining etc machinery	0.9	0.3	0.5	0.6	**1.5**	31
Community care services	0.8	1.1	1.0	1.2	**1.3**	219
Wholesale trade	0.8	0.9	1.1	0.9	**1.3**	441
Water, sewerage & drainage	0.4	0.6	0.6	0.7	**1.3**	20
Mechanical repairs	1.2	1.3	1.5	1.4	**1.3**	139
Other agriculture	2.4	1.8	1.3	1.1	**1.2**	96
Other repairs	0.3	0.7	1.0	1.1	**1.2**	21
Basic chemicals	0.0	0.0	0.0	0.0	**1.2**	13
Poultry	0.3	2.3	1.1	0.5	**1.1**	6
Retail trade	1.1	1.1	1.1	1.0	**1.1**	947
Electricity	1.8	2.2	3.1	3.9	**1.0**	30
Other construction	0.8	0.3	0.4	0.3	**1.0**	158
Education	0.9	1.1	1.0	1.0	**0.9**	455
Health services	0.8	0.7	0.9	1.0	**0.9**	445
Personal services	0.6	0.7	0.8	0.7	**0.8**	104
Other services	0.5	0.5	0.6	1.0	**0.6**	75
Other business services	0.9	0.8	0.6	0.5	**0.6**	124
Banking	1.0	0.9	0.8	0.7	**0.6**	65
Legal, accounting srvs	0.8	0.5	0.6	0.5	**0.6**	136
Communication services	1.1	0.9	0.8	0.6	**0.5**	59
Other property services	0.5	0.6	0.5	0.5	**0.4**	43
Insurance	0.6	0.6	0.4	0.5	**0.4**	27
Services to finance etc	0.5	0.3	0.1	0.3	**0.3**	16
Scientific research etc	0.4	0.1	0.1	0.2	**0.2**	39
Transport srvs, storage	0.1	0.2	0.2	0.1	**0.2**	10

Overall, the economy is heavily dependent on primary production and related processing activities. The diversity index (ranges from 100 for a 1-industry economy to 1 for the Australian economy) is calculated to be 26.7 in 2001. That is a low value and compares with a value for NSW of 4.7. For the diversity index to be below 20, the economy would need to have industrial and commercial activities that extend much further beyond those that are based on the natural resources of the region.

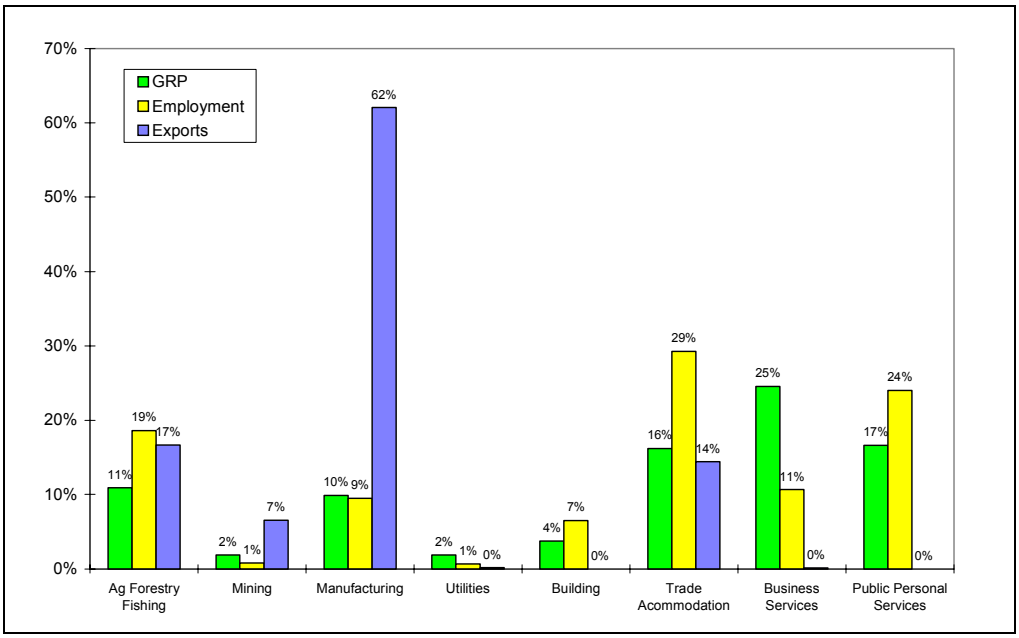

FIGURE 3-F: Aggregated Industry Structure, Upper Nandewar Region, 2001

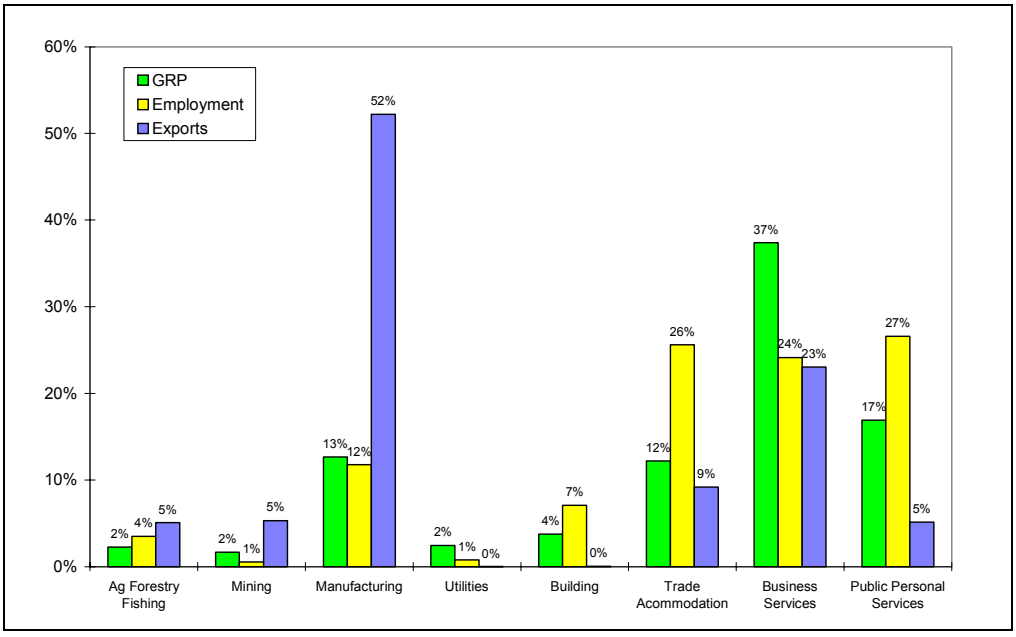

FIGURE 3-G: Aggregated Industry Structure, NSW 2001

The general structure of the Upper Nandewar economy is shown in **Figure 3-F** and is compared with that for NSW in **Figure 3-G**. Exports of manufactured products (meat) dominates the Upper Nandewar economy. Among other categories, the Upper Nandewar economy is more dependent on primary production and has a smaller proportion in building, business services and personal services relative to NSW.

The industry composition of production, employment, earnings from employment, exports and imports are shown in **Figure 3-H** through **Figure 3-M** derived from the input-output table for the Upper Nandewar region.

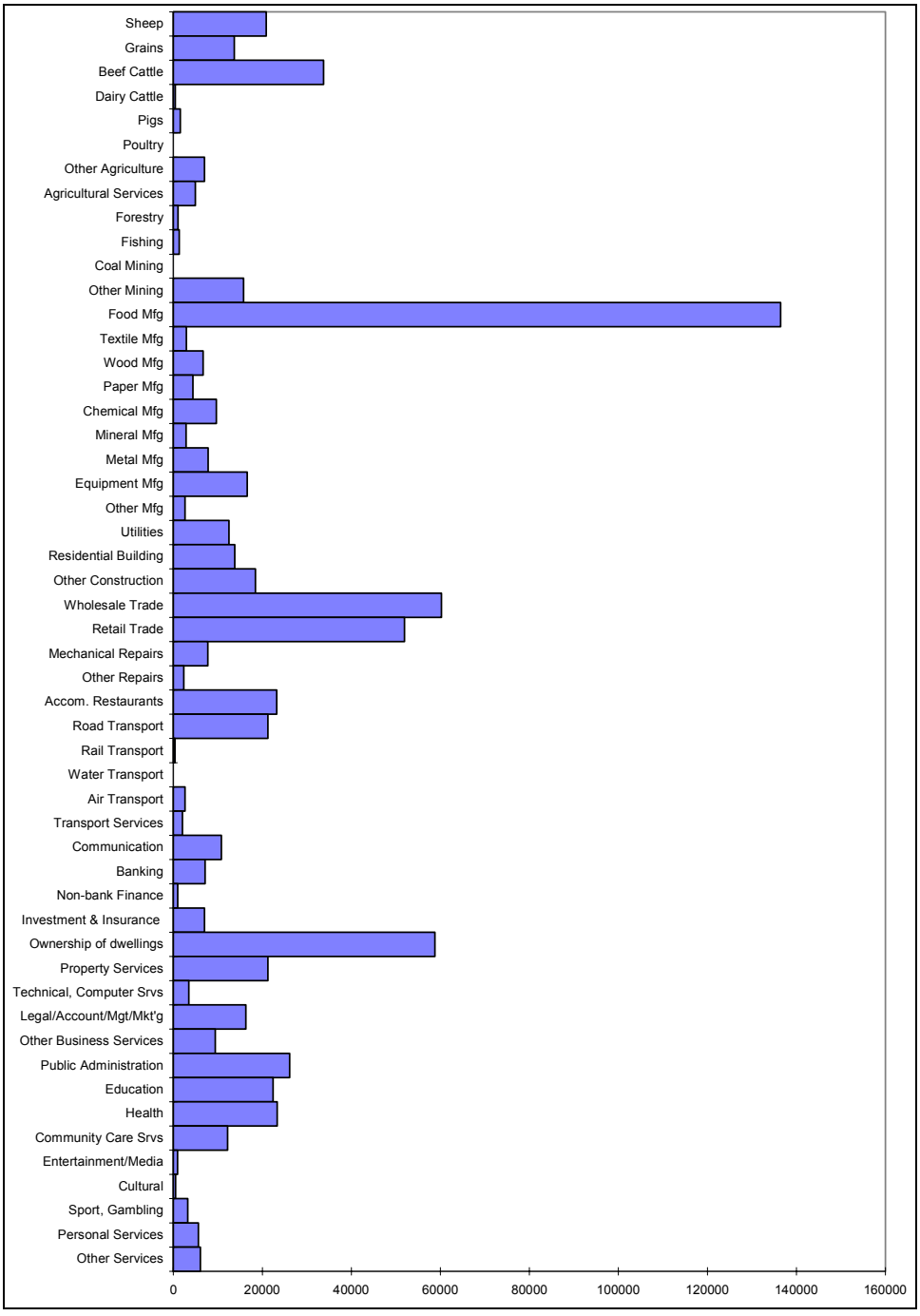

FIGURE 3-H: Industry Composition of Production, Upper Nandewar Region 2000-01 ($'000)

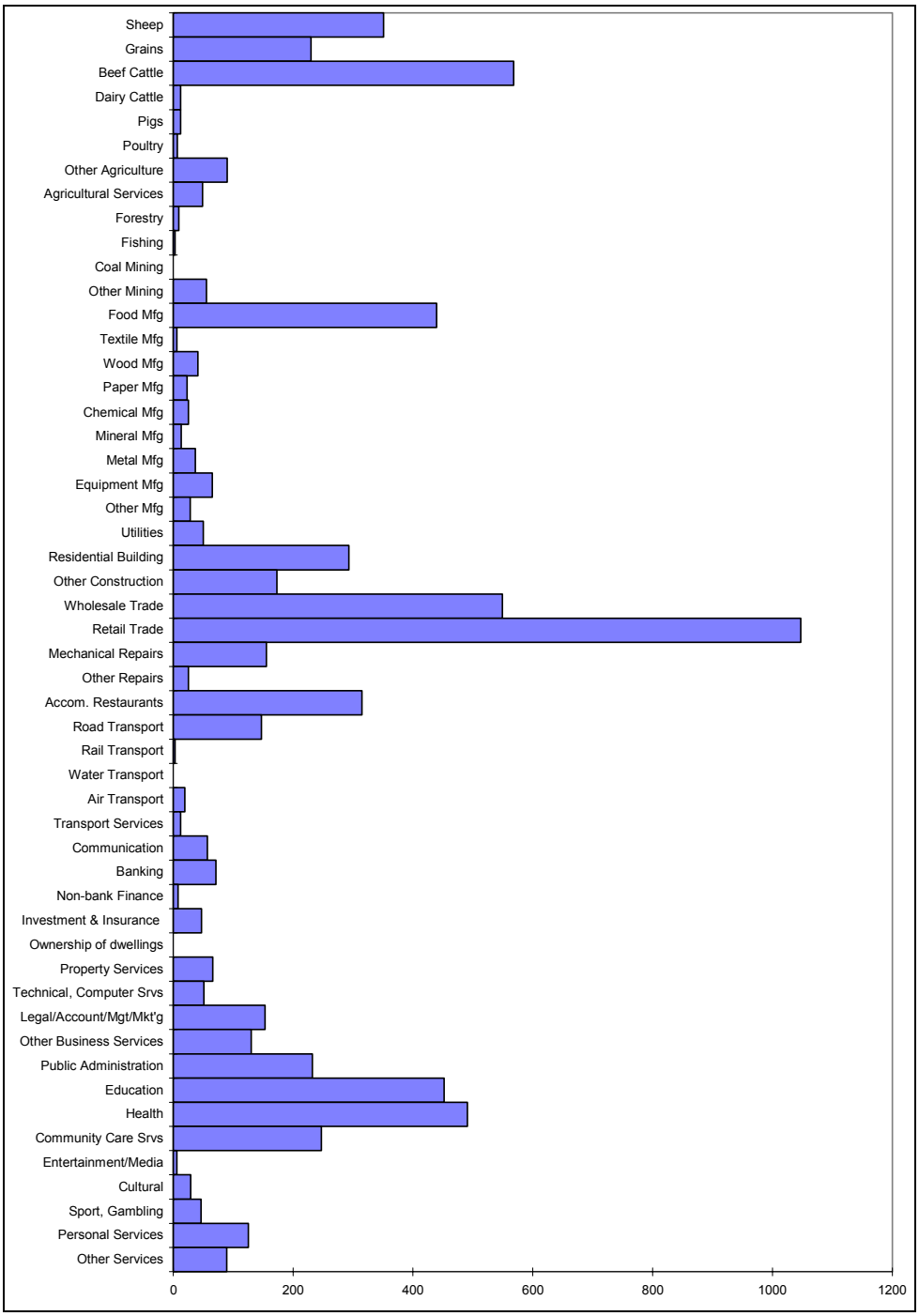

FIGURE 3-I: Industry Composition of Employment, Upper Nandewar Region 2000-01 (No)

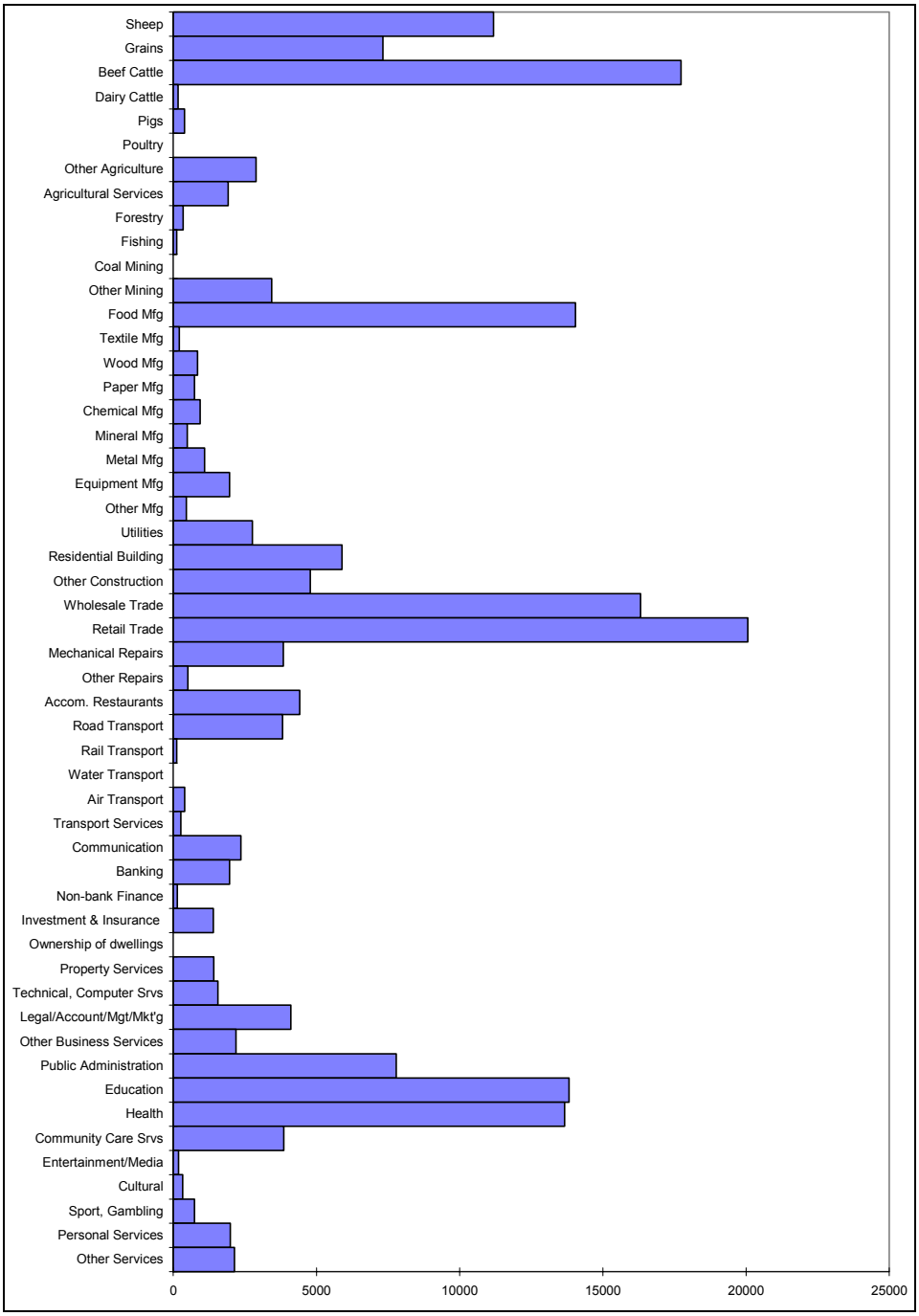

FIGURE 3-J: Industry Composition of Employment Earnings, Upper Nandewar Region 2000-01 ($'000)

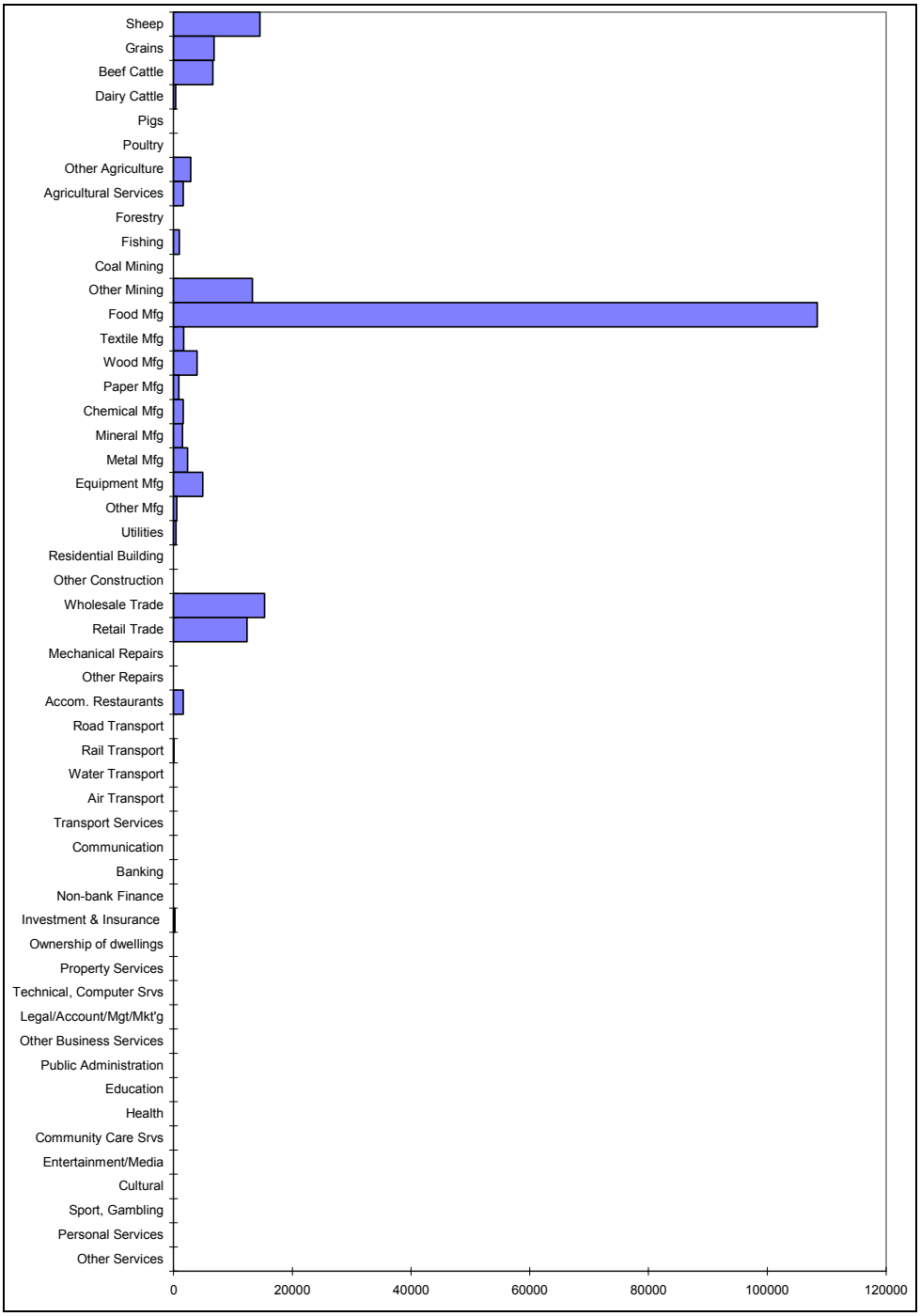

FIGURE 3-K: Industry Composition of Exports, Upper Nandewar Region 2000-01 ($'000)

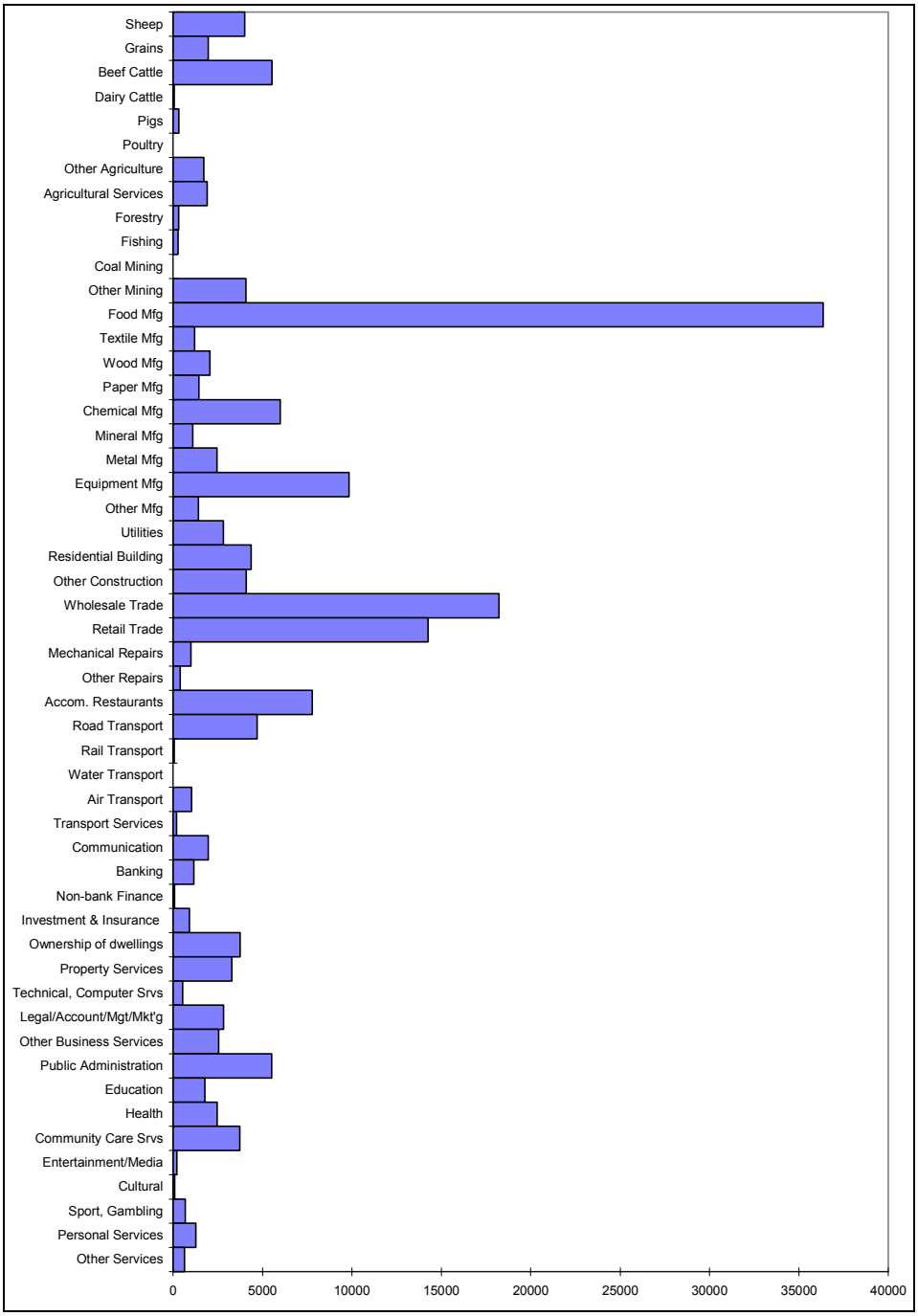

FIGURE 3-L: Industry Composition of Imports, Upper Nandewar 2000-01 ($ '000)

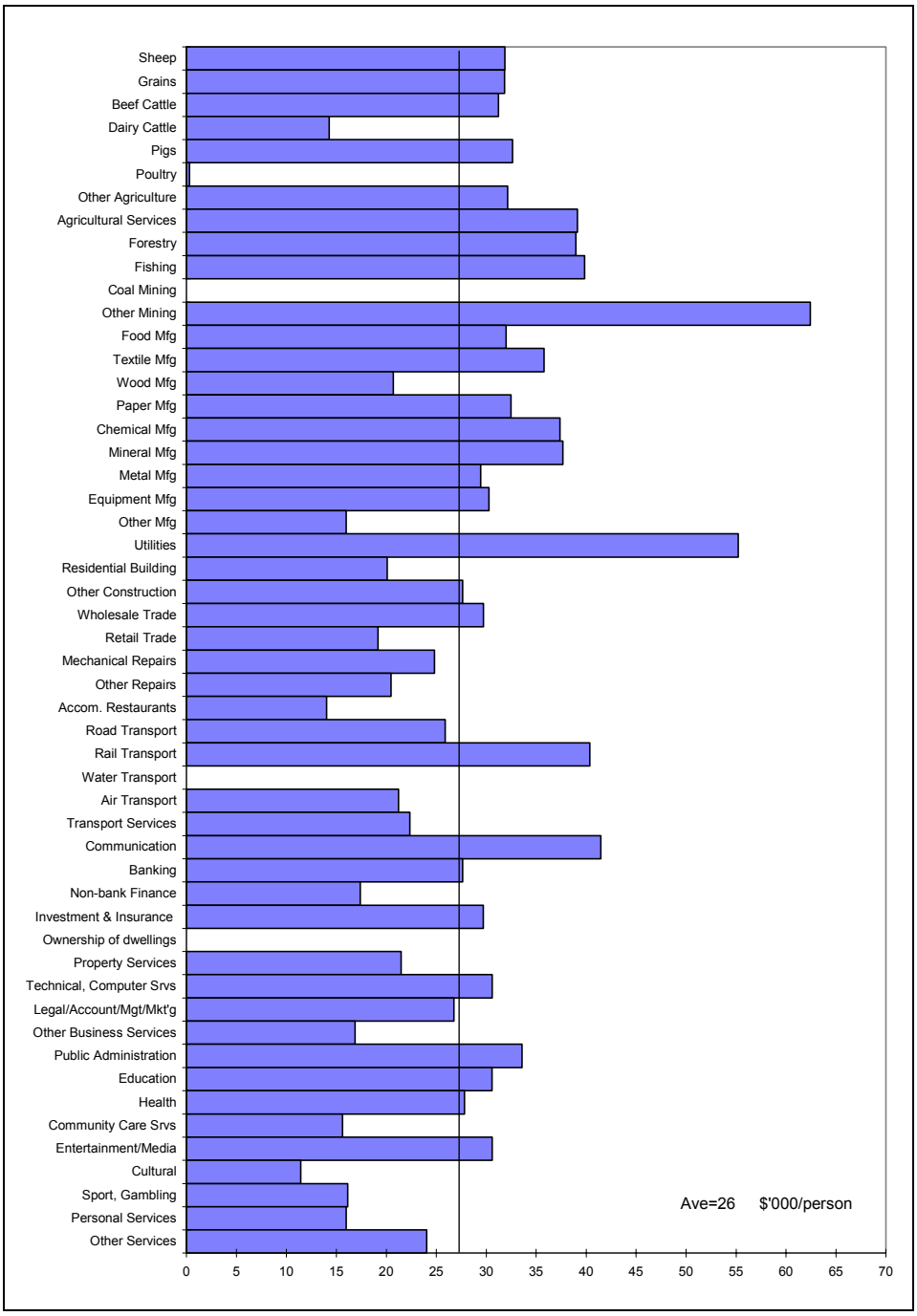

FIGURE 3-M: Industry Average Annual Earnings, Upper Nandewar 2000-01 ($)

The figures highlight the following characteristics of the Upper Nandewar regional economy:

- The dominance of food manufacturing in production, exports and imports (of materials for processing);
- A concentration of employment and wage earnings in agriculture, food processing, trade and education health and community care;
- Apart from large imports of materials for food processing, there is significant imports of a large range of services that offer the potential for expansion in employment (the share

of services in total employment is around 10 percentage points below the NSW average):

- The average annual earnings in the Upper Nandewar region was estimate to be $26 450 which was 77% of the NSW level ($34 286).
- Average earnings were notably lower than the NSW level across most of the service industries in contrast to those for agriculture and manufacturing.

3.4 FUTURE TRENDS IN THE UPPER NANDEWAR ECONOMY

The structure of the economy outlined above is essentially historical. That provides some context in which to consider resource conservation issues. It is useful to consider some issues related to likely future trends in the regional economy that would be considered in developing a projected input-output model for 2011.

As background to this process, detailed employment data by industry from population censuses over the past 20 years have been analysed (see Appendix 3.1). That reveals the trend in employment and the relationship of those trends to those that are occurring in NSW such as the growth in productivity and the growth in real wage earnings. Those data are combined with qualitative information on possible developments in the regional economy and its major industries to develop estimates of likely growth rates for industries over the 10 years to 2011.

The demographic information available is considered as part of the overall trend. At the time of preparing this report, there are no revised estimates of population growth compiled by planning authorities in NSW since the 2001 Population Census. The ABS has compiled some population projections on the basis of the demographic characteristics of the population. This indicates what would occur if current demographic characteristics and migration trends were allowed to run their course and there were no other interventions. Those projections indicated that the Upper Nandewar resident population would rise from 17 836 in 2001 to 18 109 in 2011, a rise of 1.3% in 10 years. Given that local actions would seek to increase the level of employment and to increase the resident population, this estimate would be considered to be conservatively low. (Subsequently, the DIPNR projections have been released and indicate a decline in population of 620 between 2001 and 2011, a decline of 3.5 per cent.)

As a starting point, a population growth of 0.4% pa for 10 years is assumed. This is a compromise between the downward trend from 1981 to 1996 and the recovery since then. 1996 is interpreted as a particularly low point given the difficult agricultural situation in the first half of the 1990s. It does seem likely that the region will see some population and employment growth in this decade. This provides an overall dimension to the likely change and would involve an increase in population to around 18 000, with employment rising by about 260 to 6 800 based on their place of work. (Note that employment in the input-output tables is based on the place of work while other estimates are based on usual residence.)

Within the industries, the following assumptions have been made in compiling the industry growth rates:

- There will be a small decline in agricultural employment and within agriculture, there will be a switch from broadacre cropping and grazing to more intensive production such as viticulture and olives;
- There will be continued growth in food processing;
- With a return to population growth, there will be higher levels of building and construction;
- Most of the services linked to population and incomes will grow at rates equivalent to the population rate or higher, such as in retail trade that contracted over some of the 1990s under difficult conditions in the region; and
- There is likely to be some increase in the role that Inverell plays as a regional service centre.

The resulting changes in employment by industry are shown in **Table 3-E**. In addition to these changes, it has been assumed that:

- Productivity has increased at the NSW average rate of 2.3% per year
- Wages increase at 50% of the growth in productivity

There are two further factors that can influence the nature and size of the projected economy to 2011. First, there is the level of visitation to the region. This has the effect of increasing exports to those that are visiting the region. Many regions make a considerable effort to attract more visitors as part of their economic development strategy. There is likely to be some increase in the attraction of the Upper Nandewar region with the developing wine and olive industries along with gemstones. There is also the possibility that there could be a culture shift among tourists that involves more people preferring visits to country areas. This projected model has made no allowance for an increase in visitation.

The second factor is the number of residents apart from those related to employment. There is an aging of the population as indicated earlier. In some cases, there is a loss of retirees from rural areas to coastal locations. However, in recent years, there has been renewed interest from city people to purchase houses in regional cities and towns for other than investment purposes. For some centres that offer an attractive location and good services, there has been an inward movement of retired or near to retirement people. This increases the population and consumption expenditure without directly increasing employment (the employed share of the population declines). There is a good possibility that this factor will operate in the Upper Nandewar region, although it has not been included in the projected table.

The Nandewar regional assessment includes project work on conservation and industry development opportunities. It is anticipated that the outputs from this work could also be used as a source of information for building a Nandewar projected input-output table.

TABLE 3-E: Projected Employment Growth by Industry, Upper Nandewar Region

IO Sector	2001 Workplace Employment	2011 Projected Employment	IO Sector	2001 Workplace Employment	2011 Projected Employment
Sheep	351	333	Basic non-ferrous metals etc	0	0
Grains	230	218	Structural metal products	12	12
Beef cattle	568	539	Sheet metal products	3	3
Dairy cattle	12	12	Fabricated metal products	7	8
Pigs	12	12	Motor vehicles and parts etc	16	17
Poultry	7	7	Ships and boats	0	0
Other agriculture	90	95	Railway equipment	0	0
Services to agric.; hunting	49	55	Aircraft	5	5
Forestry and logging	9	9	Scientific etc equipment	0	0
Commercial fishing	3	3	Electronic equipment	0	0
Coal; oil and gas	0	0	Household appliances	0	0
Iron ores	0	0	Other electrical equipment	3	3
Non-ferrous metal ores	0	0	Agricultural, mining etc machinery	33	34
Other mining	52	53	Other machinery and equipment	8	8
Services to mining	3	3	Prefabricated buildings	0	0
Meat and meat products	314	376	Furniture	16	17
Dairy products	0	0	Other manufacturing	12	12
Fruit and vegetable products	4	4	Electricity	35	36
Oils and fats	10	10	Gas	0	8
Flour and cereal foods	0	0	Water, sewerage and drainage	15	16
Bakery products	15	15	Residential building	293	308
Confectionery	0	0	Other construction	173	182
Other food products	93	113	Wholesale trade	549	576
Soft drinks, cordials, syrups	0	0	Retail trade	1047	1099
Beer and malt	3	3	Mechanical repairs	155	163
Wine and spirits	0	0	Other repairs	25	26
Tobacco products	0	0	Accommodation, cafes & restaurar	315	331
Textile fibres, yarns etc	3	3	Road transport	147	151
Textile products	0	0	Rail, pipeline, other transport	3	3
Knitting mill products	0	0	Water transport	0	0
Clothing	3	3	Air and space transport	19	21
Footwear	0	0	Services to transport; storage	12	13
Leather and leather products	0	0	Communication services	57	57
Sawmill products	28	25	Banking	71	68
Other wood products	13	13	Non-bank finance	8	8
Pulp, paper and paperboard	0	0	Financial asset investors	0	0
Paper bags and products	0	0	Insurance	27	27
Printing; services to printing	10	11	Services to finance etc	20	20
Publishing; recorded media etc	13	14	Ownership of dwellings	0	0
Petroleum and coal products	3	3	Other property services	66	66
Basic chemicals	10	10	Scientific research etc	51	54
Paints	0	0	Legal, accounting etc services	153	157
Pharmaceuticals etc	3	3	Other business services	130	147
Soap and detergents	0	0	Government administration	232	243
Cosmetics and toiletries	0	0	Defence	0	0
Other chemical products	0	0	Education	452	452
Rubber products	4	4	Health services	491	515
Plastic products	5	5	Community services	247	259
Glass and glass products	5	5	Motion picture, radio etc	6	6
Ceramic products	0	0	Libraries, museums, arts	29	29
Cement, lime and concrete slurry	0	10	Sport, gambling etc	46	47
Plaster; other concrete products	0	5	Personal services	125	128
Non-metallic min. products nec	8	8	Other services	89	92
Iron and steel	15	16	**TOTAL**	**7151**	**7429**

3.4.1 The Projected Upper Nandewar Input-output Table

The projected input-output table for 2011 is shown in **Table 3-F**. From that table the estimates of the key measures used earlier can be compiled as follows (with the increase shown in parentheses):

Gross region product	$516m	(25%)
Employment	7 425	(4%)
Exports (from the region to all destinations)	$320	(58%)
Imports (to the region from all sources)	$364	(8%)
Household income from employment	$220	(16%)
Household expenditure	$378	(1%)

TABLE 3-F: Projected Input-output Table 2011, Upper Nandewar Region

	Ag Forestry Fishing	Mining	Manufacturing	Utilities	Building	Trade Acommodation	Business Services	Public Personal Services	TOTAL	H-hold Exp	O.F.D	Exports	Total
Ag/Forest/Fish	9905	6	60288	1	26	304	34	110	70673	1629	437	30078	102817
Mining	55	287	1116	46	430	102	103	158	2297	33	799	16893	20022
Manufacturing	5490	1494	25456	413	4171	7177	3529	2035	49765	20354	9119	191336	270574
Utilities	465	16	2921	730	58	946	1373	943	7452	7140	406	1322	16319
Building	306	38	18	10	31	262	1661	119	2446	0	39183	739	42367
Trade/Accommodati	6155	1285	13096	600	2370	9471	7184	4061	44221	79206	9777	58120	191325
Business Srvs	6547	1904	23406	891	3944	30279	32857	10322	110151	73454	5860	15979	205443
Public/Personal Srvs	428	268	1680	68	105	1076	1965	4367	9957	31290	83806	5403	130455
TOTAL	29350	5298	127981	2759	11135	49618	48706	22115	296962	213106	149386	319869	979322
H-hold Income	45751	3905	26535	3218	12614	53392	22893	51755	220063	0	0		220063
O.V.A.	8798	5753	30849	6832	7599	34319	105098	36860	236108	53249	6719		296076
Imports	18918	5065	85210	3510	11020	53996	28746	19725	226190	111891	25620		363701
TOTAL	102817	20022	270574	16319	42367	191325	205443	130455	979322	378245	181726	319869	1859162
Employment	1283	56	778	60	490	2195	792	1771	7425				

Table 3-F provides an example of how the assumptions feed through to influence the future performance of the regional economy. Some notable features include:

- The low growth in household income relative to household earnings;
- The increase in exports relative to imports; and
- The critical role of productivity growth in increased gross regional product.

The projections made do not include developments that indicate a lessening of the high dependence on primary production and associated processing activities. The growth of intensive industries such as viticulture and olives may have less vulnerability to seasonal and market conditions than do the broadacre industries. A catch-up in the level of services to be nearer to the NSW level would also add to the stability of the regional economy and may increase the average earnings closer to the NSW average. However, on the scenario depicted in this projection the economic structure of the Upper Nandewar is evolving slowly and will not reduce the reliance on those activities based on natural resources. In that case, actions related to the management of those natural resources will need to be carefully crafted to minimise adverse impacts on those industries and the regional economy.

3.5 THE LOWER NANDEWAR REGION

3.5.1 Population and Employment

Some contextual demographic information is presented here to provide a context for the remainder of the discussion of the Lower Nandewar economy. These are shown in **Table 3-G** and **Table 3-H**. The main features of the Lower Nandewar region are:

- The region was a relatively high growth area for population up to 1991 and then growth was slightly negative.
- Employment declined in the second half of both the 1980s and 1990s.
- The share of the population in employment is higher than in the Upper Nandewar area but lower than that for NSW (43.5).
- The age profile of the population indicates a less dominant higher aged group than in the Upper Nandewar region although there is still a lower proportion than NSW in the 20 to 39 aged groups.
- The employment by industry trends indicate that the utilities and construction employment remained low over the 1990s. The Lower Nandewar region shared the lower growth associated with the difficult times in the 1990s that included drought, economic recession and sluggish commodity prices.
- There has been a steady and mostly growing level of employment in manufacturing.
- The share of services of total employment is around 10 percentage points higher than in the Upper Nandewar region. This would seem to reflect the role that Tamworth plays as a regional centre for public administration, education and health.

TABLE 3-G: Population and Employment Summary, Lower Nandewar Region

Census Year	Total Employment	Total Population	Employment Share of Population	Average Annual Change Between Census Years	
				Employment	Population
			%	%	%
1976		47,600			
1981	20,700	50,500	41.0		1.19
1986	20,297	52,760	38.5	-0.39	0.88
1991	21,871	55,290	39.6	1.50	0.94
1996	21,699	54,851	39.6	-0.16	-0.16
2001	22,410	54,332	41.2	0.65	-0.19

TABLE 3-H: Employment by Industry Group, Lower Nandewar Region

Industry	1981	1986	1991	1996	2001
Primary	3534	2980	2752	2475	2535
Manufacturing	1941	1715	2026	2185	2066
Utilities and building	1997	1791	1834	1384	1438
Services	13229	13812	15259	15655	16371
Total	**20701**	**20298**	**21871**	**21699**	**22410**

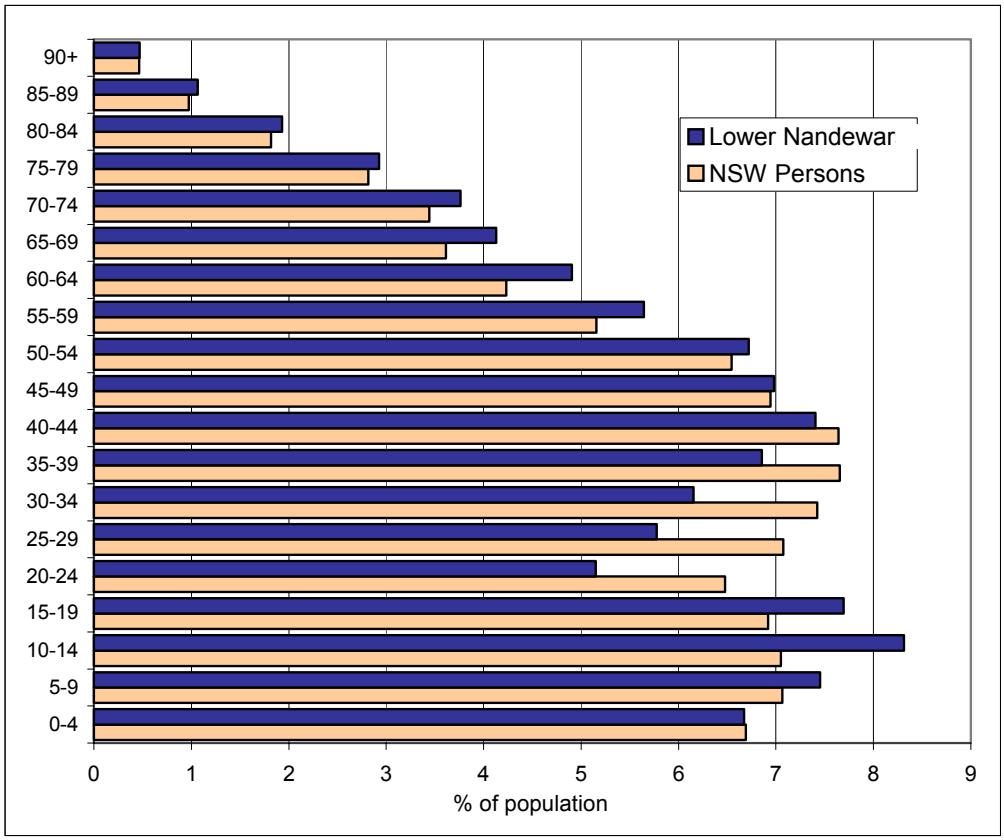

FIGURE 3-N: Age Profile, Lower Nandewar Region

3.5.2 The Lower Nandewar Economy

The Lower Nandewar region is a much larger regional economy than the Upper Nandewar and includes Tamworth as a regional centre (Tamworth is considered to include both Tamworth and the (former) surrounding Parry Shire). The characteristics and trends in the Lower Nandewar region generally reflect those of Tamworth as the main centre which tends to hide the structure of the remainder of the region which have the characteristics of rural areas. In 2000-01, the following aggregates were estimated based on the input-output table that is shown in an aggregated form in **Table 3-I**:

Gross region product	$1,513m
Employment	23,051
Exports (from the region to all destinations)	$608m
Imports (to the region from all sources)	$942m
Household income from employment	$664m
Household expenditure	$1,192m

The 2000-01 year was about an average year in terms of agricultural production but was an improvement over the poor years of most of the 1990s. The Lower Nandewar region derives its economic activity from a large array of industries and regional services that are based in Tamworth. In aggregate terms, this region displays many of the typical characteristics of a regional economy. There is a high proportion of exports from the region in gross regional product. However, this is less than all imports that is dominated by the import of consumer goods. Household expenditure is well above earnings from employment (including an imputed wage to self-employed persons).

TABLE 3-I: Aggregate Input-output Table, Lower Nandewar Region, 2001 ($m)

	Ag Forestry Fishing	Mining	Manufacturing	Utilities	Building	Trade Acommodation	Business Services	Public Personal Services	TOTAL	H-hold Exp	O.F.D	Exports	Total
Ag/Forest/Fish	11504	5	64083	1	26	528	107	273	76528	3441	3344	102970	186282
Mining	58	111	3373	73	700	168	243	399	5127	79	-280	5421	10347
Manufacturing	22834	1365	98394	1893	22787	37037	32177	14294	230782	117469	49664	334461	732376
Utilities	1369	76	5278	1451	129	2799	4561	2654	18316	20016	1393	142	39866
Building	439	52	53	21	65	550	3944	639	5762	0	97801	0	103563
Trade/Accommodati	9827	610	34544	1418	6035	25065	29773	14854	122125	263421	33349	83430	502325
Business Srvs	14948	1138	65702	3419	11742	107994	145560	44800	395303	273156	32267	56843	757570
Public/Personal Srvs	945	114	3922	163	236	5842	9245	16777	37245	120901	288195	24976	471317
TOTAL	61925	3471	275347	8440	41721	179983	225610	94690	891187	798483	505733	608242	2803646
H-hold Income	70268	557	67445	9414	34737	141739	117478	221942	663581	0	0		663581
O.V.A.	21590	4258	93950	15038	13437	87217	323503	100818	659810	166438	22966		849214
Imports	32499	2061	295634	6975	13669	93386	90978	53866	589068	226735	126690		942492
TOTAL	186282	10347	732376	39866	103563	502325	757570	471317	2803646	1191656	655390	608242	5258934
Employment	2529	27	2234	183	1289	6404	3738	6647	23051				

Recently available data for 2000-01 from the ABS (Cat No 6524.0) highlights the weak household income position indicated in the input-output table. Average weekly household income in all LGAs was lower than the NSW average of $895 (Barraba, $581, Manilla $565, Parry, $706, Nundle, $740 and Tamworth $767). Further, the combined household income included 15 per cent from social welfare payments compared to an average of 10 per cent in NSW.

The trends in the Lower Nandewar economy over the 1981 to 2001 period are shown in **Figure 3-O**. This chart shows the overall trend in relation to the trend in NSW. The blue shaded portions indicate the change in employment that would be required if the Lower Nandewar region was changing at the same rate as NSW. In each of the five-year periods, the growth rate in the Lower Nandewar region has been below that of NSW. In most cases, 1996 being the exception due to drought effects, the region has been sharing in the growth in the NSW economy. The extent to which the change in employment is below the NSW level is shown as the 'local effects' that are shaded yellow. These areas are relatively small apart from the 1991 to 1996 period when drought had a significant impact on the region. The

second half of each of the 1980s and 1990s have been periods of strong growth. Over the past 20 years, employment growth has been at about 0.5% per year which is a lower rate than for NSW.

Figure 3-O indicates that over 1996 to 2001 there was an increase of 711 jobs that contrasts with a loss of 172 jobs in the previous five years. That represents a total turnaround of 883 jobs. Some of this change can be attributed to recovery from the severe drought conditions that occurred in the early to mid 1990s in the region.

The changes in employment by industry is shown in **Figure 3-P** for the 1990s. This chart shows some significant effects in the early 1990s which were impacted by low growth, poor seasonal and commodity price conditions impacting on agriculture and an economy-wide recession. Agriculture, building, trade, transport and some business services employment declined in this period. Most growth occurred in meat processing, public administration, health, community care and various activities that service the population and visitors.

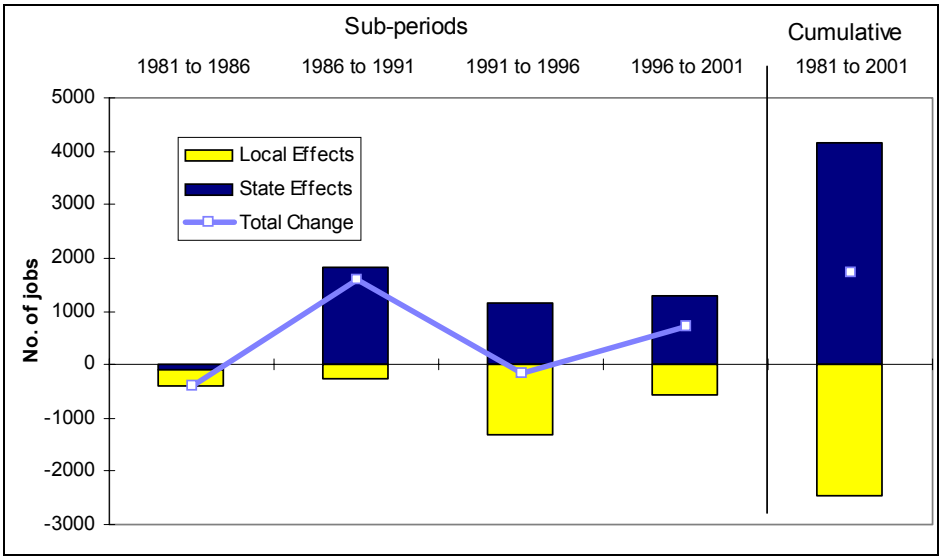

FIGURE 3-O: Employment Change in the Lower Nandewar Region, 1981 to 2001

The second half of the 1990s was a period of higher growth with good gains in other manufacturing, residential building trade, some areas of business services and an array of personal services. There were negatives in food processing, other construction, non-road transport, communications, banking and public administration. Losses of employment in these industries appear to be widespread among inland regions.

The trend in employment in the 1990s on an industry basis relative to that for NSW is shown in **Figure 3-Q**. This figure indicates the difference between the local change and the NSW change for each of the industries shown over the two five-year periods. Those industries on the left of the '0' line are industries that lost employment relative to NSW, while those to the right increased employment relative to NSW. These are used as indicators of whether the industry in the region is losing or increasing its share of the NSW industry, measured in terms of employment.

In the first half of the 1990s, there were large losses of employment in residential building, retail trade, accommodation and restaurants, transport and communication, technical services and legal, accounting etc services and education along with small losses in many other industries. The main gains were in employment in broadacre agriculture, meat processing and public administration.

In the second half of the 1990s, there were net losses due to local effects. The best growth occurred in other agriculture and residential building along with some small gains in other industries. On the other side of the equation, there were losses in employment share in other construction, accommodation and restaurants, communication, along with small losses in several other service industries such as public administration.

Tamworth has a substantial employment in service industries, particularly those associated with trade, transport and visitation (including the personal services that go with visitors) and in the regional centre activities such as public administration, eduction, health and community care. Public administration that consists of federal, state and local government and defence employment is generally regarded as desirable and a stabilising element of a regional economy. An examination of the detailed data indicates that state government employment varied from 249 in 1991 to 353 in 1996 and back to 254 in 2001. These are large variations for any industry let alone government agencies. Over 1996 to 2001, the federal government also reduced employment by about 50 although there was an increase in defence employment associated with the flying school in Tamworth.

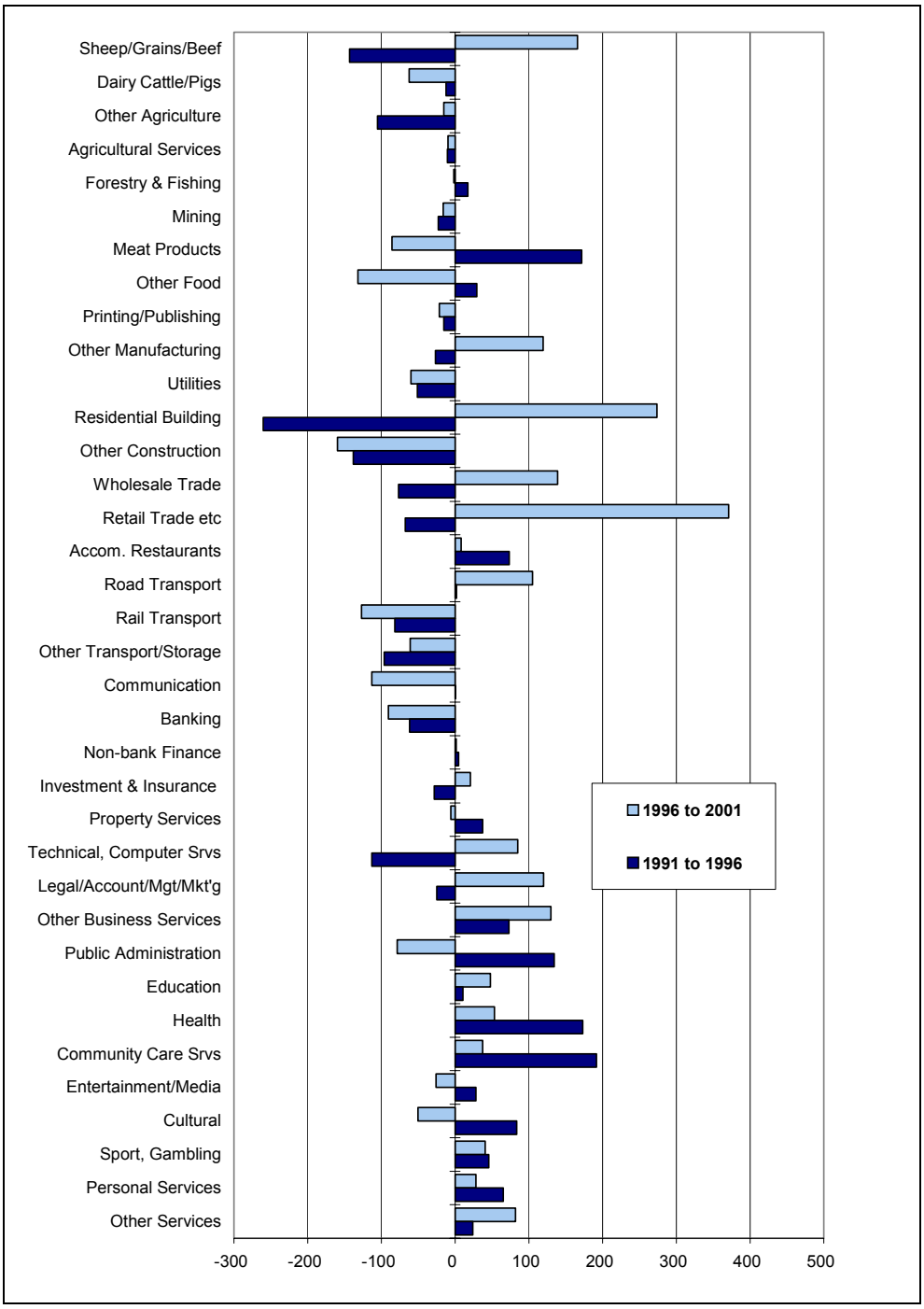

FIGURE 3-P: Employment Change, Lower Nandewar Region 1991 to 2001

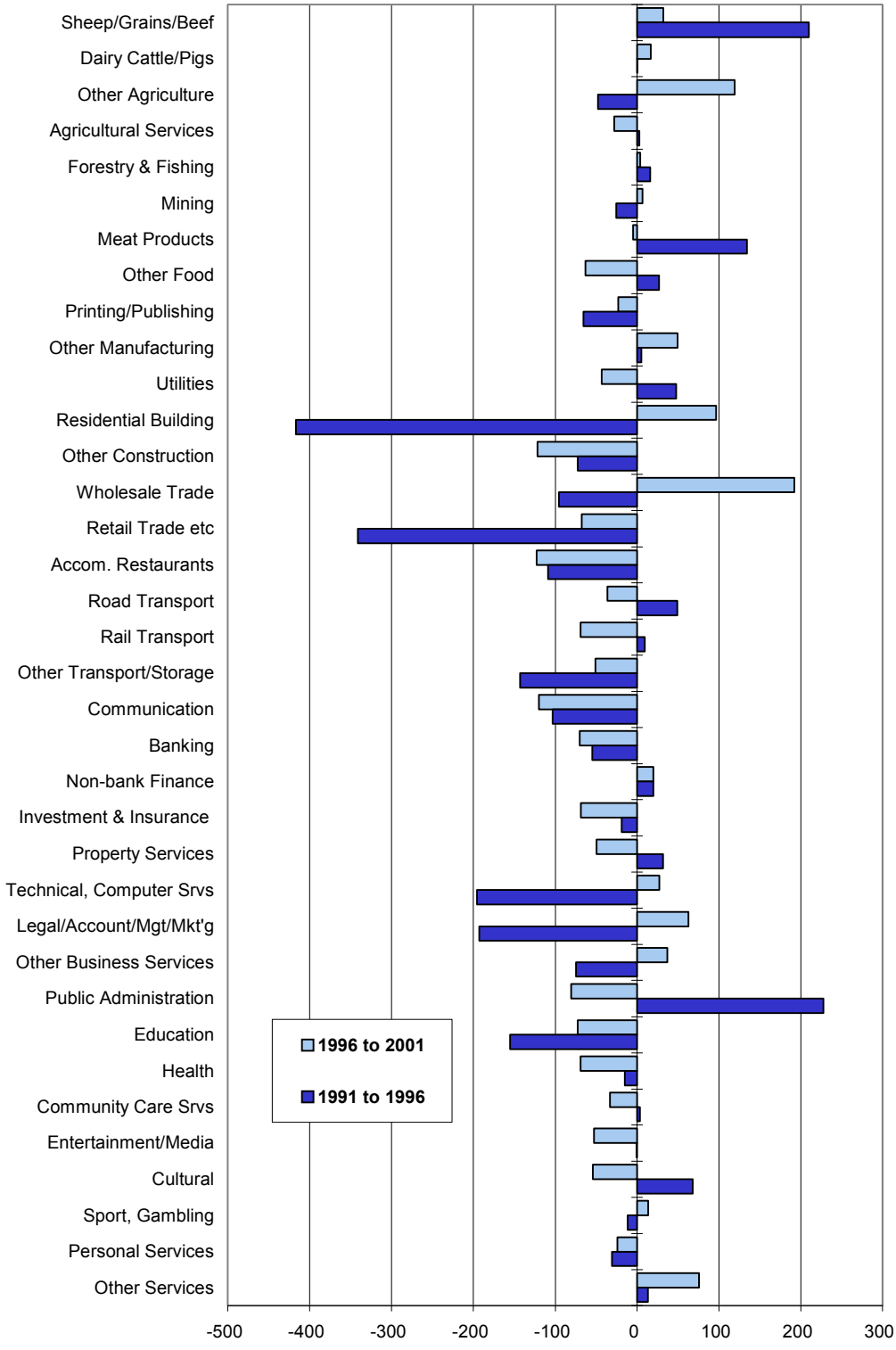

FIGURE 3-Q: Local Effects on Employment, Lower Nandewar Region, 1981 to 2001

The level of service provision is indicated by population/employment ratios (the number in the population serviced by an employee in the relevant service industry). Over all service industries, the average for the Lower Nandewar region is 3.5 (each service industry

employee services 3.5 people). This is lower than the NSW average which is 3.0, but it has to be noted that some of those 'regional services' will be provided to residents beyond the Lower Nandewar area.

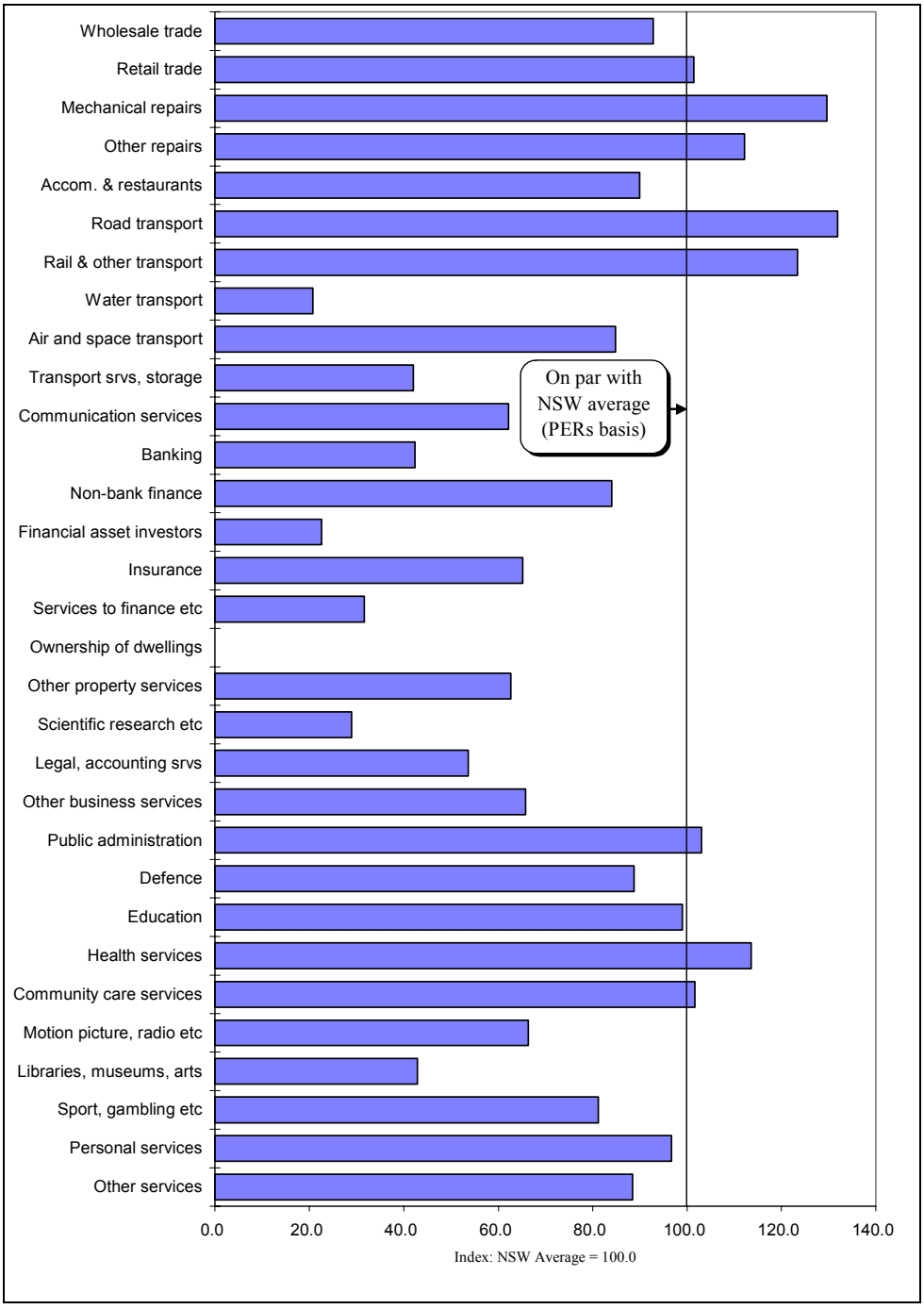

FIGURE 3-R: Service Delivery Indexes, Lower Nandewar Region 2001

On a service industry basis, the level of service in the Lower Nandewar can be expressed relative to the NSW average level as shown in **Figure 3-R**. A value of 100 indicates that the level of service is at the same level as for NSW. This level or more is achieved in retail trade, mechanical and other repairs, road and rail transport, public administration, health and

community care. In all other services, the level is below the NSW level and for many of the 'business services' (transport to other business services with many being less than one-half of the NSW level. That represents a weakness in the economic structure of the Lower Nandewar economy. There is a low level of service for many categories of business services such as banking and finance, property, scientific and legal etc. services where a low level builds concern about the capacity to service the needs of businesses in the region.

The weakness in business services is highlighted by the percentage of employment that is in the industries from transport to other business services as these have a major role in supporting the development and operation of businesses. Most of the other services tend to be focused on providing services to people and households. In the Lower Nandewar region, 16 per cent of employment is in business services compared with the NSW average of 24 per cent.

The Location Quotients (LQs) provide an indication of the relative importance of industries in the local economy relative to the national economy. These are useful in portraying an aspect of the diversity or specialisation of the economy, and of trends over time. The LQs for the Lower Nandewar region are shown in **Table 3-J**. These data indicate that there are more industries with a value over 1.0 in the Lower Nandewar region than in the Upper Nandewar region. There has also been an increasing importance in the production and processing of livestock products, particularly beef and poultry. (Recently, a new sheep meat processing operation has been opened and a dairy processing plant has closed.) Tamworth also has substantial cereal processing operations including a malting plant, flour mill and the preparation of livestock feeds. The region is also notable for the level of mechanical repairs and aircraft operations. It remains puzzling that most of the business services sectors have LQs that are significantly less than 1.0. There is a larger forestry and sawmilling industry in the Lower Nandewar region relative to the Upper Nandewar region. Sawmilling has a LQ of 1.1 while forestry, sawmilling and other wood product processing employed 130 people in 2001. That includes the processing of softwoods that are mostly produced in areas to the east of the Nandewar region.

Overall, the economy is heavily dependent on primary production and related processing activities. The diversity index (ranges from 100 for a 1-industry economy to 1 for the Australian economy) is calculated to be 26.7 in 2001. That is a low value and compares with a value for NSW of 4.7. For the diversity index to be below 20, the economy would need to have industrial and commercial activities that extend much further beyond those that are based on the natural resources of the region.

The differences in economic structure between the Lower Nandewar region and NSW are shown by comparing **Figure 3-S** and **Figure 3-T**. What is notable is the similar level of manufacturing in both economies although in the Lower Nandewar region that is mainly processed primary products. In the Lower Nandewar region primary industry building and utilities and most services, particularly business services ore less important than in NSW as a whole.

TABLE 3-J: Location Quotients, Lower Nandewar Region, 2001

Ranked Sectors by 2001	LQs 1981	1986	1991	1996	**2001**	Employment **2001**
Beef cattle	11.0	9.3	11.1	13.3	**31.0**	593
Sheep	5.8	6.8	12.5	13.2	**11.5**	367
Other mining	8.7	4.0	6.2	3.9	**8.2**	50
Meat and meat products	5.4	4.1	3.3	7.0	**7.5**	229
Oils and fats	0.0	0.0	0.0	0.0	**5.8**	8
Services to agric.; hunting	5.0	6.6	4.8	3.5	**4.8**	71
Other food products	0.2	0.0	0.0	0.8	**3.8**	81
Pigs	7.0	5.1	4.6	2.8	**3.6**	11
Grains	3.8	7.6	6.0	8.7	**3.2**	240
Sawmill products	1.5	1.2	2.1	2.4	**1.6**	18
Agricultural, mining etc machinery	0.9	0.3	0.5	0.6	**1.5**	31
Community care services	0.8	1.1	1.0	1.2	**1.3**	219
Wholesale trade	0.8	0.9	1.1	0.9	**1.3**	441
Water, sewerage & drainage	0.4	0.6	0.6	0.7	**1.3**	20
Mechanical repairs	1.2	1.3	1.5	1.4	**1.3**	139
Other agriculture	2.4	1.8	1.3	1.1	**1.2**	96
Other repairs	0.3	0.7	1.0	1.1	**1.2**	21
Basic chemicals	0.0	0.0	0.0	0.0	**1.2**	13
Poultry	0.3	2.3	1.1	0.5	**1.1**	6
Retail trade	1.1	1.1	1.1	1.0	**1.1**	947
Electricity	1.8	2.2	3.1	3.9	**1.0**	30
Other construction	0.8	0.3	0.4	0.3	**1.0**	158
Education	0.9	1.1	1.0	1.0	**0.9**	455
Health services	0.8	0.7	0.9	1.0	**0.9**	445
Personal services	0.6	0.7	0.8	0.7	**0.8**	104
Other services	0.5	0.5	0.6	1.0	**0.6**	75
Other business services	0.9	0.8	0.6	0.5	**0.6**	124
Banking	1.0	0.9	0.8	0.7	**0.6**	65
Legal, accounting srvs	0.8	0.5	0.6	0.5	**0.6**	136
Communication services	1.1	0.9	0.8	0.6	**0.5**	59
Other property services	0.5	0.6	0.5	0.5	**0.4**	43
Insurance	0.6	0.6	0.4	0.5	**0.4**	27
Services to finance etc	0.5	0.3	0.1	0.3	**0.3**	16
Scientific research etc	0.4	0.1	0.1	0.2	**0.2**	39
Transport srvs, storage	0.1	0.2	0.2	0.1	**0.2**	10

The following charts indicate the industry composition of production, employment, earnings from employment, exports, imports and average wage levels. Some of the key points to note include:

- The importance of food manufacturing in production and exports;
- The more diversified production base than in the Upper Nandewar region;
- The dominance of the trade, accommodation, road transport, public administration, education and health in employment terms, some of which represent services for the region as a whole (such as the base hospital in Tamworth);
- Public administration, education, health, trade and food manufacturing are the main sources of earnings for households;
- There are significant imports of products by the food manufacturing, chemicals and equipment manufacturing industries , some of which is also reflected in the exports of their products to other areas including other parts of the Northern region.
- There is a large number of industries where average annual earnings are equal to or higher than the NSW average; and

- The average annual earnings in the Lower Nandewar region is estimated to be $28 788, which is 84% of the NSW average of $34 286.

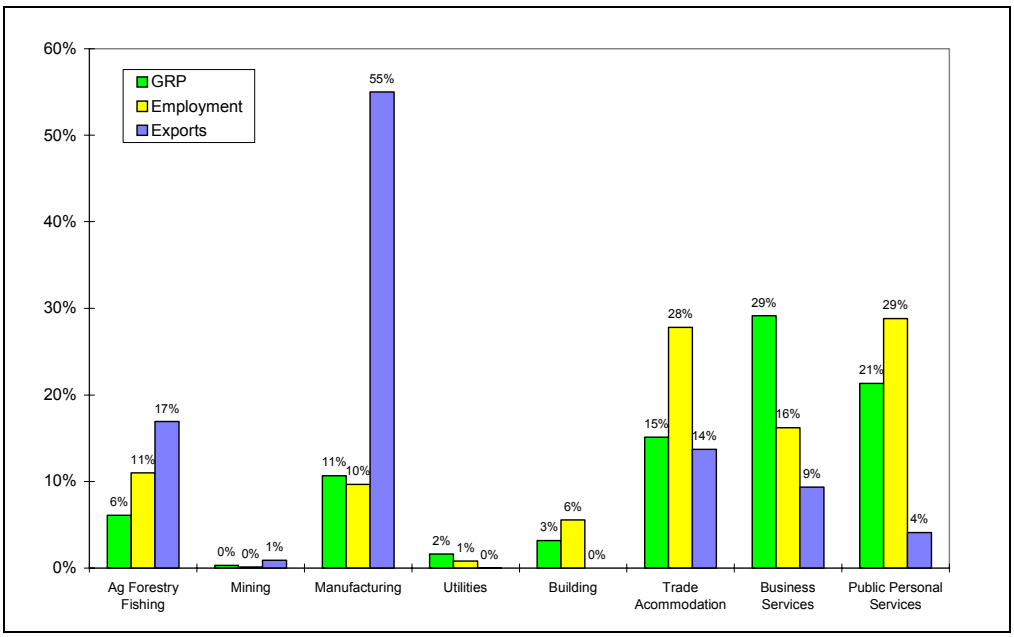

FIGURE 3-S: Aggregated Industry Structure, Lower Nandewar Region, 2001

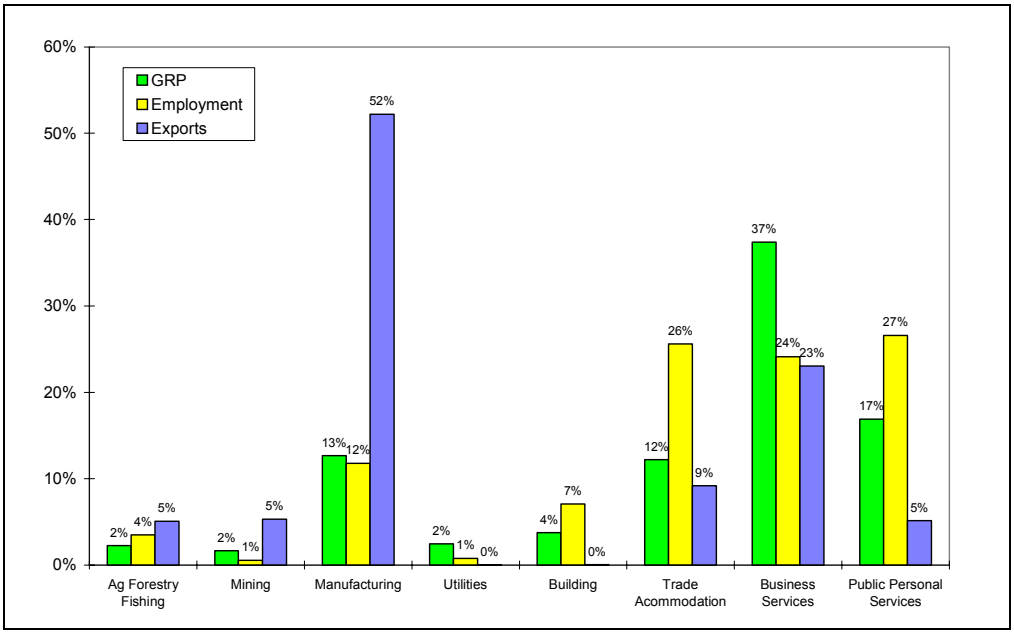

FIGURE 3-T: Aggregated Industry Structure, NSW, 2001

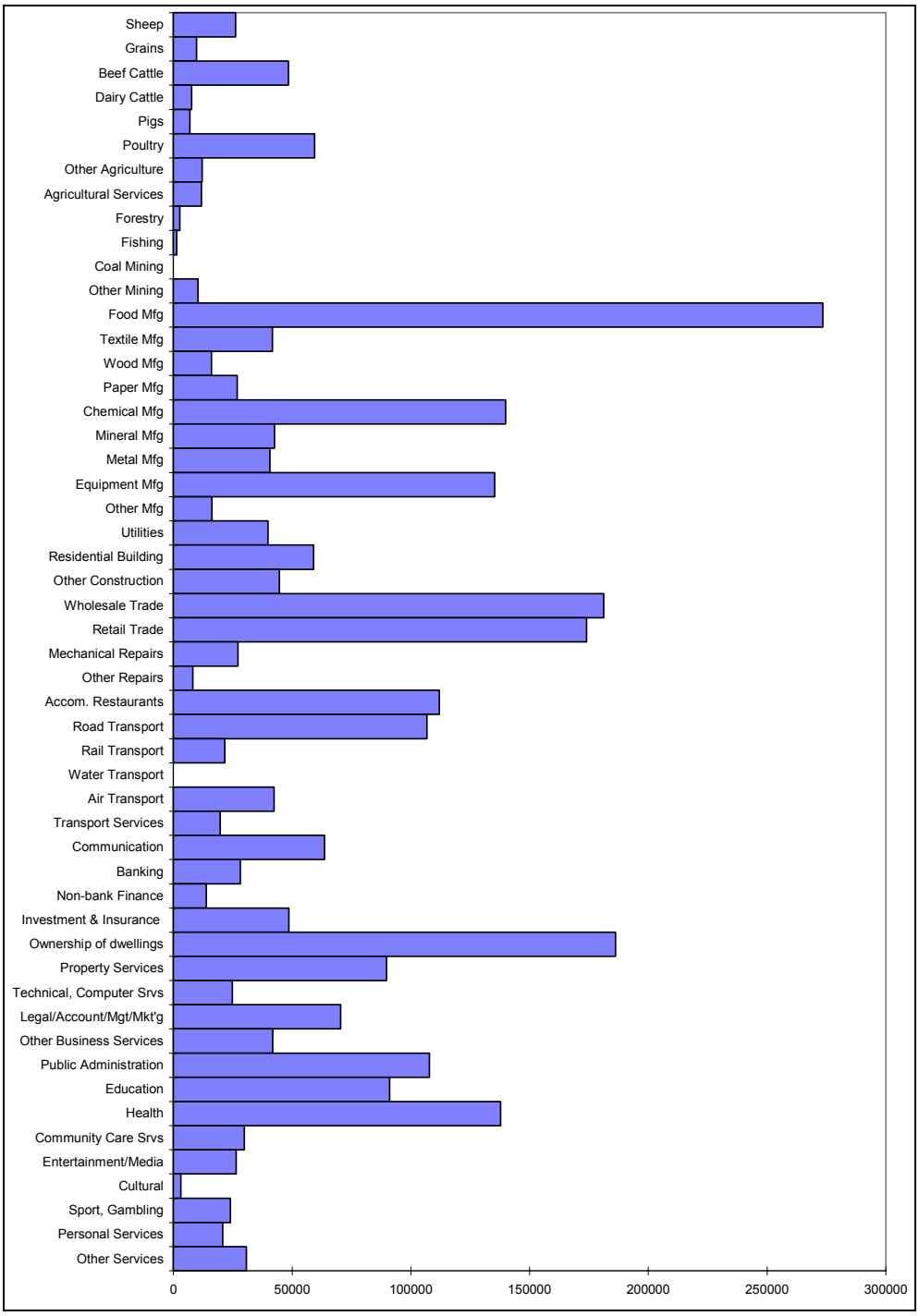

FIGURE 3-U: Industry Composition of Production, Lower Nandewar Region, 2001 ($'000)

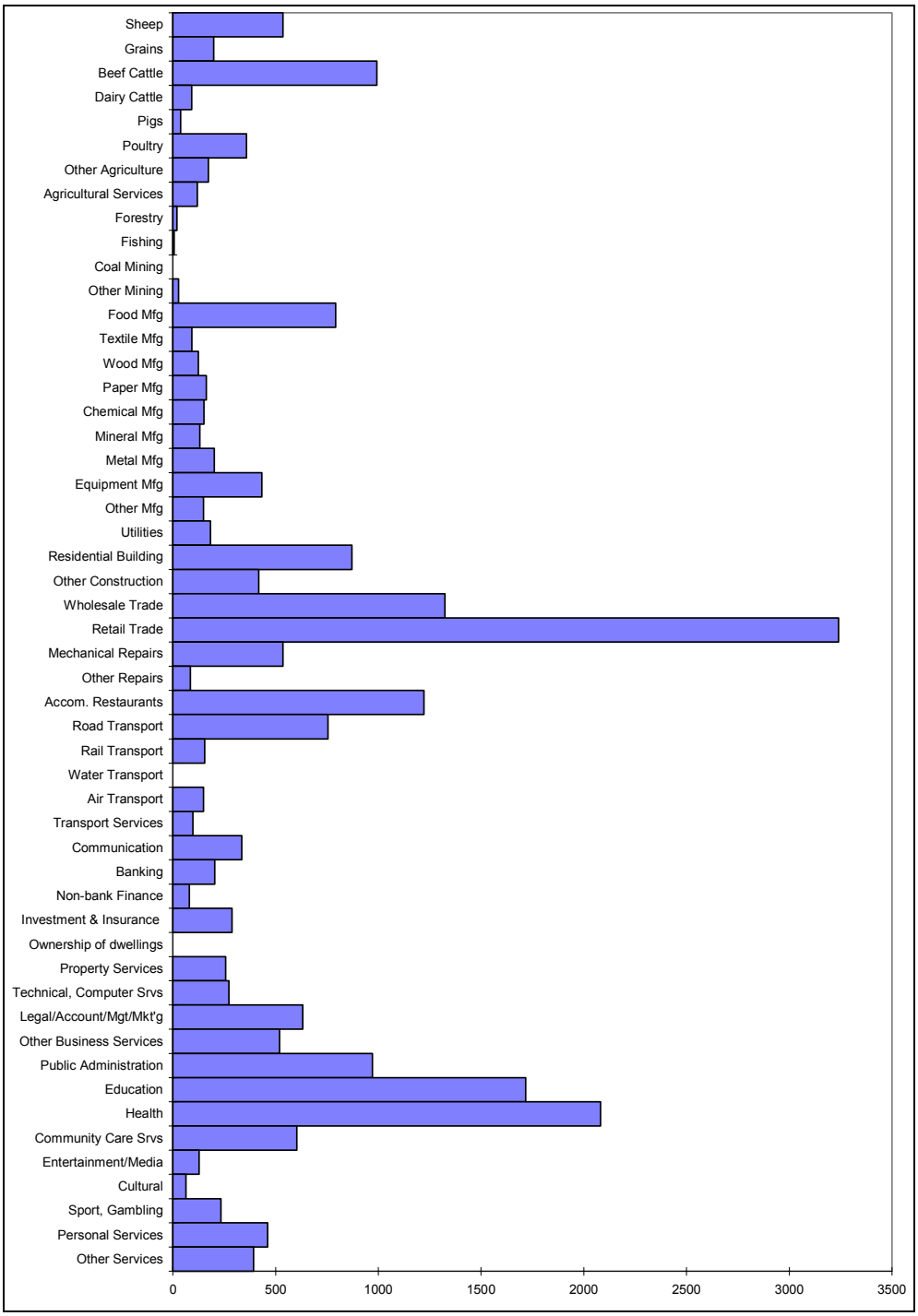

FIGURE 3-V: Industry Composition of Employment, Lower Nandewar Region, 2001 (No)

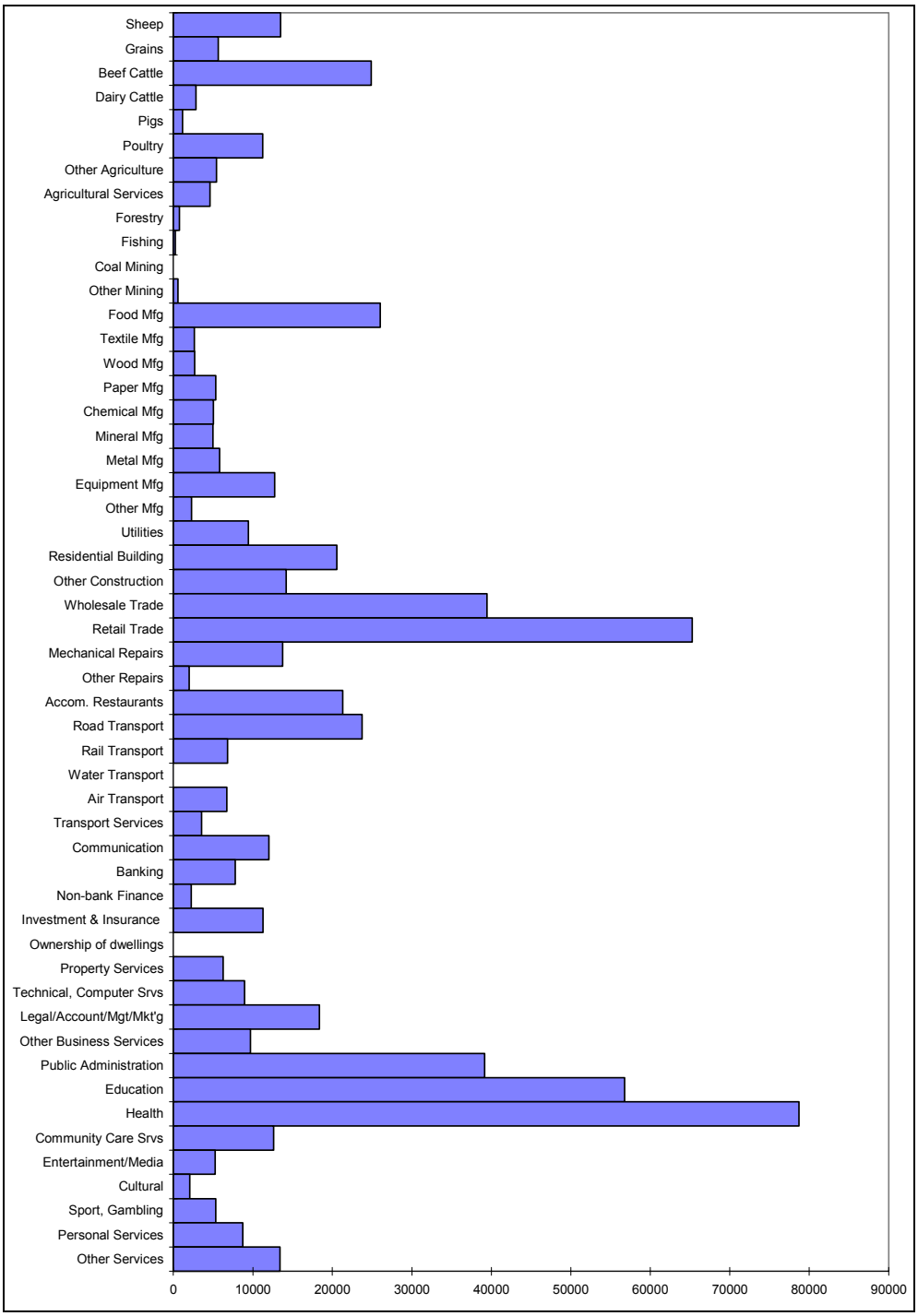

FIGURE 3-W: Industry Composition of Employment Earnings, Lower Nandewar Region, 2001 ($'000)

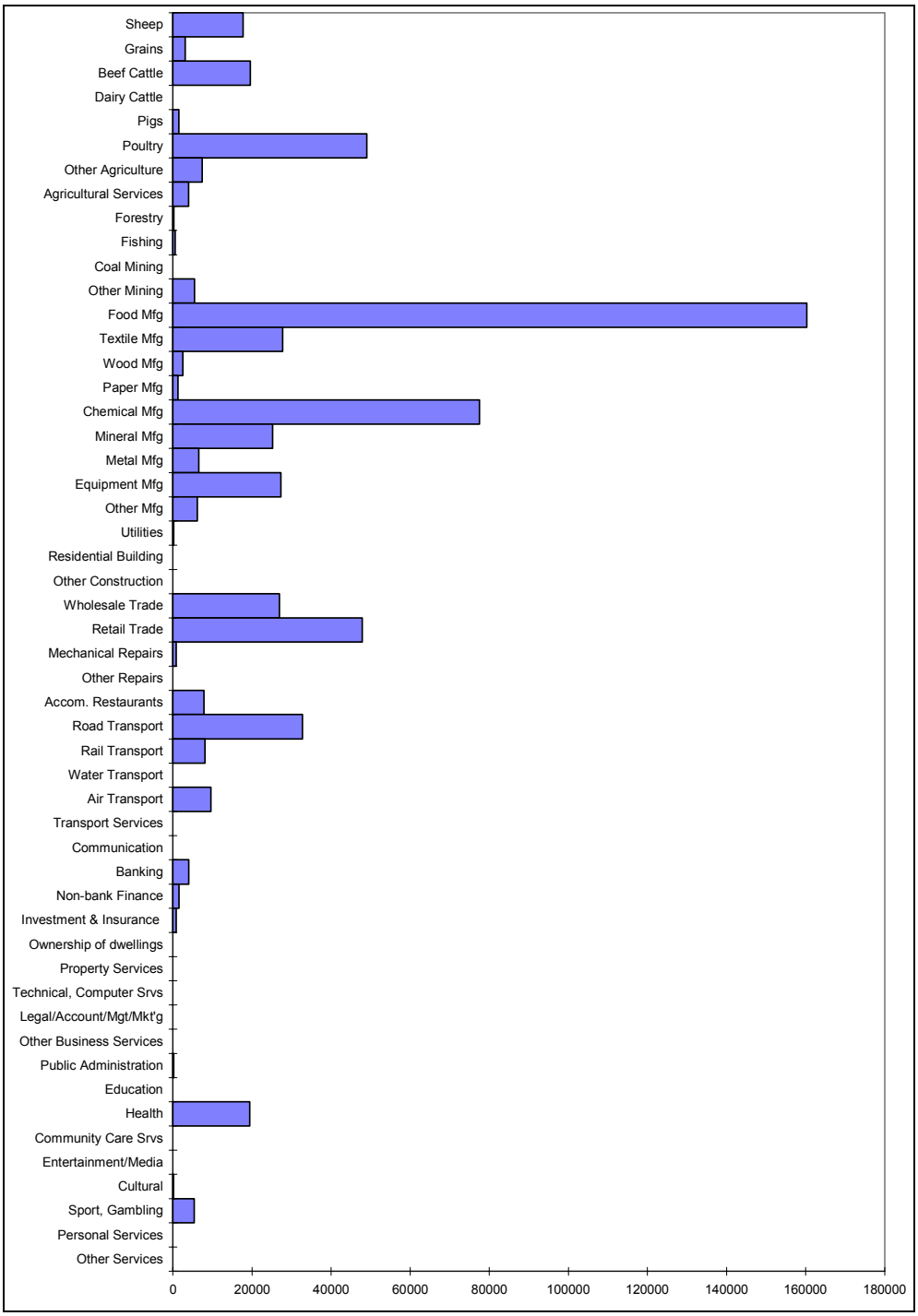

FIGURE 3-X: Industry Composition of Exports, Lower Nandewar Region, 2001 ($'000)

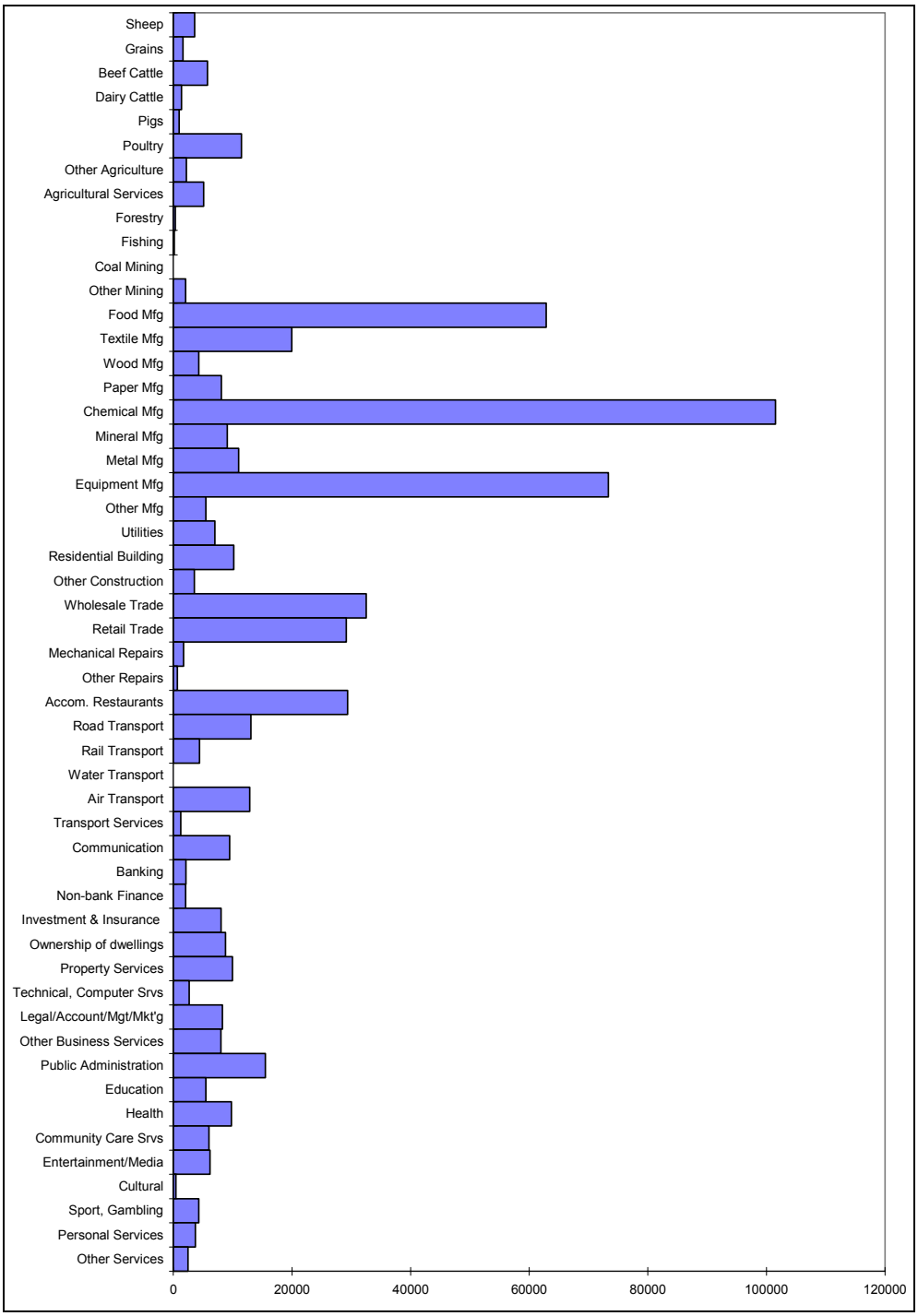

FIGURE 3-Y: Industry Composition of Imports, Lower Nandewar Region, 2001 ($'000)

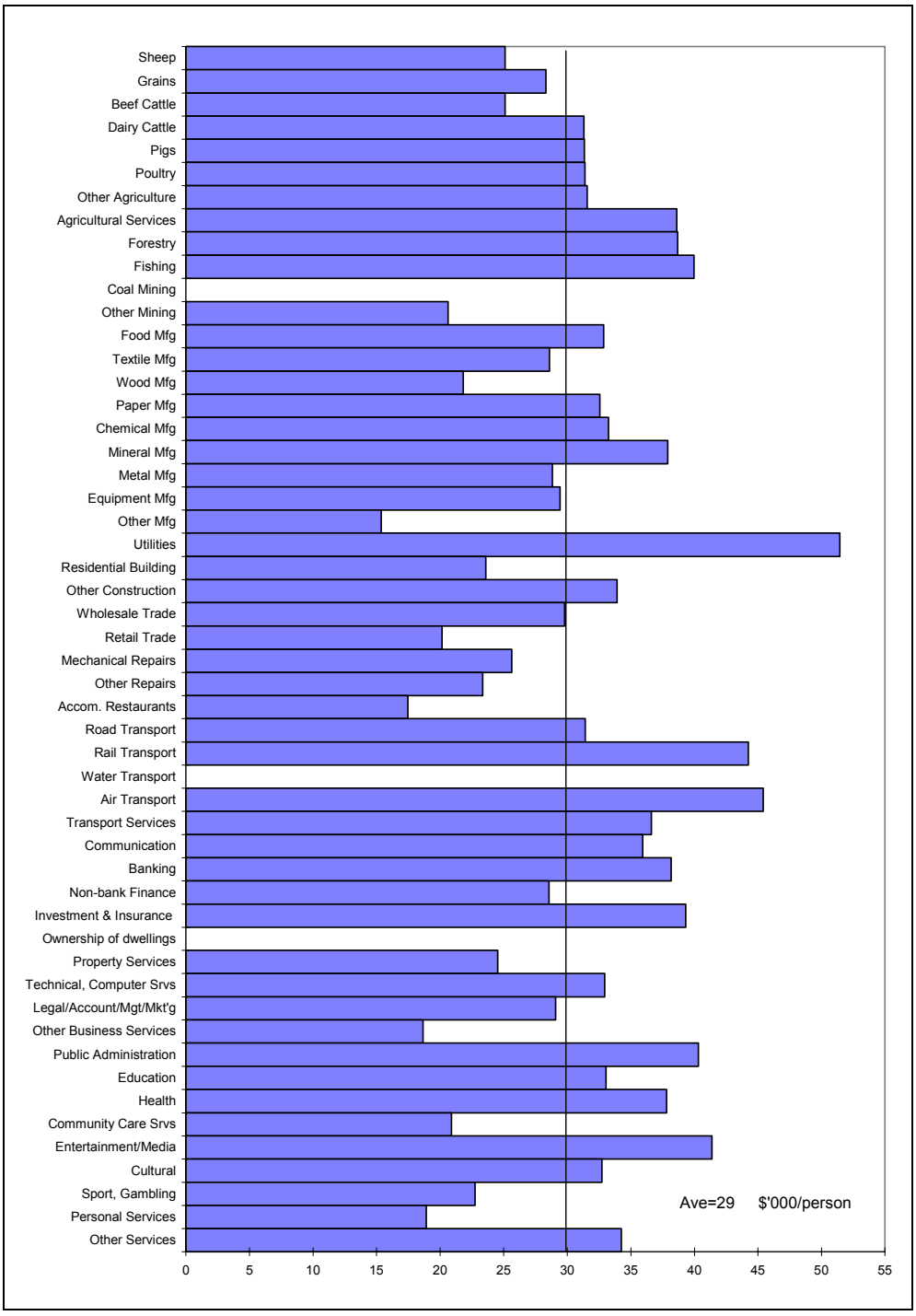

FIGURE 3-Z: Industry Average Weekly Earnings, Lower Nandewar Region, 2001 ($'0000)

3.6 TRENDS IN THE LOWER NANDEWAR REGION

A similar analytic approach to that used for the Upper Nandewar region has also been applied to the Lower Nandewar region (see Section 3.4). The background analysis of growth rates of employment by industry is contained in Appendix 3.1.

The ABS has compiled some population projections on the basis of the demographic characteristics of the population. This indicates what would occur if current demographic characteristics were allowed to run their course and there were no other interventions. Those projections indicated that the Lower Nandewar resident population would rise from 56 507 in 2001 to 58 203 in 2011, a rise of 3% in 10 years (or about 0.3% per year). This would be a pessimistic estimate given that local actions would seek to increase the level of employment and to increase the resident population. (Subsequently, the DIPNR projections have been released and indicate a growth in population of 2410 between 2001 and 2011, a rise of 3.3 per cent.)

As a starting point, a population growth of 0.9% pa for 10 years is assumed. This is a faster rate than for the 1981 to 2001 period, but lower than during the 1980s. It is above that for the 1990s when there was a small fall in the population. It is about the same rate as the growth in employment over the 20 years. This provides an overall dimension to the likely change and would involve an increase in population to around 61 800, with employment rising by about 1600 to 24,100. Employment on a workplace basis increases to over 25 000.

Within the industries, the following assumptions have been made in compiling the industry growth rates (see **Table 3-K**):

- There is a small decline in broadacre agriculture but specialist agriculture and poultry increase.
- A larger proportion of agricultural products is processed in the region: meat processing and associated activities continue to expand (beef, sheep and poultry) while the processing of cereals is mixed with some of the traditional operations declining and animal feed production expands;
- The higher population growth provides an impetus to building and construction;
- Population growth and higher incomes lead to a faster that average rate of growth in trade services and those activities that service the population and visitors;
- Business services (legal etc. property and other business services) are expected to increase at above average rates; and
- Public administration has fluctuated significantly in the past and with the amalgamation of these councils into one is expected to result in a small increase along with some of those sectors that have been rationalising such as communications, banking, and non-road transport.

It is assumed that productivity and wage rates will increase at the average NSW rates of 2.3% and 1.15%, respectively as in the analysis of the Upper Nandewar region.

This region is noted for its Country Music focus that attracts many visitors to the region, especially in January along with other events. It is possible that the Lower Nandewar region may succeed in achieving a higher than average increase in the number of visitors. The

overall region has advantages that may allow it to attract many more residents who may live in Tamworth or the surrounding smaller towns. They would achieve access to the many services that are available in Tamworth. Thus, population may grow faster than employment, and the number of visitors may represent additional demands for the goods and services provided by businesses in the Lower Nandewar region. At this stage, these factors have not been included in the projected table presented below.

TABLE 3-K: Projected Employment Growth by Industry, Upper Nandewar Region

IO Sector	2001 Workplace Employment	2011 Projected Employment	IO Sector	2001 Workplace Employment	2011 Projected Employment
Sheep	536	483	Basic non-ferrous metals etc	7	7
Grains	199	203	Structural metal products	54	55
Beef cattle	992	942	Sheet metal products	14	14
Dairy cattle	90	85	Fabricated metal products	68	70
Pigs	37	40	Motor vehicles and parts etc	223	258
Poultry	358	394	Ships and boats	13	13
Other agriculture	172	189	Railway equipment	3	3
Services to agric.; hunting	119	131	Aircraft	53	53
Forestry and logging	20	20	Scientific etc equipment	9	10
Commercial fishing	6	6	Electronic equipment	20	21
Coal; oil and gas	0	0	Household appliances	17	19
Iron ores	0	0	Other electrical equipment	15	15
Non-ferrous metal ores	7	7	Agricultural, mining etc machine	43	48
Other mining	20	20	Other machinery and equipmen	37	39
Services to mining	0	0	Prefabricated buildings	28	28
Meat and meat products	370	451	Furniture	103	104
Dairy products	69	34	Other manufacturing	17	18
Fruit and vegetable products	8	9	Electricity	142	142
Oils and fats	4	4	Gas	3	43
Flour and cereal foods	116	126	Water, sewerage and drainage	38	38
Bakery products	102	98	Residential building	871	1010
Confectionery	0	0	Other construction	418	485
Other food products	100	101	Wholesale trade	1324	1536
Soft drinks, cordials, syrups	0	0	Retail trade	3239	3757
Beer and malt	20	19	Mechanical repairs	535	621
Wine and spirits	3	38	Other repairs	85	90
Tobacco products	0	0	Accommodation, cafes & restau	1221	1343
Textile fibres, yarns etc	7	7	Road transport	755	830
Textile products	29	31	Rail, pipeline, other transport	154	141
Knitting mill products	0	0	Water transport	0	0
Clothing	30	34	Air and space transport	148	149
Footwear	4	4	Services to transport; storage	97	104
Leather and leather products	22	22	Communication services	335	335
Sawmill products	31	32	Banking	204	198
Other wood products	92	97	Non-bank finance	79	84
Pulp, paper and paperboard	0	0	Financial asset investors	0	0
Paper bags and products	0	0	Insurance	198	198
Printing; services to printing	52	56	Services to finance etc	89	96
Publishing; recorded media etc	111	118	Ownership of dwellings	0	0
Petroleum and coal products	34	34	Other property services	256	296
Basic chemicals	15	15	Scientific research etc	272	281
Paints	12	12	Legal, accounting etc services	632	689
Pharmaceuticals etc	13	13	Other business services	519	592
Soap and detergents	7	7	Government administration	826	834
Cosmetics and toiletries	0	0	Defence	145	166
Other chemical products	0	0	Education	1717	1872
Rubber products	27	29	Health services	2081	2268
Plastic products	43	50	Community services	603	663
Glass and glass products	8	8	Motion picture, radio etc	127	127
Ceramic products	3	3	Libraries, museums, arts	63	73
Cement, lime and concrete slurry	47	52	Sport, gambling etc	233	254
Plaster; other concrete products	35	39	Personal services	460	502
Non-metallic min. products nec	38	36	Other services	392	432
Iron and steel	58	67	**TOTAL**	**23052**	**25192**

3.6.1 The Projected Lower Nandewar Input-output Table

The projected input-output table for 2011 is shown in **Table 3-L.** From that table the estimates of the key measures used earlier can be compiled as follows (with the increase shown in parentheses):

Gross region product	$1 991m	(32%)
Employment	25 190	(9%)
Exports (from the region to all destinations)	$1 058m	(74%)
Imports (to the region from all sources)	$1 077m	(14%)
Household income from employment	$812m	(22%)
Household expenditure	$1 282m	(8%)

TABLE 3-L: Projected Input output Table 2011, Lower Nandewar Region ($m)

	Ag Forestry Fishing	Mining	Manufacturing	Utilities	Building	Trade Acommodation	Business Services	Public Personal Services	TOTAL	H-hold Exp	O.F.D	Exports	Total
Ag/Forest/Fish	14878	6	94353	1	41	723	150	402	110554	3841	3662	119714	237772
Mining	74	144	4362	97	1022	226	310	508	6743	82	-485	6779	13119
Manufacturing	30309	1818	135960	2630	33076	59374	43522	19626	326315	136025	62221	467659	992221
Utilities	1764	97	9152	2429	180	4894	5948	3709	28173	27020	1706	10665	67564
Building	614	71	75	39	98	837	5341	940	8014	0	131284	11101	150400
Trade/Accommodati	12509	794	48125	2154	8863	37125	41272	20632	171475	294991	36250	217462	720177
Business Srvs	18462	1456	89954	7443	17494	157036	198281	59998	550123	290203	34654	122169	997149
Public/Personal Srvs	1257	169	6108	294	388	8991	13808	23930	54946	136718	338415	102726	632805
TOTAL	79869	4555	388088	15088	61162	269206	308632	129744	1256344	888880	607708	1058275	3811207
H-hold Income	78672	635	81801	13098	45371	183488	139646	269564	812276	0	0		812276
O.V.A.	38022	5472	137282	28332	24599	142000	433553	165342	974602	179367	24937		1178907
Imports	41209	2456	385050	11046	19268	125483	115318	68154	767984	214500	94628		1077112
TOTAL	237772	13119	992221	67564	150400	720177	997149	632805	3811207	1282747	727273	1058275	6879502
Employment	2493	27	2421	223	1495	7347	3993	7191	25190				

The projections for the Lower Nandewar region indicate a strengthening of the economy with the possibility of further improvement based on increased attraction of residents and visitors. The Lower Nandewar region is less dependent on primary industries than the Upper Nandewar region. The Lower Nandewar region has a considerable dependence on the processing of primary products which can be sourced from a large geographic area. Although, the experience of the 1990s when agricultural industries were struggling, so did the Lower Nandewar region, including Tamworth through lower levels of employment, population and activities such as retail trade. Thus, this economy is sensitive to actions on conservation measures in agriculture that in part is local but also includes factors that may affect agricultural production in a wider catchment than the Lower Nandewar region.

The Lower Nandewar region includes Tamworth as a regional centre. This is commonly perceived as a strength, but the experience of the 1990s when governments engaged in significant restructuring of their own activities, it was a significant source of fluctuations in employment. That possibility remains for the 2000s and work such as this that seeks to project the economy into the future will need to take into account the likely impact of changes in the nature and delivery of government services.

4 Forestry Impact Estimates

4.1 INTRODUCTION

The forestry and forestry-based industries in the region are relatively small. Most of the milling operations are small enterprises and materials for those mills are sourced both from within and outside the region. There are also supplies of hardwood logs for the small mills from private property. Some properties operate small fixed or mobile sawmills.

The information on which the impacts are estimated are those from the population census (workplace) employment data, and estimates of the value of production computed in developing the input-output tables. For this analysis, there was no readily available data on the output from the various industries. Three industry activities are identified within the ANZSIC (see Appendix):

- Forestry production and harvesting
- Sawmill products inc sawn timber, woodchips, dressed timber, plywood, veneer, fabricated boards
- Other wood products inc. structural components - windows, doors, trusses, frames, containers, pallets, cases, log preservation

4.2 IMPACT ESTIMATION

The impact of the forestry, milling and other processing activities are estimated for 2000-01. The current level of activities is likely to be different due to the various changes in forestry and milling within the Upper and Lower Nandewar regions. Those impacts include the direct impacts and the flow-on effects estimated using the 2000-01 tables, with the impacts measured in terms of gross output, value added (approximates gross regional product), household income (from employment) and employment (number of jobs unadjusted for hours worked).

4.2.1 Forestry in the Upper Nandewar Region

The economic impact of forestry in the Upper Nandewar region is shown in **Table 4-A**. Forestry within the region has a value of around $1m with 9 people directly employed. The milling activity is over $5m mostly from a mill processing cypress pine in Bingara and using some logs that are imported from outside the region. There are other small mills operating in

the region so that a total of 28 people were indicated for employment. Only a small amount of other wood processing occurs in the Upper Nandewar region which in total is an industry with a turnover of $7m and employs 50 people.

TABLE 4-A: Economic Impact of Forestry, Upper Nandewar Region

IMPACTS	Direct Effect	Flow-on Effects			TOTAL IMPACT
		Production Induced	Consumption Induced	Total Flow-on	
GROSS OUTPUT ($)					
Forestry & Logging	1,039	462	368	831	1,870
Milling (net)	5,213	2,080	682	2,762	7,975
Other Processing (net)	940	442	317	759	1,699
TOTAL	**7,192**	**2,984**	**1,367**	**4,352**	**11,544**
VALUE-ADDED ($)					
Forestry & Logging	398	189	205	394	793
Milling (net)	2,034	868	380	1,249	3,283
Other Processing (net)	377	180	177	357	734
TOTAL	**2,809**	**1,238**	**762**	**2,000**	**4,809**
HOUSEHOLD INCOME ($)					
Forestry & Logging	351	118	76	194	545
Milling (net)	541	328	141	469	1,010
Other Processing (net)	308	96	65	161	469
TOTAL	**1,200**	**542**	**282**	**824**	**2,024**
EMPLOYMENT (no.)					
Forestry & Logging	9	4	3	7	16
Milling (net)	28	14	6	20	48
Other Processing (net)	13	4	3	7	20
TOTAL	**50**	**22**	**12**	**34**	**84**

The flow-on effects are estimated using the multipliers that are indicated in **Table 4-B**. Those multipliers should be considered as describing the structure of the industry and its linkages to the rest of the region industries. They should not be routinely used to indicate the likely size of changes in the level of the industry as the impact will depend on how the various businesses respond to factors generating the change.

The total impact of the industry is shown to be almost $5m in contribution to gross regional product and 84 jobs. That is equivalent to 1.1 per cent of the regional economy. Although that is a small contribution, it is more significance to those locations where most of the activity takes place such as Bingara.

It appears that there has been a reduction in the level of activity since 2000-01 in the Upper Nandewar region. However, there are large amounts of native forest in the region, most of which has not been operated in a managed way and is located on private land. Further development of the forestry industry in this region could occur if there was a growth in native forestry on private land to make use of that potential. There is little plantation forestry in the region and the region is not perceived as highly suitable for forest plantations.

TABLE 4-B: Forestry Multipliers, Upper Nandewar Region

MULTIPLIERS	Direct Effect	Flow-on Effects: Production Induced	Flow-on Effects: Consumption Induced	Flow-on Effects: Total Flow-on	TOTAL IMPACT	Type II
GROSS OUTPUT ($)						
Forestry & Logging	1.000	0.445	0.354	0.799	1.799	1.799
Milling (net)	1.000	0.399	0.131	0.530	1.530	1.530
Other Processing (net)	1.000	0.470	0.337	0.808	1.808	1.808
TOTAL	**1.000**	**0.415**	**0.190**	**0.605**	**1.605**	**1.605**
VALUE-ADDED ($)						
Forestry & Logging	0.383	0.182	0.198	0.379	0.763	1.989
Milling (net)	0.390	0.167	0.073	0.240	0.630	1.614
Other Processing (net)	0.401	0.192	0.188	0.380	0.780	1.947
TOTAL	**0.391**	**0.172**	**0.106**	**0.278**	**0.669**	**1.712**
HOUSEHOLD INCOME ($)						
Forestry & Logging	0.338	0.114	0.073	0.187	0.524	1.553
Milling (net)	0.104	0.063	0.027	0.090	0.194	1.866
Other Processing (net)	0.328	0.102	0.069	0.172	0.499	1.524
TOTAL	**0.167**	**0.075**	**0.039**	**0.115**	**0.281**	**1.687**
EMPLOYMENT (no./$m)						
Forestry & Logging	8.662	3.858	3.227	7.085	15.747	1.818
Milling (net)	5.371	2.651	1.192	3.842	9.213	1.715
Other Processing (net)	13.831	3.932	3.071	7.003	20.834	1.506
TOTAL	**6.952**	**2.992**	**1.731**	**4.724**	**11.676**	**1.679**

4.2.2 Forestry in the Lower Nandewar Region

There is a higher level of forestry and forest-related activities in the Lower Nandewar Region. Most activity is in the various wood products processing activities. This region has access to cypress pine (only a small amount used) native hardwoods (some milling occurs) and softwood plantations so that there is a variety of products and processing activities. Not all of the wood processed in the Lower Nandewar region is sourced within the region. The estimated impacts are shown in **Table 4-C** using the multipliers shown in **Table 4-D**.

In total forestry and forestry-based operations have a turnover approaching $17m and involving the employment of 143 people. The flow-on impacts build the contribution to gross regional product to $13.5m (0.9% of gross regional product) and 258 jobs (1.1% of regional employment). Overall, the industry is larger than in the Upper Nandewar region, but as a share of the regional economy, it is slightly smaller. Around two-thirds of that activity is in the other processing industry. Those activities tend to be linked to building and construction activities that were relatively depressed in the 1990s.

It is possible that the forestry and forestry-based activities could expand for some of the same reasons as those applying in the Upper Nandewar region. There is also an expansion of the harvesting and milling of the softwood plantations that are located to the east of the Lower Nandewar region with a new milling operation located in Quirindi. This growth may

lead to additional activity related to forestry in the Lower Nandewar area. However, the industry is likely to remain at about one per cent of the regional economy into the future.

TABLE 4-C: Economic Impact of Forestry, Lower Nandewar Region

IMPACTS	Direct Effect	Flow-on Effects: Production Induced	Flow-on Effects: Consumption Induced	Flow-on Effects: Total Flow-on	TOTAL IMPACT
GROSS OUTPUT ($)					
Forestry & Logging	2,634	1,982	1,392	3,374	6,008
Milling (net)	4,777	2,672	1,256	3,928	8,706
Other Processing (net)	9,278	4,862	3,593	8,455	17,732
TOTAL	**16,689**	**9,515**	**6,241**	**15,757**	**32,446**
VALUE-ADDED ($)					
Forestry & Logging	1,010	763	722	1,486	2,495
Milling (net)	1,943	1,137	652	1,789	3,732
Other Processing (net)	3,490	1,989	1,866	3,854	7,345
TOTAL	**6,443**	**3,888**	**3,240**	**7,129**	**13,572**
HOUSEHOLD INCOME ($)					
Forestry & Logging	773	409	286	694	1,468
Milling (net)	596	472	258	730	1,326
Other Processing (net)	2,087	966	738	1,704	3,792
TOTAL	**3,457**	**1,846**	**1,282**	**3,128**	**6,585**
EMPLOYMENT (no.)					
Forestry & Logging	20	13	11	24	44
Milling (net)	31	18	10	28	59
Other Processing (net)	92	35	28	63	155
TOTAL	**143**	**66**	**49**	**115**	**258**

TABLE 4-D: Forestry Multipliers Lower Nandewar Region

MULTIPLIERS	Direct Effect	Flow-on Effects: Production Induced	Flow-on Effects: Consumption Induced	Flow-on Effects: Total Flow-on	TOTAL IMPACT	Type II
GROSS OUTPUT ($)						
Forestry & Logging	1.000	0.752	0.528	1.281	2.281	2.281
Milling (net)	1.000	0.559	0.263	0.822	1.822	1.822
Other Processing (net)	1.000	0.524	0.387	0.911	1.911	1.911
TOTAL	**1.000**	**0.570**	**0.374**	**0.944**	**1.944**	**1.944**
VALUE-ADDED ($)						
Forestry & Logging	0.383	0.290	0.274	0.564	0.947	2.471
Milling (net)	0.407	0.238	0.137	0.374	0.781	1.921
Other Processing (net)	0.376	0.214	0.201	0.415	0.792	2.104
TOTAL	**0.386**	**0.233**	**0.194**	**0.427**	**0.813**	**2.106**
HOUSEHOLD INCOME ($)						
Forestry & Logging	0.294	0.155	0.109	0.264	0.557	1.898
Milling (net)	0.125	0.099	0.054	0.153	0.278	2.225
Other Processing (net)	0.225	0.104	0.080	0.184	0.409	1.816
TOTAL	**0.207**	**0.111**	**0.077**	**0.187**	**0.395**	**1.905**
EMPLOYMENT (no./$m)						
Forestry & Logging	7.593	4.975	4.156	9.131	16.724	2.203
Milling (net)	6.489	3.723	2.069	5.791	12.280	1.893
Other Processing (net)	9.916	3.765	3.046	6.811	16.728	1.687
TOTAL	**8.569**	**3.944**	**2.942**	**6.885**	**15.454**	**1.804**

4.3 AN EXPLORATION OF PRIVATE NATIVE FORESTRY

This section provides an illustration of the application of the impact models. This is hypothetical as there are no developed conservation options to investigate. The Nandewar region has a significant area of private land on which there is forest cover that could support some level of private native forestry in addition to the forestry on public lands, although that is only on a modest scale. In 2001 from public lands, 6,039 m^3 of cypress was harvested which reduced to around 2,500 m^3 in 2004. Cypress mills in the region are currently operating on minimum throughput and with low quality logs. Hardwood production is around 500 m^3.

The information from the GIS mapping indicates that some 685,700 ha of private land has forest cover, amounting to around 26 per cent of the Nandewar region. Little else is known about the forest potential of that land. Some of the area has cypress cover while other areas are hardwood. Much of the land is likely to be unsuitable for silviculture and logging because of the topography and other constraints. At present very little of the land has been subjected to any significant silvicultural activity apart from some logging.

The extent of a private native forest industry will also depend on the economic return from silvicultural management and harvesting. The lack of those activities on most of the land at present suggests that the returns in recent times have been marginal. However, with changes

in access to sawlogs throughout NSW (and Australia) there has been an increase in the stumpage value of sawlogs. Further, there is some better identification of hardwood logs that may be suitable for uses that earn high values. In addition, there is an evolution of silvicultural methods that may enable a range of more effective management regimes that improve yield and lower costs.

The development of a larger private native forestry industry in the Nandewar region (and other regions for that matter) is closely linked to the development of appropriate codes of practice for the industry. These are being developed as part of the implementation of the Native Vegetation Act. Those codes of practice will have an impact on the cost of operating private native forestry and its subsequent harvesting. An onerous and inflexible code that results in high costs would limit the development of private native forestry and involve the loss of those opportunities that are indicated in this section. The uncertainty associated with the policy environment in recent years has been a factor in the cessation of almost all silviculture work on private land in the Nandewar region.

Most of the economic activity associated with forestry is generated through the harvesting and milling processes with further opportunities for value adding to make finished products such as flooring, panelling, furniture and house fittings, etc. Those forest industries that are located some distance from seaports have limited opportunities to process and market the low-grade wood from thinnings, harvesting and milling. The limited array of these activities makes it especially difficult to earn commercial returns in the industry. The size of the timber industry activities is closely related to the amount of suitable logs that are produced in the region.

For the purpose of this example, estimates of sawlog yield for both cypress and hardwood have been made for combinations of the amount of land on which private native forestry is undertaken (5 and 10 per cent of the land with tree cover in each category). For cypress, there are two options for silvicultural operations that have different yields of sawlogs.

1. The Traditional State Forests Cypress Model – State Forests of NSW (now called Forests NSW) harvest and manage timber on crown land for sales to local sawmills. The standard management approach has been described as a 'shelter wood system' where much of the volume is removed in a single harvest leaving seed trees and there is a relatively long interval between harvests. Stands tend to be of a more even-aged structure (Taylor et al 2004). A typical management regime is as follows:

- Harvest commercial overstorey trees;
- Non-commercial thinning of current regeneration 5-10 years later;
- Commercial thin of current regeneration a further 30-50 years later;
- Allow new regeneration to establish and overstorey to grow on;
- Harvest commercial overstorey again 30-50 years after the commercial thinning.

Forests NSW estimate that under this regime, typically $5m^3$/ha of commercial timber would be extracted at harvest and again at commercial thinning.

The current prescription for effective non-commercial thinning is to thin to a 6-8 metre spacing. This is typically performed with a brushcutter and at contractor rates, can be relatively expensive (up to $400/ha, Shane Andrews, Greening Australia, personal communication 2004). As a result, Forests NSW tend to non-commercially thin on the highly productive areas.

This is a low intensity management model and is expected to yield 0.2 m^3 per ha per year over the 70 year rotation. Taylor et al (2004) have indicated that on high quality sites, this management regime may yield up to 1 m^3 per ha per year.

2. An Alternative Model for Private Land – this management regime has been suggested by a landholder/sawmiller in the Nandewar Region who mills cypress pine on his property.

The model involves dividing the forest area into coupes, to provide a 24-year rotation. The coupes could each represent one year's logging with the coupes logged alternatively.

This model involves alternative logging of the 24 coupes in order to limit the disturbance of wildlife. It also allows for good fire prevention and control. The plan is to take 50 per cent of all age classes and to thin strategically, whilst harvesting, the remaining timber and also to remove decadent stems to ensure the growth of a quality forest. The reason for a 50 per cent harvest of all age classes is to guarantee the range of log sizes into the future.

If all logs were harvested down to thinnings, it could take 100 years to produce large logs again e.g. 30cm diameter. The strategy of taking 50 per cent of all age classes each 24 years would ensure a sustainable supply of large to small logs and would produce a valuable, high quality forest.

The 50 per cent harvest has very limited visual impact. The combination of a 50 per cent harvest with thinning and removal of decadent stems would allow the remaining trees to grow at a much faster rate. It should be noted that when crown lock-up occurs (tree heads touching each other), very little, if any, growth occurs. Anecdotal evidence suggests that thinned cypress on granite in a grazing situation has thickened from 17cm to 27cm at log mid length over a period of 30 years.

This management model is relatively intensive and is expected to yield around 1 m^3 per ha per year.

3. Hardwoods, zero/minimal silviculture - this involves minimum levels of input with a resultant low yield of 0.5 m^3 per ha per year. In this case, there is limited thinning with essentially just the commercial trees being harvested. This is what foresters often refer to as a 'high grading' operation, which depletes the genetic and growth potential of the forest. It is not desirable, but it is what has occurred in many private hardwood forests in the region.

4. Hardwoods, with silvicultural management – this is a more intensive management option involving the harvest of commercial trees, combined with the removal of suppressed and sub-dominant trees, while retaining habitat and growing trees. It requires some basic assessment/measurement of representative forest plots to identify trees which should be removed and those to remain. The intensity of the regime will vary with site and forest

characteristics and the initial basal area which is assessed by field measurement. The effectiveness of this (and the cypress) management regime in stimulating timber growth may be significantly altered by the intended PNF Code of Practice in NSW.

This option is conservatively assessed as resulting in a yield of 1.5 m^3 per ha per year although on some sites this could be considerably higher under a set of growth maximising silvicultural practices.

The estimated production for the Nandewar region is indicated in Table 4-E. This indicates that there may be potential for a much more significant timber industry in the Nandewar region if there is an environment that supports silvicultural improvement to existing forests although it is likely to take several decades to reach the levels indicated for high yields. Without better management practices, the growth in log production will be limited.

The production from private native forests is likely to be in addition to the impacts shown earlier in this chapter. The impacts on the region can be estimated by converting the logs produced into the value for each activity on assumptions such as those below:

Stumpage value \$30 / m^3

Log snig & haul costs \$45 / m^3

Mill output (yield = 42%), price (\$700 / m^3)

TABLE4-E: Potential Production from Private Land

Forest Area (ha)	Silvicultural regime*	Area %	Yield (m3)	Sawlog Production (m3)
Cypress				
685700	Low intensity	5	0.2	6,857
685700	High intensity	5	0.4	13,714
685700	Low intensity	10	0.2	13,714
685700	High intensity	10	0.4	27,428
Hardwood				
685700	Negligible	5	0.5	17,143
685700	Medium intensity	5	1.5	51,428
685700	Negligible	10	0.5	34,285
685700	Medium intensity	10	1.5	102,855

* These regimes are described in the text

On this basis, 1,000 m^3 will result in mill output of \$294,000 of which \$75,000 is the cost of logs.

The total impact in the region for each 1,000 m^3 of logs can be approximated by the total multipliers calculated from the input-output tables as (based on the Lower Nandewar 2011 model): The multipliers are applied to the gross output ($294,000).

Gross output	$570,000
Gross regional product	$229,000
Household income	$79,380
Employment	2.9

These values represent approximations for the potential regional economic impact of an expansion of the forestry industry in the Nandewar region. This is the impact up to the products from the mills and does not take into account further value adding. However, the particular impacts will vary according to the nature of the various operations, the technology used in the production processes, the final products produced and the capacity and structure of the region economy.

If the potential production from private property in the region reaches around 100,000 m^3 , then it would likely create over 300 jobs and add over $23m to gross regional product (an increase of around one per cent). There would be an increase in the income of landowners along the lines suggested in Chapter 2. This provides a broad indication of the opportunity foregone if private native forestry opportunities are not facilitated through appropriate policy settings.

5 Summary and Conclusions

5.1 THE OVERALL STRUCTURE OF THE MODELS

The purpose of this project was to develop the capacity to assess the impact of selected conservation measures on the Nandewar regional economy. Those conservation measures may involve public lands, and so have effects through forestry and other visitation and recreation activities on those lands, and private lands where the conservation actions will be voluntary and may impact on business activity.

The work involved two stages:

- Developing the structure of the analytical models; and
- Building the models to be ready to analyse selected conservation options and demonstrating the application of those models..

The analysis of options was to be carried out in part through additional work and by assisting with the development of in-house analytic ability and use of the models. The latter has been developed in terms of the regional impact models, but the micro models are not yet sufficiently developed in terms of particular conservation measures and operational routines for that to be a realistic possibility.

The overall structure of the analytic models involves two main components that are linked in various ways. The first part is the micro models that are constructed for farming operations and timber milling. These are designed to assess how conservation measures on farms may impact on operations including farm production and financial performance, and how changes in the wood supply may impact on timber milling. These models are constructed in Vensim™ and allow impacts to be simulated over a number of years by comparing base levels with a range of alternatives.

The regional impacts are assessed using input-output models. These models describe the economic characteristics of the regional economy, thereby providing a context within which the changes may be considered. The models also enable the estimation of the flow-on effects that are generated from changes in a particular industry through the estimation and use of appropriate multipliers. Thus it is possible to estimate how a particular change may impact (directly and indirectly) on the regional economy.

The choice of two levels of models rather than a single more complex macro model has been made on the basis of the relatively low cost of development, and the potential to include a more detailed set of descriptors about the way the affected businesses operate and respond to change than can be achieved in a single model. For this study, a number of farm models

have been developed to span the range of farming types common to the Nandewar region and the milling of cypress pine timber. At the regional level, two input-output models have been constructed: the Upper Nandewar based around Inverell and the Lower Nandewar based around Tamworth.

The input-output models have also been projected to 2011 to provide a perspective on trends in the development of those regions. That will allow all of the assessment process to be considered in terms of trends. In addition to being able to assess how an option may impact on the economy as it is now, it becomes possible to consider how actions to change the adoption of various conservation measures over time will impact on an economy that is also changing. For example, if an economy is growing rapidly and becoming more diversified into industries with little dependence on the natural resource base, then additional conservation measures that may reduce output might be considered to have little impact on the regional economy. A different conclusion might be reached if the economy is highly dependent on natural resource based industries and has little growth potential.

The links between the models are made through two mechanisms. First, the micro model results need to be aggregated to the regional level. For farming this is provided through the identification of the main farming types and the use of GIS-information systems that allow an assessment of the extent to which the various farming types occur in the region. The compilation of the GIS information was incomplete when most of this work was done but some information on tree cover was used in the analysis of the potential for private native forestry as a case study. Second, the information from the micro models is structured into a format that enables the representation of those farming types in the input-output model to be modified (output and input costs) so that the regional impacts can be assessed.

5.2 THE RESULTS

Within this report, information is presented on the micro models for farming and saw milling, the regional input-output models including the projected models that reflect an 'in-house' developed scenario, and the impact of the forestry-based activities in the region. Much of this work is of a capacity-building and demonstration nature as the work related to the assessment of conservation and development of new options, the GIS land information systems and alternative scenarios for future economic development were incomplete.

Farm models have been developed that span the predominately grazing areas of most of the Nandewar region with varying mixes of land types, enterprises and production potential. A further model for the Liverpool plains has been developed to include the high intensity cropping of the suitable areas along with the grazing of lighter soils and slopes. Those models have been applied to an operation involving the development of private native forestry, and for an actual demonstration conservation program on the Liverpool Plains.

The further application of these models awaits the outcomes from the conservation assessments and the development of conservation options and measures that may be offered to landholders.

The regional models provide a perspective on the two region economies that extends the information provided in the socio-economic profile prepared by Hassall and Associates (2004). The information reveals the Upper Nandewar region as highly dependent on primary industry and its processing. The region economy has not been growing during the 1990s, but appears likely to see some growth to 2011 such as that embedded in the projected model. That growth will, in part, be a catching up of some of the low growth and reductions that occurred in the 1990s under difficult farming conditions, a national recession and the restructuring of some government operations. However, the Upper Nandewar region economy is unlikely to become much less dependent on primary industries and so conservation measures that may impact on those industries need to carefully crafted and assessed.

The Lower Nandewar region includes Tamworth and enjoys some of the benefits of including the regional centre for the Northern region. The economy is more diverse than the Upper Nandewar region, but it is still dominated by primary product production and processing even though the products are sourced from a wide area. That dependence was reflected in the low growth in the 1990s when rural industries performed poorly. It seems likely that this region will secure significant growth in the 2000s that will strengthen and diversify the economy. While that will lessen the sensitivity to factors impacting on rural industries, there is evidence that some of the regional centre activities including government activities have been a source of instability in the regional economy.

The forestry-based industries in the Nandewar region are modest with most of the output and employment being generated by the range of downstream manufacturing of wood products. However, over the region, all of the forestry, milling and wood products activities contribute around one per cent to the regional economy. Some of those activities are based on wood supplies from outside of the Nandewar region. There is likely to be an increase in the contribution of forestry activities in the Nandewar region as a spill-over from the development of the softwood plantations to the east of the region and the sawmilling operation being developed in Quirindi.

An analysis of the private land with forest cover indicates that there is some potential for private native forestry in the region. That will require additional silviculture management to improve growth rates and timber quality, as well as an appropriate operating and regulatory environment. The considerations indicated potential production from private land of possibly 100,000m^3, but only after some decades of improved management. At that level in 2011, that production would have the potential to add around one per cent to gross regional product.

a Appendix 3.1 Employment Data

Upper Nandewar Region	Census Year				
Sector	**2001**	**1996**	**1991**	**1986**	**1981**
Population	17836	17575	18465	18360	18400
Employment					
Sheep	367	354	674	479	468
Grains	240	470	208	521	376
Beef cattle	593	352	503	469	751
Dairy cattle	10	25	11	28	21
Pigs	11	11	25	31	54
Poultry	6	4	12	23	4
Other agriculture	96	95	127	171	243
Services to agric.; hunting	71	54	77	82	67
Forestry and logging	3	25	14	6	9
Commercial fishing	3	3	0	3	0
Coal; oil and gas	0	3	3	26	5
Iron ores	0	0	0	0	0
Non-ferrous metal ores	6	3	0	7	17
Other mining	50	34	55	44	99
Services to mining	6	42	10	0	27
Meat and meat products	229	261	134	181	320
Dairy products	0	0	0	0	10
Fruit and vegetable products	3	0	0	0	0
Oils and fats	8	0	0	0	0
Flour and cereal foods	0	0	0	0	0
Bakery products	8	48	44	49	64
Confectionery	0	0	0	0	0
Other food products	81	17	0	0	5
Soft drinks, cordials, syrups	0	0	8	17	23
Beer and malt	0	0	0	0	0
Wine and spirits	0	0	0	0	0
Tobacco products	0	0	0	0	0
Textile fibres, yarns etc	0	0	8	0	0
Textile products	0	4	3	3	0
Knitting mill products	0	0	0	0	0
Clothing	0	0	0	0	5
Footwear	0	0	0	0	0
Leather and leather products	0	4	5	3	3
Sawmill products	18	30	20	17	36
Other wood products	13	7	21	12	8
Pulp, paper and paperboard	0	0	7	0	0
Paper bags and products	0	0	0	0	0
Printing; services to printing	17	18	11	10	11
Publishing; recorded media	16	15	24	29	21
Petroleum and coal products	0	0	0	0	0
Basic chemicals	13	0	0	0	0
Paints	0	0	3	0	4
Pharmaceuticals etc	0	0	0	0	0
Soap and detergents	0	0	0	0	0
Cosmetics and toiletries	0	0	0	0	0
Other chemical products	0	0	0	0	0
Rubber products	3	4	0	0	0
Plastic products	0	0	0	0	1
Glass and glass products	6	4	0	0	1
Ceramic products	0	4	0	0	0
Concrete, cement, lime	0	7	0	6	5
Plaster; other concrete produ	0	3	12	3	15
Non-metallic min. products	3	3	0	0	0
Iron and steel	16	0	0	0	5
Basic non-ferrous metals etc	8	0	0	0	2

Upper Nandewar Region	Census Year				
Sector	2001	1996	1991	1986	1981
Structural metal products	14	17	32	11	13
Sheet metal products	4	5	0	0	1
Fabricated metal products	8	15	12	6	12
Motor vehicles and parts etc	11	4	17	4	7
Ships and boats	0	0	0	0	0
Railway equipment	0	0	0	0	0
Aircraft	7	3	10	3	0
Scientific etc equipment	0	3	3	0	0
Electronic equipment	3	0	0	0	0
Household appliances	0	0	0	0	2
Other electrical equipment	3	0	0	9	3
Agricultural, mining etc mac	31	10	5	3	24
Other machinery and equipn	8	12	10	30	12
Prefabricated buildings	3	0	0	0	0
Furniture	10	8	4	3	3
Other manufacturing	12	8	3	7	4
Electricity	30	115	170	176	172
Gas	0	3	22	0	6
Water, sewerage & drainage	20	11	18	25	21
Residential building	256	267	216	221	212
Other construction	158	55	82	67	231
Wholesale trade	441	326	433	335	348
Retail trade	947	780	934	902	935
Mechanical repairs	139	156	104	92	93
Other repairs	21	22	19	12	6
Accom. & restaurants	284	226	256	241	254
Road transport	132	125	145	175	162
Rail & other transport	0	0	0	19	18
Water transport	3	0	0	0	0
Air and space transport	3	3	7	0	1
Transport srvs, storage	10	11	18	16	13
Communication services	59	79	96	128	169
Banking	65	87	114	133	146
Non-bank finance	7	12	19	20	9
Financial asset investors	0	3	4	0	0
Insurance	27	24	27	32	41
Services to finance etc	16	13	5	15	17
Ownership of dwellings	0	0	0	0	0
Other property services	43	42	48	49	41
Scientific research etc	39	28	20	10	39
Legal, accounting srvs	136	114	106	84	115
Other business services	124	83	66	66	73
Public administration	225	278	310	352	339
Defence	0	0	0	11	8
Education	455	467	494	479	442
Health services	445	445	428	345	361
Community care services	219	173	114	88	42
Motion picture, radio etc	8	14	15	17	20
Libraries, museums, arts	15	9	24	19	14
Sport, gambling etc	38	49	32	30	27
Personal services	104	86	83	60	52
Other services	75	116	80	61	53
TOTAL	**8569**	**8211**	**8613**	**8566**	**9227**

Lower Nandewar Region	Census Year				
Sector	**2001**	**1996**	**1991**	**1986**	**1981**
Population	56507	54851	55292	52760	50500
Employment					
Sheep	529	554	766	636	679
Grains	197	477	183	476	337
Beef cattle	978	506	730	662	1115
Dairy cattle	86	136	131	126	85
Pigs	40	53	70	112	180
Poultry	335	309	358	473	552
Other agriculture	166	207	264	293	258
Services to agric.; hunting	129	138	149	99	95
Forestry and logging	27	34	17	36	22
Commercial fishing	9	3	3	6	0
Coal; oil and gas	7	9	13	10	7
Iron ores	0	0	0	0	0
Non-ferrous metal ores	7	0	4	3	6
Other mining	24	43	48	48	184
Services to mining	3	4	14	0	15
Meat and meat products	344	430	258	151	181
Dairy products	70	97	59	95	54
Fruit and vegetable products	8	0	7	6	9
Oils and fats	7	4	3	0	0
Flour and cereal foods	114	62	119	181	207
Bakery products	102	229	200	128	166
Confectionery	0	3	0	3	3
Other food products	91	121	86	120	106
Soft drinks, cordials, syrups	0	0	3	5	27
Beer and malt	16	25	27	18	25
Wine and spirits	0	0	0	0	3
Tobacco products	3	0	9	0	1
Textile fibres, yarns etc	4	4	3	6	0
Textile products	31	16	8	6	2
Knitting mill products	0	0	0	0	2
Clothing	23	22	11	6	8
Footwear	0	0	0	0	0
Leather and leather products	14	22	15	12	6
Sawmill products	41	30	25	27	53
Other wood products	89	92	108	62	114
Pulp, paper and paperboard	0	0	3	3	0
Paper bags and products	0	0	3	0	2
Printing; services to printing	56	87	63	45	66
Publishing; recorded media etc	103	93	133	98	124
Petroleum and coal products	13	0	9	0	0
Basic chemicals	7	20	12	0	8
Paints	11	0	3	0	3
Pharmaceuticals etc	10	8	7	7	13
Soap and detergents	6	3	0	0	0
Cosmetics and toiletries	0	0	0	3	2
Other chemical products	0	0	0	3	0
Rubber products	30	42	46	4	20
Plastic products	36	26	10	6	9
Glass and glass products	7	4	7	6	0
Ceramic products	0	14	13	21	31
Concrete, cement, lime	41	9	48	36	48
Plaster; other concrete products	33	26	45	36	53
Non-metallic min. products nec	19	35	15	10	26
Iron and steel	52	21	34	22	12
Basic non-ferrous metals etc	13	4	3	0	1

Lower Nandewar Region	Census Year				
Sector	2001	1996	1991	1986	1981
Structural metal products	60	102	98	115	152
Sheet metal products	13	20	32	26	19
Fabricated metal products	66	50	32	43	82
Motor vehicles and parts etc	222	272	188	114	86
Ships and boats	7	0	4	3	2
Railway equipment	7	7	0	3	0
Aircraft	52	25	51	135	0
Scientific etc equipment	12	10	11	6	8
Electronic equipment	12	3	3	0	9
Household appliances	18	6	10	3	4
Other electrical equipment	7	7	19	6	45
Agricultural, mining etc machine	40	21	28	18	19
Other machinery and equipment	30	31	60	38	28
Prefabricated buildings	23	10	0	0	0
Furniture	87	55	62	53	91
Other manufacturing	15	16	32	23	11
Electricity	139	165	253	315	367
Gas	0	3	10	7	15
Water, sewerage & drainage	38	69	26	57	49
Residential building	857	583	844	731	778
Other construction	405	564	702	680	787
Wholesale trade	1275	1136	1213	971	1083
Retail trade	3171	2787	3134	2971	2762
Mechanical repairs	532	560	289	282	314
Other repairs	81	67	60	43	63
Accom. & restaurants	1169	1161	1087	771	918
Road transport	727	623	621	529	564
Rail & other transport	145	272	353	646	704
Water transport	6	3	6	12	3
Air and space transport	162	186	317	165	277
Transport srvs, storage	111	151	112	141	106
Communication services	312	425	425	542	443
Banking	210	301	363	340	302
Non-bank finance	70	68	64	105	144
Financial asset investors	12	12	6	25	4
Insurance	197	172	198	124	199
Services to finance etc	86	92	99	133	84
Ownership of dwellings	0	0	0	0	0
Other property services	249	255	218	177	159
Scientific research etc	241	156	269	207	185
Legal, accounting srvs	574	454	479	337	344
Other business services	502	372	299	210	214
Public administration	826	1008	892	856	789
Defence	148	44	26	35	38
Education	1694	1647	1636	1457	1292
Health services	2031	1977	1804	1544	1318
Community care services	589	551	360	244	162
Motion picture, radio etc	118	144	116	156	123
Libraries, museums, arts	74	125	41	48	29
Sport, gambling etc	220	179	133	149	142
Personal services	454	426	361	335	269
Other services	383	301	277	258	197
TOTAL	**24411**	**23695**	**23862**	**22283**	**22681**

a Appendix 3.2 Employment Trends

107 Sectors	Average Annual Compound Growth Rate		107 Sectors	Average Annual Compound Growth Rate	
	Upper Nandewar Region	Lower Nandewar Region		Upper Nandewar Region	Lower Nandewar Region
Sheep	-0.22	-0.17	Basic non-ferrous metals etc	2.57	10.68
Grains	-0.37	0.59	Structural metal products	0.07	-0.61
Beef cattle	-0.20	-0.46	Sheet metal products	2.94	-0.34
Dairy cattle	-0.56	0.02	Fabricated metal products	-0.35	-0.20
Pigs	-0.81	-0.78	Motor vehicles and parts etc	0.65	1.59
Poultry	0.61	-0.39	Ships and boats	na	2.06
Other agriculture	-0.61	-0.35	Railway equipment	na	na
Services to agric.; hunting	0.05	0.35	Aircraft	na	na
Forestry and logging	-0.63	0.24	Scientific etc equipment	na	0.60
Commercial fishing	na	na	Electronic equipment	na	0.41
Coal; oil and gas	-1.00	-0.12	Household appliances	-1.00	3.01
Iron ores	na	na	Other electrical equipment	-0.04	-0.84
Non-ferrous metal ores	-0.64	0.06	Agricultural, mining etc machinery	0.31	1.15
Other mining	-0.49	-0.86	Other machinery and equipment	-0.31	0.07
Services to mining	-0.77	-0.79	Prefabricated buildings	na	na
Meat and meat products	-0.28	0.91	Furniture	2.08	-0.03
Dairy products	-1.00	0.28	Other manufacturing	1.74	0.46
Fruit and vegetable products	na	-0.11	Electricity	-0.83	-0.62
Oils and fats	na	na	Gas	-1.00	-1.00
Flour and cereal foods	na	-0.46	Water, sewerage and drainage	-0.05	-0.22
Bakery products	-0.87	-0.39	Residential building	0.23	0.10
Confectionery	na	-1.00	Other construction	-0.34	-0.49
Other food products	13.76	-0.14	Wholesale trade	0.27	0.18
Soft drinks, cordials, syrups	-1.00	-1.00	Retail trade	0.01	0.15
Beer and malt	na	-0.37	Mechanical repairs	0.49	0.70
Wine and spirits	na	-1.00	Other repairs	2.41	0.29
Tobacco products	na	2.09	Accommodation, cafes & restaurants	0.12	0.27
Textile fibres, yarns etc	na	na	Road transport	-0.19	0.29
Textile products	na	11.74	Rail, pipeline, other transport	-1.00	-0.79
Knitting mill products	na	-1.00	Water transport	na	0.97
Clothing	-1.00	1.84	Air and space transport	1.83	-0.41
Footwear	na	na	Services to transport; storage	-0.20	0.04
Leather and leather products	-1.00	1.38	Communication services	-0.65	-0.30
Sawmill products	-0.52	-0.20	Banking	-0.55	-0.30
Other wood products	0.68	-0.22	Non-bank finance	-0.14	-0.52
Pulp, paper and paperboard	na	na	Financial asset investors	na	1.84
Paper bags and products	na	-1.00	Insurance	-0.35	-0.01
Printing; services to printing	0.61	-0.15	Services to finance etc	-0.05	0.03
Publishing; recorded media etc	-0.24	-0.17	Ownership of dwellings	na	na
Petroleum and coal products	na	na	Other property services	0.06	0.57
Basic chemicals	na	0.12	Scientific research etc	0.02	0.30
Paints	-1.00	2.23	Legal, accounting etc services	0.18	0.67
Pharmaceuticals etc	na	-0.28	Other business services	0.69	1.35
Soap and detergents	na	na	Government administration	-0.33	0.05
Cosmetics and toiletries	na	-1.00	Defence	-1.00	2.89
Other chemical products	na	na	Education	0.03	0.31
Rubber products	na	0.50	Health services	0.23	0.54
Plastic products	-1.00	3.18	Community services	4.23	2.63
Glass and glass products	4.79	na	Motion picture, radio etc	-0.60	-0.03
Ceramic products	na	-1.00	Libraries, museums, arts	0.12	1.57
Cement, lime and concrete slurry	-1.00	-0.15	Sport, gambling etc	0.41	0.55
Plaster; other concrete products	-1.00	-0.36	Personal services	1.01	0.68
Non-metallic min. products nec	na	-0.27	Other services	0.40	0.94
Iron and steel	1.93	3.28	**TOTAL**	**-0.09**	**0.08**

a Appendix 3.3 I-O Sector Classification

Sector Aggregation	107 IO Sectors
Sheep	Sheep for meat and wool
Grains	Grains inc. cereals, oilseeds, legumes
Beef Cattle	Beef cattle
Dairy Cattle	Dairy cattle
Pigs	Pigs
Poultry	Poultry for meat and eggs
Other Agriculture	Other agriculture, inc. nurseries, vegetables, fruit, cotton, tobacco, sugar cane, herbs, hay, goats, horses, deer, beekeeping, pet breeding.
Services to agriculture	Cotton ginning, shearing and wool classing, aerial ag services, contract harvesting, seed grading, land clearing; hunting
Forestry	Forestry and logging
Fishing	Commercial fishing and aquaculture
Mining	Coal; oil and gas
	Iron ores
	Non-ferrous metal ores
	Other mining inc. construction materials
	Services to mining inc. exploration
Food Mfg	Meat and meat products
	Dairy products
	Fruit and vegetable products
	Oils and fats
	Flour and cereal foods
	Bakery products
	Confectionery
	Other food products inc sugar, seafood, animal/bird feed, spices, herbs, savoury snacks, tea, honey - blended etc.
	Soft drinks, cordials, syrups
	Beer and malt
	Wine and spirits
	Tobacco products
Textile Mfg	Textile fibres, yarns and woven fabrics
	Textile products inc. blinds, awnings, curtains, sails, tents, carpets, rugs, ropes, nets, string, cord, bags, sacks etc.
	Knitting mill products
	Clothing
	Footwear
	Leather and leather products
Wood Mfg	Sawmill products inc sawn timber, woodchips, dressed timber, plywood, veneer, fabricated boards Other wood products inc. structural components - windows, doors, trusses, frames, containers, pallets, cases, log preservation.
Printing/Publishing	Pulp, paper and paper-board
	Paper bags and products
	Printing; services to printing
	Publishing; recorded media etc
Chemical Mfg	Petroleum and coal products
	Basic chemicals inc. fertilisers, industrial gas/chemicals, synthetic resins, dyes, acid, salt, urea, fluoride, chlorine etc.
	Paints
	Pharmaceuticals etc inc. drugs, medicines, medicinal preparations
	Soap and detergents

Sector Aggregation	107 IO Sectors
	Cosmetics and toiletries
	Other chemical products inc. explosives, ink, glue, polish, cleaners
	Rubber products
	Plastic products
Mineral Mfg	Glass and glass products
	Ceramic products
	Cement, lime and concrete slurry
	Plaster; other concrete products
	Non-metallic mineral. products nec inc. abrasives, chalk, stone products, insulation materials, ag/hydrated/quick lime,
Metal Mfg	Iron and steel rolling, galvanising, casting, forging, pipes and tubes
	Basic non-ferrous metals inc alumina, aluminium, copper, silver, lead, zinc, gold, bronze, nickel, tin – smelting, refining, rolling, drawing, extruding, casting, forging
	Structural metal products inc girders, reo-mesh, architectural products, doors, gates, windows etc
	Sheet metal products inc. containers, guttering, downpipes, tanks
	Fabricated metal products inc. tools, general hardware, springs, wire, nails, nuts, bolts, screws, rivets, metal coating, non-ferrous pipe fittings, miscellaneous metal products
Mach/Equip Mfg	Motor vehicles and parts etc
	Ships and boats
	Railway equipment
	Aircraft
	Scientific etc equipment inc photographic, optical, medical, surgical
	Electronic equipment inc. computer, telecommunication, radio, TV
	Household appliances
	Other electrical equipment inc. cable, wire, batteries, lights, signs, fuses, electric motors, generators, welding equip. etc
	Agricultural, mining, construction machinery inc lifting/handling
	Other machinery and equipment inc. food processing, machine tool/part, pumps/compressors, commercial heating/cooling equip.
Other Mfg	Prefabricated buildings
	Sheet metal, wooden and upholstered furniture, mattresses, pillows, cushions (not rubber)
	Other manufacturing inc jewellery, toy, sporting goods, brushes, miscellaneous goods
Utilities	Electricity generation, distribution and supply
	Gas distribution and town gas mfg/dist. Via mains
	Water supply, sewerage and drainage services
Residential Building	Residential building
Other Construction	Non-residential building, Non-building construction inc. road/bridge, earthmoving, irrigation, mitigation
Wholesale Trade	Resale of new or used goods to business or institutional users.
Retail Trade	Resale of new or used goods to final consumers for personal or household consumption eg main-street establishments
Mechanical Repairs	Mechanical repairs
Other Repairs	Other repairs in. household equipment repairs etc
Accommodation Restaurants	Accommodation inc. hotels, motels, guest houses, youth hostels, student residences, camping grounds, caravan parks; cafes & restaurants; hospitality clubs, pubs, taverns and bars
Road Transport	Road freight and passenger transport
Rail Transport	Rail; pipeline; other inc. cable car, chair lift etc
Water Transport	International, coastal, inland water transport inc sea freight, cruise operation, boat charter, ferry.
Air Transport	Scheduled domestic and international air transport and non-scheduled air & space transport.
Transport Services	Services to road, water and air transport; travel agency, freight forwarding, customs agency; storage
Communication	Postal, courier, telecommunications

Sector Aggregation	107 IO Sectors
Banking	Reserve Bank; development, savings and trading banks
Non-bank Finance	Building societies, credit unions, money market dealers, deposit taking financiers, financial asset investors etc
Insurance	Insurance and services
	Services to finance and investment inc. brokers
Ownership of dwellings	Residential Property Operators
Property Services	Commercial property operators and developers, real estate agents, non-financial asset investors, machinery and equipment hiring and leasing
Technical, Computer Services	Scientific research, architectural, surveying, consultant engineering, other technical services, data processing, information storage and retrieval, computer maintenance and consultancy services.
Legal/Account/Mgt/ Mkt'g	Legal, accounting, advertising, commercial art and display, market research, business administration and management services
Other business services	Employment placement, contract staff, secretarial, pest control, cleaning, packing, etc.
Public Administration	Federal, state, local government administration; justice
	Defence
Education	Education
Health	Hospitals, nursing homes, medical and health services; veterinary services
Community Care Services	Child care, accommodation for the aged, residential care services
Entertainment/ Media	Motion picture, film and video, radio and television
Cultural	Libraries, museums, parks and gardens, arts
Sport, Gambling	Sport, gambling and other recreation services
Personal Services	Personal and household goods hiring; laundries, drycleaners; photographic studios and processing, funeral directors etc, gardening, hairdressing etc; private households employing staff
Other Services	Religious organisations; Interest groups - business and professional associations; Public order and safety

b References

ABS (2001) Australian National Accounts – Input-output Tables1996-97, (5209.0), Canberra.

Australian Landcare (2004) Vegetation Management Boosts Grazing Productivity, Australian Landcare Magazine, pp. 36-37.

CARE (1997) Conservation Management on Private Forested Land in Tasmania, Estimating compensation payments for landholder, Report to the Public Land Use Commission, CARE, Armidale

Hassall and Associates (2004) Nandewar Economic and Social Regional Profile (NAND 11), Report to DIPNR, Sydney.

Jackson, D. (1998), *A Stochastic Analysis of Drought Management Strategies for a Mixed Cropping and Beef Enterprise in the Liverpool Plains of New South Wales*, Centre for Agricultural and Regional Economics, Armidale.

Mullen, J.D (2002) Farm Management in the 21st Century, Agribusiness Review, Vol.10, paper 5.

Productivity Commission (2003), *Impacts of Native Vegetation and Biodiversity Regulations*, Draft Report, Melbourne, December.

Taylor, D., King, J., Swift, S., Hopewell, G., Debuse, S., Roberts, S. and Cotter, D. (2004), *The influence of forest management on sawn timber recovery and value in cypress pine,* report for the RIRDC Joint Venture Agroforestry Program, Canberra, November.