Land and Water

Quantifying and valuing land use change for Integrated Catchment Management evaluation in the Murray-Darling Basin 1996/97 – 2000/01

Stage 2 Report to the Murray-Darling Basin Commission

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CSIRO Land and Water

Urrbrae, South Australia

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Executive Summary

This study provides a broad scale assessment of the distribution and dynamics of agricultural land use and the economic returns to agricultural use of land and water resources from 1996/97 to 2000/01 in the Murray-Darling Basin (MDB), Australia. The aim of this study is to provide a spatially explicit, comprehensive, integrated, basin-wide summary as baseline data for informing Integrated Catchment Management policy in the MDB.

To assess the changes to agricultural land use and the economic returns to agricultural use of land and water resources from 1996/97 to 2000/01 we extend the methods used in the National Land and Water Resources Audit Theme 6 (Hajkowicz and Young 2002). Land use maps constructed by the Bureau of Rural Sciences (BRS) are combined with Australian Bureau of Statistics (ABS) agricultural statistics data to map the spatial distribution of irrigated and dryland versions of 48 agricultural commodities in the MDB. Spatially-explicit data on the value, production, area, water requirements and costs of production of each commodity in the MDB is assembled for input into a profit function. Price and yield data for each commodity is derived by Statistical Local Area from the agricultural statistics and the spatial distribution of yield is refined using satellite data. Spatially explicit data on cost parameters for each commodity are assembled from Gross Margin Handbooks and data on water costs for each commodity are derived from irrigation benchmarking data. Data on government support to agriculture is derived from Trade and Assistance Review data. A profit function is used to calculate the returns to agriculture in terms of gross revenue, profit at full equity, and net economic returns to each agricultural commodity type in the MDB.

To quantify the economic returns to water of different irrigated agricultural land uses in the MDB and the changes between 1996/97 and 2000/01 we use estimates of crop water requirements. Water requirements are an estimate of the typical application rates of water in ML/ha rather than actual water application rates. Typical water requirements for each irrigated land use are derived from irrigation benchmarking data. Water requirements vary by crop type and by region with crops grown in moister climates requiring less water than those grown in drier climates. We estimate the total water requirements of irrigated land uses by applying water requirement estimates for different irrigated land uses to the mapped land use areas. For this study the same crop water requirements rates were used for both 1996/97 and 2000/01. We have not considered the effect of possible increases in water use efficiency resulting from improvements in irrigation technologies and management techniques (e.g. re-use etc.) on crop water requirements. Hence, our estimates of total water requirements in 2000/01 are likely to be higher than the actual water used for irrigation.

Results are presented in terms of the total returns, returns per hectare, and returns per megalitre of irrigation water used. Results are summarised by the 20 Catchment Management Regions (including the ACT) in the MDB. The spatial distribution of these economic measures is mapped and changes are assessed from 1996/97 to 2000/01.

This analysis attempts to synthesise all of the biophysical, agronomic and geographic complexities of agricultural activity in the MDB and provide a comprehensive and integrated summary based on the best available data and techniques. However, to achieve this goal,

significant spatial and agronomic detail has necessarily been generalised and assumptions have been made at many stages of the analysis. Also, limited on-ground verification of results has been undertaken. As a result, the outputs from this study should be considered as *estimates* only. The uncertainty surrounding various estimates, particularly livestock and irrigation areas, and water requirements statistics, may at times be significant. The uncertainties are quantified and discussed in the report. Spatial data layers are available from the MDBC or from the authors. Selected results from the study are summarised below.

With regard to the agricultural use of land and water resources:

- Over 100 different individual agricultural products are produced in the MDB;
- The total area of land under agricultural production in 1996/97 was 87 million ha, which increased slightly to 89 million ha in 2000/01;
- Dryland agriculture occurs across the MDB such that Sheep, Beef Cattle and Cereals account for over 95% of all agriculture by area in the MDB;
- There has been large scale conversion of pasture areas from Sheep grazing to other land uses between 1996/97 and 2000/01 especially Beef grazing following recovery of beef cattle prices;
- Overall, Dairy has experienced a 19% increase in area between 1996/97 and 2000/01 with significant conversions from rainfed pastures to irrigated pastures;
- The area of Oilseeds (led by Canola) has expanded in area nearly 1.5 times and Grapes, Coarse Grains, Fruit, Cotton and Rice have also increased in area substantially;
- The irrigated agricultural land use of largest areal extent is Dairy, followed by Cotton, Cereals and Rice;
- The total area of irrigated agriculture reported was 1.5 million ha in 1996/97 and 1.8 million ha in 2000/01 – an increase of 22%;
- The modelled estimate of the total water requirements of irrigated agricultural land uses in 1996/97 was 9,346 GL which increased by nearly 29% to 12,050 GL in 2000/01, due to the increase in the total area of irrigated agriculture and a shift towards more intensively irrigated land uses. The MDBC Water Audit and Monitoring Reports show a decrease in surface water diversions for irrigation between 1996/97 and 2000/01 from 11,825GL to 11,369GL. Figures on groundwater diversions for the MDB have only been available since 1999/00 and show an increase between 1999/00 to 2000/01 from 1,052GL to 1,240GL.

  There is uncertainty surrounding the water requirements estimates modelled in this study. However, it is clear that there has been a substantial increase in the total area of irrigation in the MDB between 1996/97 and 2000/01 whilst surface water diversions have decreased.

  Both 1996/97 and 2000/01 were years of fairly average rainfall in the MDB and hence there is no reason to suggest any significant influence on irrigation demand resulting from climatic variation. An increase in the use of groundwater resources may account

for some of the increase in the area of irrigated agriculture. However, we suggest that significant improvements in irrigation efficiency both on-farm and in the irrigation water supply systems may have also contributed to this effect. Increases in irrigation efficiency may result in lower return flows to the river both through surface and groundwater systems. This effect was predicted by Young and McColl (2003) although these results suggest that the magnitude of the effect may be larger than predicted. These findings have important implications for environmental flows and water policy. More research is required to validate these results, to better understand where irrigation efficiencies are being made, and the implications of these gains in efficiency.

- The largest user of water for irrigation in the MDB is Dairy, followed by Cotton, Rice, Cereals and Grapes;
- Areas of irrigated Cotton expanded by 108,000 ha (36%) and the total water requirements of Cotton increased by 729 GL to a total of 2,856 GL in 2000/01;
- In terms of changes in areas of irrigated land uses, Cereals expanded by around 90,000 ha, Grapes expanded by around 33,000 ha and Rice by some 24,000 ha. Irrigated Sheep pasture contracted by 118,000 ha and Beef pasture contracted by some 23,000 ha;
- Significant new areas have opened up to irrigation. In the southern parts of the MDB, newly irrigated areas are opening up with a variety of land uses including Dairy, Cereals, Grapes and Fruit. In the northern parts of the MDB areas previously used for dryland agriculture are being opened up to irrigation largely for Cotton.
- The Agricultural Land Uses of Sheep and Beef pasture, Oilseeds and Legumes experienced reduced areas of irrigation, saving just over 600 GL in total water requirements of irrigated agriculture in the MDB;
- New South Wales accounts for around 60% of the total water requirements for irrigated agriculture in the MDB, Victoria accounts for 32%, Queensland around 5% and South Australia 3%.
- Geographically, around 65% of the total water requirements of irrigated agriculture occurs in just 4 Catchment Management Regions - North Central (Vic), Goulburn (Vic), Murray (NSW) and Murrumbidgee (NSW);
- The irrigation character of the MDB is such that irrigated agriculture in the lower Murray area is dominated by Fruit and Grapes; in the Victorian CMRs Dairy is dominant; in the Murray and Murrumbidgee CMRs in NSW Rice and Dairy dominate; and in the northern CMRs such as Gwydir, Namoi and Border Rivers Cotton dominates.

With regard to the economic returns to agricultural use of natural resources:

- In 1996/97 the gross revenue from agriculture in the MDB was around $11.7 billion. This increased by 16% to $13.6 billion in 2000/01;
- Total profit at full equity from agriculture in the MDB in 1996/97 was $3.856 billion which decreased slightly to $3.732 billion in 2000/01;

- The total value of government support to agriculture was $665 million in 1996/97 or 17% of profit at full equity. In 2000/01 the total government support to agriculture was $533 million, or 14% of the total profit at full equity;
- The total net economic returns to agriculture in the MDB in 1996/97 was $3.192 billion. This increased slightly to $3.199 billion in 2000/01;
- New South Wales accounts for 49% of the total profit at full equity to agriculture, Victoria accounts for 34%, Queensland 12% and South Australia 5%;
- Most parts of the MDB increased in gross revenue from 1996/97 to 2000/01 except the north-eastern CMRs which suffered from a drop in revenue from Cotton;
- Around 50% of the total profit at full equity occurs in around 1% of the agricultural area and 80% of the total profit at full equity occurs in around 5% of the agricultural area;
- Although irrigated agriculture covers only about 1.4% of the total land area of the MDB, it accounts for around 36% of the total profit generated from agriculture;
- Highest total economic returns are obtained from dryland land uses with low returns per hectare but which cover broad areas such as Cereals, Beef and Sheep;
- Per hectare the highest returns are obtained from Cut Flowers, Fruit, Grapes and Tree Nuts whereas the lowest returns are from livestock grazing and cereals;
- Per megalitre of irrigation water the highest returns are obtained from those land uses that have high to moderate returns and lower water requirements per hectare including Cut Flowers, Vegetables, Fruit, Grapes and Tree Nuts. The large water users Dairy, Cotton and Rice have moderate returns per megalitre. Beef and Sheep pasture, Legumes, Oilseeds etc have low returns per megalitre because although they have low water requirements their returns are very low;
- Geographically, the economic returns to agriculture largely follow the distribution of water from both rainfall and irrigation. High value agriculture is concentrated in the crescentic region stretching from the River Murray in South Australia, curving east around the southern, eastern and north-eastern parts of the MDB. The drier interior of the MDB has very low returns to agriculture per hectare.

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Preface

This report is the second of a series of reports being prepared for the Murray-Darling Basin Commission (MDBC) under the Integrated Catchment Management (ICM) Business Knowledge Plan. This plan, among other things, identifies a need to build an integrated information base that can be used by the MDBC and its partners to:

- establish a quantitative baseline enabling assessment of the influence of ICM on the natural resource and community outcomes in the Murray-Darling Basin (MDB) at the regional level;
- establish a database that will result in a greater return on investment as public and private funds are invested across the Murray-Darling Basin;
- develop information necessary for objective evaluation of ICM in 2003.

As part of this process CSIRO Land and Water's Policy and Economic Research Unit has been commissioned to prepare a series of reports and data sets that help quantify and value land-use change for ICM evaluation in the MDB. The project is being implemented in four stages:

- Stage One provides an interim regional snapshot of agricultural use of land and water resources for the Murray-Darling Basin in 1996/97 using existing National Land and Water Resources Audit datasets;
- Stage Two updates and expands this data and provides an assessment of change between 1996/97 and 2000/01;
- Stage Three will then review ICM information needs with a view to providing input to an ICM snapshot as of the end of 2003;
- Stage Four will then assemble the data needed to produce this snapshot.

This Stage 2 report includes an update of the profit mapping for 1996/97 and an assessment of change to 2000/01. The Stage 1 report to the MDBC was an interim report only. This Stage 2 report supersedes the Stage 1 report. Some results for the 1996/97 analyses differ because of the updated and improved methods used in the Stage 2 report.

1. Introduction

Use of land and water resources in the Murray-Darling Basin (MDB) and the resultant condition of these resources is currently one of the most important social, economic and environmental issues in Australia. The goal of the Integrated Catchment Management (ICM) Policy of the Murray-Darling Basin Initiative is to manage the natural resource base of the MDB in an ecologically sustainable way. Access to timely, accurate and relevant information about critical natural and human aspects of the MDB at appropriate scales is imperative to achieving these ICM goals (MDBMC 2001). Young *et al*. (2003) created a snapshot of the economic returns to agriculture from land and water resources in the MDB for the year 1996/97. This study adds further to this knowledge base in updating the 1996/97 snapshot, creating a 2000/01 snapshot of agricultural returns to land and water resources and assessment of change from 1996/97 to 2000/01 in the MDB.

Agricultural land uses in the MDB vary in their levels of economic return and their demands on land and water resources (e.g. area, water requirements). Hence, the impact of agricultural land uses on the natural environments of the catchments and waterways (e.g. erosion, salinity etc.) also varies. Information about the amount and spatial distribution of different agricultural land uses, their resource utilisation and profitability can be extremely useful in developing integrated catchment management policy (Walker and Reuter 1996; Walker and Young 1997; Vertessy 2001; Young *et al.* 2003). Spatially-explicit knowledge of agricultural land use and returns to agriculture provides a useful basis on which to assess the relative economic benefits resulting from the use of natural resources, the impact of agriculture on natural resources, and the priorities for managing these impacts through ICM. In this study we quantify and assess changes in agricultural land use types and their water requirements, and the agricultural returns to the land and water resources of the Murray-Darling Basin. The objectives of this study are to quantify and interpret the distribution and dynamics of:

- dryland and irrigated agricultural land use in the MDB from 1996/97 to 2000/01;
- the total returns to agricultural land uses in the MDB from 1996/97 to 2000/01 in terms of the gross revenue, profit at full equity, and net economic returns;
- the returns per hectare to agricultural land uses in the MDB from 1996/97 to 2000/01 in terms of the gross revenue, profit at full equity, and net economic returns;
- the water requirements and returns per megalitre to agricultural land uses in the MDB from 1996/97 to 2000/01 in terms of the gross revenue, and profit at full equity.

1.1 Background

This report builds upon a major project by Hajkowicz and Young (2002) commissioned as part of Theme 6 of the National Land and Water Resources Audit (NLWRA) and published as *Australians and Natural Resource Management 2002* (NLWRA 2002). Based on the Bureau of Rural Sciences (BRS) land use map of Australia for 1996/97 (Stewart *et al*. 2001), Hajkowicz and Young (2002) estimated the net returns to the agricultural resource base for the whole of Australia at a 1km grid cell resolution for the year 1996/97 and the average of five years ending 1996/97. The method is based on the concept of *profit at full equity* (PFE).

The results of this earlier study for the NLWRA were tailored for this current series of reports for the Murray Darling Basin Commission (Young *et al*. 2003). Young *et al*. (2003) summarised and interpreted the results of Hajkowicz and Young (2002) for the Murray-Darling Basin in the interim Stage 1 report for the Murray-Darling Basin Commission.

BRS have recently improved the land use mapping technology and produced new agricultural land use maps for 1996/97 and 2000/01 (BRS 2004). In this study we redo the analyses of Hajkowicz and Young (2002) (with some modifications) for 1996/97 based on the new land use map for 1996/97. We also calculate the returns to agriculture for 2000/01 based on the agricultural land use map for that year and assess changes from 1996/97 to 2000/01. Many of the methods used in this Stage 2 study were developed initially by Hajkowicz and Young (2002) and modified to enable comparison between years.

1.2 Assessing Agricultural Land Use Change for ICM

1.2.1 Agriculture and Integrated Catchment Management

Integrated Catchment Management requires knowledge of the distribution and dynamics of a range of human and environmental processes that impact upon the health of catchments and waterways (Reuter 1998). Agriculture is the dominant land use in many catchments including the Murray-Darling Basin and is the most pervasive influence on catchment and river health. In these catchments, agriculture often also underpins economic and social structures. Thus, assessment of agricultural land uses for policy development in integrated catchment management needs to consider not only the environmental impacts of agricultural land uses, but their economic and social impacts as well. In this study, we assess the distribution and dynamics of two of these aspects – the agricultural use of land and water resources, and the economic returns to the use of these natural resources in agriculture.

Different types of agriculture vary in the intensity with which they use land and water resources and hence, their environmental impacts. At one end of the spectrum are extensive land uses such as livestock grazing of native vegetation and pasture. These types of land uses tend to use large areas of land but have low water requirements.

Extensive agriculture may have significant ecological effects in some ecosystems and can lead to land degradation. However, extensive agriculture tends to have a lower impact on biophysical processes, such as biotic processes, hydrological and nutrient regimes and the interjection of pesticides into the environment, albeit over a wide area. At the other end of the spectrum are intensive agricultural land uses, especially those that involve irrigation such as cotton and rice farming. These tend to occur over a smaller land area but have larger requirements for water resources and involve more significant changes in biophysical processes.

Different types of agriculture also vary in the level of economic returns in terms of gross revenue and profit relative to their use of the natural resources of land and water. Agricultural land uses vary in their intensity, price per unit of production, yield per hectare, and costs of production. In general, the larger the area of agriculture the greater the total returns and the more intense the land use the greater the returns per hectare. However, significant variation about this trend exists in the economic returns of different agricultural land uses to land and water resources because of the vagaries of commodity prices, and spatial heterogeneity in climate, soils, hydrology and the management skill of farmers.

1.2.2 Mapping Agricultural Land Uses: Remote Sensing and Agricultural Statistics

Typically, there are two main sources of information about the spatial distribution and dynamics of agriculture available – remote sensing and agricultural statistics. Both techniques have advantages and disadvantages and can be used complimentarily to enhance agricultural mapping.

Aerial and, in particular, satellite-based remote sensing can provide data that can be used to map agricultural land uses over regional areas (Hansen *et al.* 2000; Giri *et al.* 2003; Eva *et al.* 2004; Latifovic *et al.* 2004). Images can also be sourced at different points in time and the changes in agriculture can be inferred using a variety of techniques. There are many different sensors that provide options in spatial, spectral and temporal resolution, and areal coverage for agricultural mapping.

Higher spatial resolution sensors such as Ikonos (1-4m pixels), SPOT (10m pixels) and even Landsat (30m pixels) can capture a high degree of spatial detail but only over smallish areas (Seto *et al.* 2002). Coarser resolution sensors such as the 1.1km resolution Advanced Very High Resolution Radiometer (AVHRR) provide low spatial detail but can be used to map whole regions (Eva *et al.* 2004). MODIS is the exception and features moderate spatial resolution (250m resolution) and large areal coverage. High temporal resolution sensors such as AVHRR and MODIS can provide data at regular time steps, often in cloud-free composites, which can be used to capture different elements of the growing cycles of agricultural crops (Walker and Mallawaarachchi 1998; Agarwal *et al.* 2003). Areal coverage is important when large regional areas need to be mapped such as the Murray-Darling Basin in Australia. Radar remote sensing is also being increasingly used for land use mapping (Liew *et al.* 1998; Shao *et al.* 2001).

Attempts at mapping agricultural land use have largely fallen into three groups. The first group attempts to map land use/land cover in general and distinguish agriculture from urban, water, forest and other major land use types (Al-Bakri *et al.* 2001; Gonzalez 2001; Petit et al 2001; Cardille *et al.* 2002; Alphan 2003; Cardille and Foley 2003; Giri *et al.* 2003; Eva *et al.* 2004; Semwal *et al.* 2004). The aim of these studies typically is to quantify the distribution of land use and land use change with regard to assessing drivers and implications. The second group attempt to identify the distribution of individual agricultural crops of importance in a particular region to provide information for policy issues such as food security (Frolking *et al.* 1999, 2002; Maxwell *et al.* 2004; van Niel and McVicar 2004). The third group, of which this study is a member, attempt to map individual agricultural land uses or commodities (Walker and Mallawaarachchi 1998; Congalton *et al.* 1998; Stewart *et al.* 2001; Agarwal *et al.* 2003). The aim of these studies is typically to assess the economic, environmental and policy implications of agricultural land use change.

For broad land use mapping studies, standard remote sensing data sources such as Landsat perform well as they are designed to be sensitive to the spectral changes typical of broad land use categories such as soil, water, forest and agriculture. For those studies mapping the distribution of single agricultural crops or multiple individual agricultural land uses or commodities, standard remote sensing data sources and analytical techniques based on image snapshots are often inadequate. The spectral distinctiveness of different agricultural types is often very subtle and difficult to detect. However, different agricultural land uses tend to have markedly different growth phenology over the year and multi-temporal data can be used to distinguish between them. Multi-temporal Normalised Difference Vegetation Index (NDVI) data from the AVHRR sensor has been used to good effect in this capacity (Walker and Mallawaarachchi 1998; Hansen *et al.* 2000; Stewart *et al.* 2001; see also Senay and Elliot 2002).

However, the main problems with mapping agricultural land use using remote sensing imagery on its own are errors of omission and commission. In image classification studies there is usually no knowledge of the total areas of each land use occurring in the study area. Whilst error analysis is often performed, this does not indicate how well the mapped results match the regional aggregate areas of agricultural land use. Mapping too much or too little of particular land uses can have significant effects on subsequent analyses based on the land use maps, especially change detection, economic analysis, and interpretation for ICM.

In many countries, agricultural statistics are routinely collected by government administrative and statistical agencies. This data also provides information on the distribution of agricultural land uses. Frolking *et al.* (1999) compared agricultural areas derived from remote sensing data with those reported in agricultural census in China. They found that remote sensing tends to overestimate the area of agriculture whilst agricultural census tends to underestimate it. Agricultural statistics data can complement the use of remote sensing in mapping agricultural commodities by providing spatially aggregated information on the total area of different land uses.

Agricultural statistical data is usually reported by spatially aggregated areas (or *zones*) delineated so that given the sampling regime, each area has a reliable estimate for the statistics reported. Agricultural statistics are commonly used very effectively to provide summaries of regional or national trends in individual commodities over time (Martin *et al.* 2003) and can inform regional economic models (Wittwer *et al.* 2003). However, the level of spatial aggregation of agricultural statistics is often too coarse for effective assessment of agricultural use of natural resources and the policy implications.

For effective use in integrated catchment management and environmental policy, agricultural statistics data needs to be accurately mapped at a finer scale than the statistical reporting zones. Geographical techniques such as areal interpolation exist for reaggregating zone-based statistical data into different spatial units (such as Catchment Management Regions) (Goodchild *et al.* 1993). However, these techniques are based on the assumption of spatial homogeneity of the attributes over the statistical zones and reallocation of areas of agriculture to the new spatial units is proportional to the area of intersection with the statistical zones. Alone, areal interpolation techniques are not sufficient to enable on-ground mapping of agricultural commodities from agricultural statistics data at a scale or level of accuracy suitable to inform ICM. However, there is potential to integrate remote sensing and agricultural statistics to map the distribution of agricultural landuses.

Several studies have successfully combined remote sensing with agricultural statistics to enhance agricultural mapping. Walker and Mallawaarachchi (1998) were the first to formally integrate remote sensing with agricultural statistics. SPREAD is a technique developed by Walker and Mallawaarachchi (1998) that uses multi-temporal AVHRR NDVI data and field sampling data to perform supervised classification of 21 agricultural land use types. However, SPREAD uses aggregate area data from an agricultural census reported by Statistical Local Area (SLA) to constrain the allocation of land uses. Stewart *et al.* (2001) use SPREAD to map land use for Australia. Cardille and Foley (2003) integrate monthly AVHRR NDVI data and agricultural census data to map agricultural land use in the Brazilian Amazonia and assess change from 1980 – 1995. However, Cardille and Foley (2003) focus on the impacts of agriculture on deforestation and restrict their analysis to broad agricultural classes of cropland, natural pasture and planted pasture. Müller and Zeller (2002) combine remote sensing using Landsat snapshots with village surveys in mapping agricultural land use change in Vietnam to detect the drivers of land use change.

In this study, we use agricultural land use mapping by BRS that builds on the work of Walker and Mallawaarachchi (1998) and Stewart *et al.* (2001). BRS map land use for the Murray-Darling Basin using SPREAD II, a Bayesian Markov Chain Monte Carlo algorithm that combines monthly AVHRR NDVI data with field sampling data, agricultural statistics data, and Geographic Information System (GIS) data to map the spatial distribution of land use. Essentially, SPREAD II provides a method of spatially reallocating agricultural census data using remotely sensed data on a 1km grid cell basis. It ensures that mapped areas of agricultural land uses match those reported in the agricultural statistics by SLA. Furthermore, in this study we use areal interpolation to devolve the coarse agricultural

land use class mappings output by SPREAD II using commodity level agricultural statistics data to provide a detailed map of the distribution of agricultural commodities.

1.2.3 Agricultural Land Use Change Detection and Analysis

Detection of land use change is very important for understanding local and regional changes in environmental, economic and social processes. Many studies have assessed land use change to inform regional policy (Congalton *et al.* 1998; Gonzalez 2001; Müller and Zeller 2002; Alphan 2003; Cardille and Foley 2003). Land use mapping especially through remote sensing plays a fundamental role in the detection of land use change. There are many ways to detect change from pixel-level comparison of raw and classified images to high level comparison of aggregated regions. Pixel level change detection has the potential to provide very high spatial detail of land use changes. However, this is only suitable when there is a high level of confidence in the spatial and spectral comparability of the data. For data with lower pixel level confidence of land use classification such as this study, aggregate comparison provides a simpler and much more reliable method of change assessment.

Catchment Management Regions (CMRs) are the administrative unit for the implementation of ICM policy in the MDB. In this study pixel level data mapped by SPREAD II is aggregated to CMRs and agricultural land use change is assessed at this aggregate level to inform ICM in these regions.

1.2.4 Water Requirements of Irrigated Agricultural Land Uses

The use of water for irrigated agricultural land uses is an important economic and environmental issue. Irrigated agriculture is economically and socially important in many regions due to the typically high yields and returns to irrigated agricultural commodities, and other contributions to social welfare such as local employment. However, irrigation involves significant changes to the hydrology of rivers or aquifers from which the water is extracted, resulting in changes in the hydrology of these systems such as reduced environmental flows. Irrigation also involves changes to the hydrology of the land on which the water is applied, generally increasing recharge, leaching nutrients from the soil, increasing water tables and potentially, causing waterlogging and soil salinisation. All of these are prominent issues in the Murray-Darling Basin. Hence, knowledge of the distribution and dynamics of the use of irrigation water in agriculture is important for ICM policy.

Knowledge of the quantities of irrigation water used, where they are used and how they change can come from a variety of sources. The Australian Bureau of Statistics (ABS) publishes information on irrigated areas of agriculture by SLA but does not provide information of water quantities, or irrigation technology used. The ABS also publishes the Water Accounts for Australia (e.g. Trewin 2004) which summarises water use by industry sectors in Australia. The Murray-Darling Basin Commission regularly publishes its Water Audit Monitoring Report (MDBC 1998, 2002) which summarises total diversions to agriculture and other uses by catchment regions similar to those used in this study.

Probably the most comprehensive regular reporting on irrigated agriculture in Australia is done by the Australian National Committee on Irrigation and Drainage (ANCID). ANCID regularly publish in their Australian Irrigation Water Provider Benchmarking Reports (ANCID 2000, 2002) a variety of indicators of irrigation performance by irrigation district including the area irrigated and the quantities of water used. In addition, a variety of irrigation data is kept in State Government and irrigation company databases.

A range of irrigation data is available but it is disparate and there is no existing information on the spatial distribution of irrigation water usage in the MDB at a spatial scale or level of detail commensurate with other data used in this study. Other studies have successfully combined remote sensing and agricultural land use mapping with modelling approaches to estimate the distribution of water used in irrigated agriculture. Congalton *et al.* (1998) mapped agricultural land use using Landsat and used these maps as input into a model of consumptive water use in the Colorado River Basin. De Santa Olalla *et al.* (2003) map crop development types using NDVI data and integrate water use data from an irrigation advisory service within a GIS to quantify the spatial and temporal dynamics of irrigation water use with a view to informing groundwater sustainability policy. Ray and Dadhwal (2001) combine remote sensing and GIS to map crop evapotranspiration of irrigation demand in Gujarat, India. In this study we model the spatial distribution of typical water requirements of agricultural land uses rather than actual water use, using ANCID data (ANCID 2000, 2002).

1.3 Quantifying Economic Impacts of Land Use Change

Agricultural economic data is often recorded at coarse spatial scales, usually through agricultural census' and surveys as discussed above. To be of most use for informing ICM policy, economic data needs to be spatially disaggregated to the same level as the agricultural land use mapping and irrigation data. It then needs to be integrated with land and water use data to provide information on the economic benefits and environmental trade-offs of agriculture to inform priority-setting for ICM.

Agricultural census data commonly has information not only on the areas of each individual agricultural land use, but also on key economic attributes such as total production and value of production. Once the areas of each agricultural land use are mapped on a pixel basis using the techniques discussed above, the economic data from the agricultural statistics and elsewhere can be linked to create maps of economic parameters. These spatial layers can be combined in a GIS using a profit function to derive mapped measures of the economic performance of agriculture such as gross revenue, profit at full equity and net economic returns.

Few studies, apart from the forerunners to this study (i.e. Hajkowicz and Young 2001; Young *et al.* 2003), have attempted to directly model and map economic aspects of agriculture on a spatial scale useful for ICM and environmental policy. Spatial distribution of the economic value of agriculture has been estimated typically based on the assumption that it is related to the value of agricultural land. The value of agricultural land, in turn, may be mapped using cadastral valuation and sales data where it exists, and

modelled against other variables such as amenity value (Bastian *et al.* 2002) and greenness (Sengupta and Osgood 2003). Zhao *et al*. (2004) use an ecosystem services framework to value agricultural land use change in China.

Bateman *et al.* (1999) used GIS and farm survey statistics to model and map profit to dairy and sheep farms in Wales based on biophysical data and farm level agricultural data in order to identify potential areas for targeting by land use conversion policy. Skop and Schou (1999) assessed the spatial distribution of trade offs between economic returns to agriculture and the environmental impact in terms of nitrate leaching in Vejl County, Denmark, to test the impact of nitrate leaching regulations. The authors mapped the distribution of agricultural land uses on different soil types. Price, yield and cost data from agricultural statistics were then used to calculate the economic value of farm outputs and these were mapped to farm types. Nitrate leaching and loading of each type of farm on each soil type were also modelled and mapped. Skop and Schou (1999) conclude that targeting regulatory measures on the basis of nitrogen leaching alone might not be the most economically efficient policy option for reducing nitrate leaching. Similarly, in this study, we integrate land use mapping, agricultural statistics, economic and environmental models with a variety of other data to map the economic performance of agriculture relative to the use of land and water resources. We also assess change in agricultural land use and economic returns to agriculture from land and water resources in the Murray-Darling Basin from 1996/97 to 2000/01.

1.3.1 Gross Revenue and Profit at Full Equity

Profit at full equity is a measure of farm economic performance commonly used by the ABS, the Australian Bureau of Agricultural and Resource Economics (ABARE), and the Australian Government's Productivity Commission. Profit at full equity from agriculture is an estimate of the net returns to the natural resource base and management skill under control of private individuals and under current farming conditions. From the available datasets it is not possible to separate the return to the natural resource base from the return to managerial skill.

Profit at full equity equals the gross revenue from agricultural production less the variable costs, water costs and fixed costs of production. Gross revenue is the value of production from agricultural land use and equals yield multiplied by price per unit of production. Variable costs include quantity dependent costs (e.g. storage and handling costs) and area dependent costs (e.g. fertiliser, fuel costs). Water costs (irrigated areas only) are an estimate of the total cost of water for irrigation and equal the water requirements (in megalitres/ha) of the agricultural land use multiplied by the price of water per megalitre. Fixed costs include fixed operating costs, fixed depreciation costs and fixed labour costs. The concept of profit at full equity is based on the assumption that the land is fully owned (i.e. 100% equity). Thus, there is no consideration of interest or rent payments, or depreciation on leased items. It is also assumed that there is no income from sources other than farming the land. In addition, profit at full equity does not include income received from off-farm sources.

In this study, profit at full equity, gross revenue and costs are represented in dollars per hectare. Profit at full equity to agriculture in the Murray-Darling Basin is calculated and mapped on a 1 kilometre grid cell basis, based on dominant agricultural land use, the local gross value and costs of production, including costs of managerial labour. These mapped indicators of agricultural economic performance can then be aggregated by any spatial unit and land use classification, and summarised to provide regional synopses.

1.3.2 Net Economic Returns

Net economic returns to agriculture can be considered as the profit at full equity less the amount of government support to agriculture. All member countries of the Organisation for Economic Cooperation and Development (OECD) provide some support to agriculture and on an international scale the level of support supplied to Australian farmers is relatively low. To facilitate international debate about degrees of protection, the OECD has developed a method for converting estimates of the costs of all forms of assistance to agricultural production into a producer subsidy equivalent. This is the amount of money that, if paid in lieu of all government programs and arrangements like research and extension that tends to increase the value of agricultural production, would result in farmers receiving the same net income benefit. Arguably, if this estimate is deducted from profit at full equity, the result is an estimate of the *net economic return* to the resource base and management skill from agricultural production. Critics of this measure argue that the most appropriate measure is one that effectively compares MDB agriculture with the average degree of support for all agriculture across the world.

Estimates of the net value of support to agriculture are derived from Trade and Assistance data published by the Productivity Commission. The measure does not include the cost of environmental programs like the Natural Heritage Trust and the National Action Plan for Salinity and Water Quality.

1.3.3 Data Integration and Analysis

Quantifying and valuing the agricultural returns to land and water resources in the MDB requires the integration of several different data sources within a profit function. Profit function parameters such as yield, price and costs are dependent on both commodity and spatial location. To calculate the economic returns to each agricultural pixel in the Murray-Darling Basin, we need information for each profit function parameter for each pixel. To quantify each profit function parameter we integrate a number of different data sources to create GIS layers of profit function parameters across the MDB.

The ABS Agricultural Census (ABS 1997, 2001a) data provides information about the quantity and price of agricultural commodities. Satellite NDVI data provides spatially explicit information on agricultural yields. Water requirements of irrigated agricultural commodities are estimated through benchmarking studies. The costs of agricultural production for each commodity are estimated from Gross Margin Handbooks and a variety of other sources. Information on the levels of government support to agriculture is sourced from Productivity Commission Trade and Assistance data. Using these disparate data

sources we can create layers for each profit function parameter which estimates the spatial distribution of parameter values. By integrating these information sources using the profit function in a GIS we can quantify and value returns to land and water resources in the MDB including the spatial distribution of agricultural gross revenue, profit at full equity, net economic returns, water requirements and returns to water use.

Results are presented in a variety of ways. Maps provide spatially explicit information about the location and distribution of agricultural land uses in the MDB. Tables provide information by agricultural land use and Catchment Management Region for both 1996/97 and 2000/01. The raw values provide an indication of the magnitude of change in the presented agricultural and economic measures and a percentage change calculation from 1996/97 to 2000/01 is also presented to provide an indication of the relative change occurring for each agricultural land use and Catchment Management Region. Percentage change information is not calculated for statistics that have a value for 1996/97 of <=0. Figures for percentage change can also be very large when low numbers are involved. Hence, caution must be used in interpreting percentage change information alone. Rather, information on gross change should be considered in conjunction with the relative percentage change information to provide a more comprehensive interpretation of overall change.

This information provides a knowledge basis for ICM in the MDB in the form of snapshots of agricultural landuse and economic information for 1996/97 and 2000/01. Spatially-explicit policy decisions can be informed by these information layers in their own right. Assessment of the changes in these measures between 1996/97 and 2000/01 can also provide information on the status and short term variations of different agricultural land uses and agricultural regions, useful for assessing the impacts of policy and possible future agro-economic scenarios. Change in agricultural returns to land and water resources are also assessed by Catchment Management Region and agricultural land use type. Caution should be used in inferring longer term trajectories from the snapshot information as it is likely that significant inter-annual variation in agricultural landuse and returns to land and water resources occurs.

2. Methods

Methods used to quantify and value agricultural returns to land and water resources in the Murray-Darling Basin can be described as two main tasks - mapping agricultural land use and commodities, and calculating agricultural returns. These are described in detail below. The methods used are GIS-based and build upon the development of the new SPREAD II land use maps of the Murray-Darling Basin by BRS (2004). The land use maps are raster Geographic Information System (GIS) layers or *grids* with pixels of 0.01 degree spatial resolution (about 1.1 km). All subsequent analyses share this data structure and are conducted interchangeably in either the GIS or the Microsoft Access database. The land use map is broken down into Commodity classes where pixels are assigned finer scale agricultural commodity classes suitable for input into the profit function. Grids of profit function parameters such as price, quantity and cost surfaces are also constructed by combining data from various sources including the ABS, satellite remote sensing and Gross Margin Handbooks. The profit surface is also calculated within the GIS using these component layers.

In order to fill gaps in knowledge and data it is necessary to make several critical assumptions at various stages of the agricultural land use mapping and economic modelling. These are discussed in detail in the relevant sections. As a consequence, the results of this study should be interpreted as estimates around which there is some uncertainty. This uncertainty has been quantified where possible and other data sources used to cross-check results. Notwithstanding, the results of this analysis should be interpreted with full cognisance of the uncertainty inherent in the estimates. Further research is required to enhance the techniques used and to verify the results in order to provide greater certainty. Nonetheless, at the aggregate levels presented in this study we have good confidence that the results we are seeing are indeed real and provide a sound basis for Integrated Catchment Management.

2.1 Catchment Management Regions

A total of 20 Catchment Management Regions (including the ACT) have been defined in the Murray-Darling Basin (Figure 1). Catchment Management Regions, through their regional strategies and action plans, are the vehicle for implementation of many on-ground ICM works across the Basin. Many of the results in this report are summarised by Catchment Management Region and changes are assessed to provide information for these administrative units.

Figure 1 - Catchment Management Regions of the Murray-Darling Basin.

2.2 Land Use and Commodity Mapping

Quantifying agricultural returns to land and water resources in the Murray-Darling Basin relies on a map of Commodity-level agricultural land use as a primary input. BRS produced the original Land Use Map of Australia for 1996/97 (Stewart *et al.* 2001) for the National Land and Water Resources Audit. BRS was again commissioned to reproduce the 1996/97 land use map of the MDB and produce a new 2000/01 land use map for the MDB using the new SPREAD II technique (BRS 2004). In this study we use Version 2 of the land use maps. We then use a process of areal interpolation to devolve the SPREAD level land use map into a Commodity level land use map suitable for economic modelling. The process is illustrated in Figure 2.

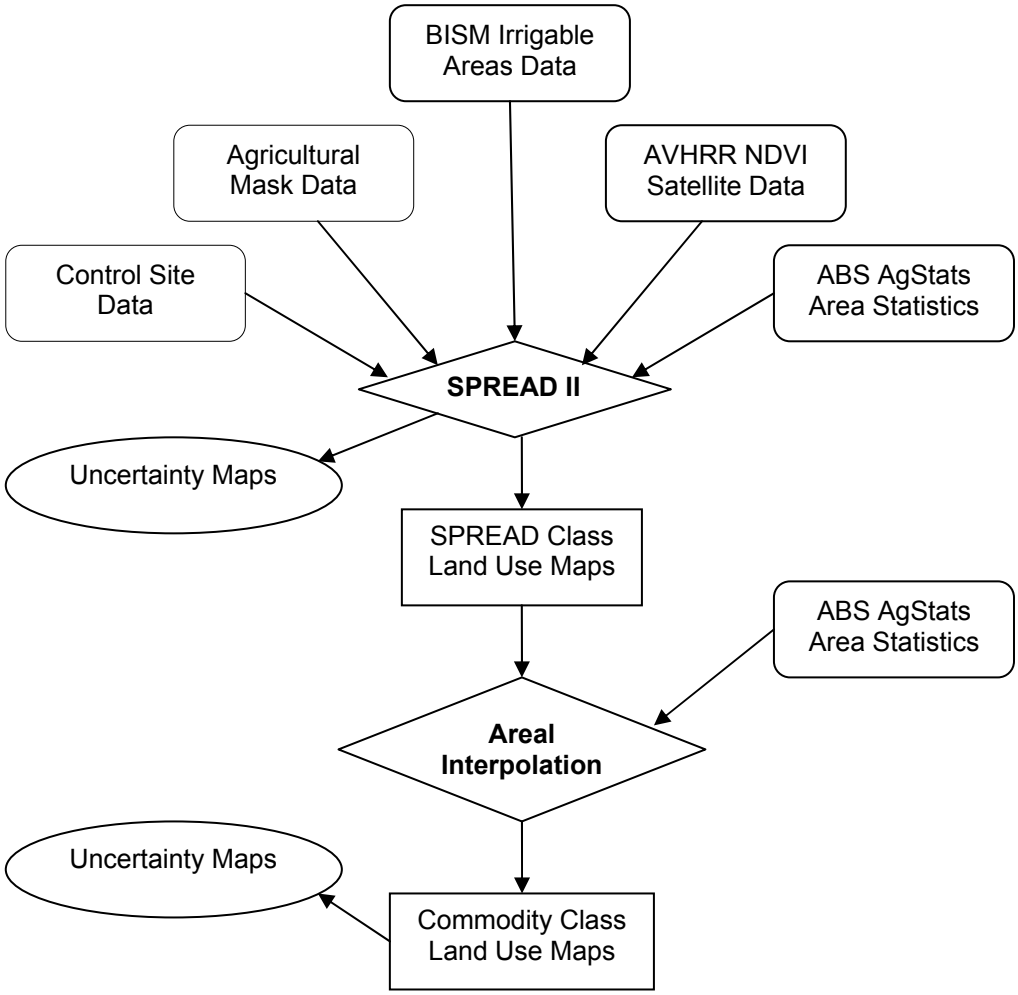


Figure 2 – The process of creating a Commodity level agricultural land use map suitable for quantifying and valuing the economic returns to agriculture. BRS created the SPREAD level land use maps and we devolve these into a Commodity map.

The SPREAD II-based Version 2 land use maps of the Murray-Darling Basin were constructed using a similar methodology to the 1996/97 Land Use of Australia, Version 2 (Stewart *et al.* 2001). Creation of the land use maps utilises spatial databases including satellite data and data from the Australian Bureau of Statistics to map land use over entire regions. SPREAD II essentially reallocates aggregate areas of agricultural land uses reported by SLA in AgStats to pixels based on their temporal NDVI signatures sourced from satellite imagery. Some non-technical details of the land use mapping techniques are provided below for background. Full details can be found in BRS (2004), Stewart *et al.* (2001), and Walker and Mallawaarachchi (1997).

2.2.1 Masking Out Non-Agricultural Areas

The first step in creating the land use maps was to distinguish agricultural from non-agricultural land use areas. This was done using the same topographic and land tenure masks as Stewart *et al.* (2001). Different datasets were used to identify protected areas and forests. The Collaborative Australian Protected Areas Database – CAPAD – 2000 (Environment Australia 2000) was used to identify protected areas and the Forests of Australia, 2003 (BRS 2003) dataset was used to identify forests. Hence, the distribution of agricultural and non-agricultural land is significantly different than that identified in the 1996/97 Land Use of Australia (Stewart *et al.* 2001) dataset and work based on this earlier data (e.g. Young *et al.* 2003).

2.2.2 ABS Agricultural Census Data

The Australian Bureau of Statistics conducts its full Agricultural Census (AgCensus) every 5 years, the data from which is published as *AgStats* (ABS 1997, 2001a). The population surveyed in the Agricultural Census includes all establishments with an Estimated Value of Agricultural Operations (EVAO) of $5,000 or more (approximately 150,000 farmers). In intervening years it conducts Agricultural Surveys involving smaller sample sizes (approximately 30,000 respondents). As the Agricultural Survey involves greatly reduced sample sizes the data is less powerful. A full Agricultural Census was conducted in 1996/97 and again in 2000/01. The 1996/97 Land Use Map of Australia (Stewart *et al*. 2001) was created using AgStats data and the AgCensus year 2000/01 makes an obvious date to revisit the study and assess change in land use and value thereby making the most out of these very useful databases. Thus, the 1996/97 and 2000/01 land use maps of the MDB were created by BRS using full Agricultural Census data.

For the 1996/97 land use map, the 1997 AgStats database (ABS 1997) was used, covering the period 1 April, 1996 to 31 March, 1997. SLA boundaries were taken from the Australian Standard Geographical Classification (ASGC) 1996 (ABS 1996). For the 2000/01 land use map, the 2001 AgStats database (ABS 2001a) was used covering the period 1 April, 2000 to 31 March, 2001. SLA boundaries were taken from the ASGC 2001 (ABS 2001b).

The ABS Agricultural Census provides agricultural statistics including the area (ha), value ($) and yield (tonnes, number of trees etc.) for hundreds of different individual commodities by SLA. These are aggregated by the ABS into Level 3 and Level 1 classifications. The ABS Level 3 commodity classification (approximately 120 classes) is the finest level of commodity aggregation by the ABS. The commodities have been further aggregated in the ABS Level 1 commodity classification into 9 broad classes. Stewart *et al.* (2001) aggregated the ABS Level 3 commodity classes into 21 land use classes (or *SPREAD classes*; Table 1; Appendix 1) for the whole of Australia. For example, the SPREAD class of *Nuts* includes the ABS Level 3 commodities almonds, cashews, chestnuts, hazelnuts, macadamia, pecan, walnuts etc. Full details of the aggregation method are provided in Stewart *et al.* (2001). Not all SPREAD classes occur in the MDB and only 17 agricultural SPREAD classes were considered in this study (Agroforestry was

not considered in the economic analysis). BRS also map irrigated and dryland agricultural areas. Irrigated areas are obtained from AgStats (see Stewart *et al*. 2001) and are spatially constrained to occur within the "irrigable" areas designated by the MDBC (BRS 2004). Thus, for each SPREAD class there is an irrigated and dryland version mapped.

ID	SPREAD class	Meaning
-1*	Non-agricultural land or no data	Non-agricultural land or no data.
0	Unallocated potentially agricultural land	Potentially agricultural land for which no agricultural land use was allocated by SPREAD. The total area submitted to SPREAD exceeds the total commodity area available, for the SLA concerned. The land is non-forested and non-public. It is probably mainly non-agricultural. Intensive uses may be prominent, especially rural residential ('hobby farms') in periurban areas.
1	Residual/Native pastures	Native pasture of variable quality.
2*	Agroforestry	Agroforestry
3	Sown pastures	Sown pastures
4	Cereals excluding rice	Cereals excluding rice (eg wheat, oats, barley, grain sorghum, maize, millet)
5	Rice	Rice
6	Legumes	Legumes (eg soybeans, peanuts, lupins)
7	Oilseeds	Oilseeds (eg canola, sunflower)
8*	Sugar cane	Sugar cane
9	Non-cereal forage crops	Non-cereal forage crops
10	Cotton	Cotton
11	Other non-cereal crops	Other non-cereal crops (eg tea, coffee, turf, herbs)
12	Other vegetables	Other vegetables
13	Potatoes	Potatoes
14	Citrus fruit	Citrus fruit (eg oranges, lemons)
15	Apples	Apples
16	Pears	Pears (includes quinces and nashi)
17	Stone fruit	Stone fruit (eg apricots, figs, olives, peaches, avocados)
18	Nuts	Nuts (eg macadamia, almonds)
20*	Plantation fruit	Plantation fruit (eg bananas, kiwifruit, pineapples)
21	Grapes	Grapes

Table 1 – Description of the land uses (SPREAD classes) mapped by BRS (2004). * denotes landuses not assessed in this study. Note BRS map both irrigated and dryland versions of each SPREAD class.

For land use mapping, the key agricultural statistic reported in AgStats is the area in hectares of each land use/commodity type. The areas of each ABS Level 3 class were summed to give total area figures for each SPREAD class in each SLA. However, before inclusion in the land use mapping, the reported statistics in AgStats are modified by BRS in a number of ways to make them more appropriate for use in land use mapping. These modifications include disregarding any SPREAD class in an SLA if its area was less than 100 ha (the approximate size of a pixel), converting the number of horticulture trees into an areal measure using a trees/hectare conversion ratio, adjusting vegetables and other land uses for multiple cropping practices, calculating the areal constraints for dryland versus irrigated versions of each land use from AgStats data, and scaling the agricultural

areas reported in AgStats to match the area of potentially agricultural land identified in the land use map. See Stewart *et al.* (2001) for a full description of these processes. The SPREAD II algorithm ensures that the mapped area of each SPREAD class concords to these modified area statistics by SLA.

2.2.3 Satellite Imagery and Control Site NDVI Data

The other important data used in creating the 1996/97 and 2000/01 land use maps of the MDB is satellite data from the NOAA AVHRR sensor. AVHRR data is converted to a Normalised Difference Vegetation Index (NDVI) (a measure of vegetation greenness) where each 0.1 degree (approximately 1.1km) pixel is given an NDVI value. Monthly cloud-free composite images are used to characterise the temporal greenness signature of each pixel for the year. The NDVI data covered the same time periods as the agricultural census data (1 April 1996 to 31 March 1997, and 1 April 2000 to 31 March 2001). In contrast to Stewart *et al.* (2001), 13 images spaced at 4 week intervals were used instead of 26 images. The cloud correction was carried out using the same splining method as Stewart *et al.* (2001). However, no attempt was made to further correct 'no data' pixels (where the NDVI values were abnormal at the outset or where satisfactory splining could not be achieved) to 'data' pixels by spatial averaging.

A library of the *greenness signatures* of the 21 different land uses mapped by BRS was developed by analysing the NDVI values for over one thousand geolocated control sites of known land use type across Australia, sampled during construction of the 1996/97 Land Use of Australia, Version 2 (Stewart *et al.* 2001). Only a subset of these occurred within the MDB (see BRS 2004). The number of control sites per SPREAD class for a given SLA was variable but tended to be at least 3.

Greenness signatures contain information about the typical annual lifecycles of different crops. For example, barley crops in southern Australia become green around June after the crops are sown and greenness increases until around November when it drops off as the crops ripen to a golden colour. The temporal greenness signatures of other land uses such as canola, apples and grapes are very different and this information is used to identify agricultural land use types using the satellite NDVI imagery.

2.2.4 The SPREAD II Algorithm and Land Use Mapping

The 1996/97 Land Use of Australia (Stewart *et al.* 2001) was created using the original SPREAD method of constrained allocation (Walker and Mallawaarachchi 1998; Stewart *et al*. 2001). The Young *et al.* (2003) quantification of agricultural returns to land and water resources in the MDB for 1996/97 was based on this land use map. Since that time BRS have improved the SPREAD technique to the 2nd generation SPREAD II which was used to create the 2000/01 land use map. For comparability of method, the 1996/97 land use map was redone using the SPREAD II technique. Hence, the maps and data presented in this report may differ from those presented in Young *et al.* (2003).

SPREAD II is a Bayesian Markov Chain Monte Carlo (MCMC) technique for assigning probabilities of each particular land use occurring in each pixel (BRS 2004). SPREAD II uses information on the (modified) area of both the dryland and irrigated versions of each SPREAD class occurring in the SLA and the greenness signature of the pixel as priors. Areas are defined from AgStats using the techniques described above. The modified agricultural land use data from AgStats is then used to assign probabilities for each land use occurring in each cell based on the known area of production of each land use by SLA. The signature of each pixel in the imagery is then compared to the known signatures of different land uses sourced from nearby control points. Using Bayesian MCMC techniques each pixel is assigned a probability for each of the 42 SPREAD classes. SPREAD II generates one GIS layer for every SPREAD class land use displaying the posterior probability of the land use occurring in each cell. Thus, these posterior probability surfaces provide a good indicator of the land use mapping confidence.

The final Version 2 land use maps for 1996/97 and 2000/01 (BRS 2004) are essentially maximum likelihood summaries derived from the probability grids using the following algorithm (from BRS 2004):

1. For each SLA, allocate rarest land use to the pixels with highest posterior probability for the land use until the areal constraint is satisfied;

2. Allocate next rarest land use to the remaining pixels with highest posterior probability for the land use until the areal constraint is satisfied;

3. Continue until all land uses, and SLAs are allocated.

2.2.5 Creating a Commodity Level Classification

The SPREAD II land use maps for 1996/97 and 2000/01 published by BRS (2004) involve a classification of land use to 21 SPREAD classes. The agricultural SPREAD classes are further classified into irrigated and dryland types. However, the SPREAD class of Non-Agricultural Land is not considered, neither are Agroforestry, Sugar Cane, and Plantation Fruit as there are negligible areas occurring in the MDB. Thus, only 34 SPREAD classes (17 irrigated, 17 dryland) are assessed in this study.

Each SPREAD class includes a range of ABS Level 3 classes (Appendix 1). Whilst the commodities grouped within each SPREAD class may be similar in terms of their physical characteristics, they often have very different economic characteristics including variations in price, yield, water requirements and costs of production. Creating profit function parameters for SPREAD classes would involve unacceptable generalisation of economic detail and lower quality estimation of agricultural returns to land and water resources. Hence, in this study, we disaggregate the SPREAD classes in the land use maps into a *Commodity* classification for economic analysis.

The Commodity classification used in this study is a systematic and subtle aggregation of ABS Level 3 classes. A total of 62 ABS Level 3 classes occur in the MDB (Appendix 1). ABS Level 3 classes were included in our Commodity classification if they had >= 100 ha

of area in any SLA in either 1996/97 or 2000/01. ABS Level 3 classes not occurring in areas >= 100 ha in any SLA were aggregated into larger classes. The ABS Level 3 classes of *Buckwheat* and *Rye* were included in the commodity class *Other Cereal Crops*; *Lemon/Lime* and *Mandarins* were included in *Other Citrus*; *Hops*, *Nurseries/Flowers*, *Peppermint* and *Turf* were included in *Other non-Cereal Crops*; *Chestnuts*, *Other Nuts*, *Pecans* and *Pistachios* were included in *Other Nuts*; *Linseed* and *Sesame* were included in *Other Oilseeds*; and *Avocados*, *Kiwi Fruit*, *Olives*, *Other Orchard Fruit* and *Prunes* were included in *Other Stone Fruit*. Appendix 1 provides a comprehensive mapping of ABS Level 3 classes to our Commodity classes, SPREAD classes and the broad land use classes of Stewart *et al.* (2001) used in this study. The final Commodity classification included 48 commodities of which there are both dryland and irrigated versions of each. These 96 classes are used in the profit function to assess the agricultural returns to land and water resources in the MDB.

2.2.6 Spatial Allocation of Commodity Classes

In order to enable statistical reaggregation of agricultural economic and resource use data by areal units such as Catchment Management Regions, local government area, and state; we assign Commodity classes to pixels in the land use map. This is done differently for non-livestock Commodities than for livestock Commodities.

2.2.6.1 Non-Livestock Commodities

Spatial allocation of non-livestock Commodities was performed using a process of areal interpolation based on probabilities derived from the areas of each Commodity by SLA as summarised from AgStats. Note that the NDVI was not used to reallocate pixels to Commodity classes because there is insufficient discriminatory power in the control site signatures to distinguish between agricultural land uses at finer levels of detail.

Figures for total area of production (ha) for each Commodity class in each SLA were calculated by summing the total area of production (ha) figures for all of the component ABS Level 3 classes comprising each Commodity class (Appendix 2). These areas provided the probabilities for allocating Commodity classes to pixels based on their SPREAD class and SLA.

Each SPREAD class is an aggregate of 1 or more Commodity classes. Some SPREAD classes such as *Cotton* and *Rice* map directly to a single Commodity class (termed "*Cotton*" and "*Rice*", respectively; Appendix 1). Other SPREAD classes comprising more than one Commodity are reallocated using areal interpolation based on probabilities derived from the relative area proportions of each of the component Commodities with the SLA. Assignment is then done randomly based on these probabilities. For example, say that from the AgStats data we know that for the SPREAD class *Cereals excluding Rice* in the Waikerie SLA the following areas of Commodities exist: 70,000 ha of *Wheat*, 20,000 ha of *Barley* and 10,000 ha of *Oats*. Say there are 1,000 pixels mapped in the land use map as *Cereals excluding Rice* in the Waikerie SLA. For areal interpolation, each of these pixels is then given a 70% chance of being *Wheat*, 20% chance of being *Barley*, and 10%

chance of being *Oats*. The areal interpolation technique will randomly assign roughly 700 pixels as *Wheat*, 200 pixels as *Barley* and 100 pixels *Oats* in that particular SLA. The spatial location of the Commodities within the SPREAD class and within the SLA is random. The output of this procedure is a map of Commodities at a high level of disaggregation whose areas concord to the original unmodified AgStats data by SLA, and which is suitable for input into profit calculations. Note that the allocation of the livestock Commodities *Beef Cattle*, *Dairy Cattle* and *Sheep* is more complex.

2.2.6.2 Livestock Commodities

Livestock grazing is the dominant agricultural land use in the MDB by area. However, livestock is neither mapped by Stewart *et al.* (2001) in the Land Use of Australia nor by BRS (2004) in the land use maps for 1996/97 and 2000/01. Rather, the mapped SPREAD classes relevant to livestock are *Native Pasture*, *Sown Pasture*, and *Unallocated Potentially Agricultural Land*. There are significant differences between different types of livestock grazing both in terms of their use of land and water resources and economic returns. These different land uses need to be distinguished in order to more accurately capture the variation in economic returns to agriculture. In the process of creating a map of Commodities from the SPREAD class map, we allocate the livestock Commodities of *Beef Cattle*, *Dairy Cattle* and *Sheep* to pixels mapped as *Native Pasture*, *Sown Pasture* and *Unallocated Potentially Agricultural Land*. No other livestock types are considered.

A rule-based method for allocating livestock to pixels in the MDB was developed. Livestock production statistics were converted to Dry Sheep Equivalent numbers (DSE) and distributed on a pro-rata basis amongst the relevant pixels. Pixels were then assigned to the Commodities of Beef Cattle, Dairy Cattle or Sheep according to rules described in detail below.

The ABS reports in AgStats the production statistics for livestock enterprises in terms of the total numbers of Beef Cattle, Dairy Cattle and Sheep at year end and the total number of sales of cattle and sheep (Appendix 2). The total numbers of Beef Cattle equals the AgStats items “Number of meat cattle at year end” plus a proportion of the “Total cattle sales”, based on the ratio of dairy cows and beef cows at year end by SLA. Likewise, the total numbers of dairy cattle equals the “Number of dairy cows at year end” plus a proportion of the cattle sales, based on the ratio of dairy cows to beef cows at year end by SLA. The total number of Sheep equals the “Number of sheep at year end” plus “Total sheep sales”.

A standard conversion rate was used to convert numbers of these animals into DSE to standardise the energy requirements of different livestock types such that Beef Cattle equal 8 DSE, Dairy Cattle equal 10 DSE and Sheep equal 1.5 DSE. For each SLA the number of livestock pixels were also totalled (this includes pixels classified in the land use map as the SPREAD classes *Native Pastures*, *Sown Pastures,* and *Unallocated Potentially Agricultural Land*). The number of pixels classed as Beef Cattle, Dairy Cattle and Sheep were calculated for each SLA based on the proportions of DSE numbers, with remainder being assigned preferentially to Dairy, followed by Beef, then Sheep.

For example, consider that in a given SLA there are 100 mapped pasture pixels in the land use map. Furthermore, the following mix of DSE occurs (as calculated from the AgStats production statistics and converted to DSE):

- Dairy in SLA = 4,000 DSE
- Beef in SLA = 2,000 DSE
- Sheep in SLA = 1,000 DSE

We can calculate the numbers of pixels assigned to each livestock Commodity using the proportions of DSE. Hence, the number of pixels in each SLA allocated to each livestock Commodity equals the number of pixels classified as pasture in the SLA multiplied by the number of DSE of the particular livestock type divided by the total number of DSE in the SLA. Therefore, with rounding down to whole numbers (as a Commodity cannot be assigned to a portion of a pixel) the number of pixels classified as livestock in the SLA will be as follows:

- Dairy pixels = 100 x 4000/7000 = 57
- Beef pixels = 100 x 2000/7000 = 28
- Sheep pixels = 100 x 1000/7000 = 14

The remaining pixel goes to dairy, so that the final quotas of pixels are 58, 28 and 14 for Dairy, Beef, Sheep respectively (if there were no dairy in this SLA, the remainder would get added to the beef quota).

The result of the above process is the derivation of the total number of pixels in each SLA classified as Beef Cattle, Dairy Cattle and Sheep. The livestock Commodities now have to be assigned to specific pixels to enable mapping. The pasture type and irrigation status data from the land use map are combined with the NDVI data to assign pasture pixels to the livestock Commodities of Dairy Cattle, Beef Cattle and Sheep. The assumptions are that Dairy Cattle occur on the best quality pasture, then Beef Cattle and lastly, Sheep.

Firstly, the livestock pixels within each SLA are ranked by pasture quality using the following rules:

1) Irrigated is superior to non-irrigated (derived from the land use grid), regardless of pasture type or NDVI;

2) Sown Pasture is superior to Native Pastures, and both Sown and Native Pasture are superior to Unallocated Potentially Agricultural Land (derived from the land use grid) regardless of NDVI;

3) Where irrigation status and pasture type are equal, pixels with higher NDVI are superior to lower NDVI pixels;

4) Where irrigation status, pasture type and NDVI are the same, rank is randomly determined.

Next, the highest ranked pixels (best quality pasture) are allocated to Dairy Cattle until the dairy quota is filled. The next highest quality pixels are allocated to Beef Cattle until the beef quota is filled. Finally, Sheep get allocated to the pixels with poorest pasture quality as ranked by the algorithm above. This process allocates a livestock Commodity type to pixels with the SPREAD classes of *Native Pasture*, *Sown Pasture* and *Unallocated Potentially Agricultural Land*.

2.2.7 Calculating the Effective AgStats Area of Commodities

In modifying the AgStats data for use in land use mapping, BRS employ an area scaling method to reconcile the Total Area of Holdings data recorded in AgStats with the area of potentially agricultural land identified in the land use mapping and masking procedures. The area scaling method involves calculating the ratio of potentially agricultural land to the Total Area of Holdings and multiplying the areas of all AgStats items by this ratio up to a maximum of 4.2 (Stewart *et al.* 2001). The result of this means that the mapped areas of agricultural land uses are around 7% greater that those reported in AgStats on average, and in some cases mapped areas are much greater. This has a significant effect on the calculation of agricultural returns through the increase in area costs. When the area of an agricultural land use is larger, the gross revenue per hectare is less because it is spread over a larger area, but the costs are the same. Hence, the profits are less than they would be with the same gross revenue over a smaller area. With many agricultural enterprises operating on fairly small margins, the impact on economic measures tends to be substantial (in the order of billions of dollars).

To remedy this, we use the original areas of Commodities reported in AgStats instead of the areas mapped in the land use maps. We calculate an effective AgStats area of the Commodity occurring in each land use map pixel. This is done by dividing the total reported area of each Commodity in each SLA by the total number of pixels mapped as that commodity in the SLA. For most Commodities this is a straightforward exercise of summing the areas reported in hectares in AgStats over the Commodity groups (Appendix 2). However, for horticultural and livestock Commodities the areas are not directly reported in AgStats and we first need to estimate areas by SLA.

To estimate the area of horticultural Commodities some processing and assumptions are required as AgStats does not report actual areas but reports numbers of trees. These are converted to areas using typical tree density figures (Table 2) put together by Stewart *et al.* (2001). BRS (2004) use the same rates to convert tree numbers to areas for the 1996/97 and 2000/01 land use maps.

Orchard Type ABS Level 3 Classification	Orchard Tree Densities (# trees//ha)	Orchard Type ABS Level 3 Classification	Orchard Tree Densities (# trees//ha)
ORANGES	420	OTHER ORCHARD FRUIT	350
GRAPEFRUIT	420	AVOCADOS	180
LEMON/LIME	420	CARAMBOLA	220
MANDARINS	420	CUSTARD APPLES	140
TANGELOS	420	DATES	150
OTHER CITRUS	420	JACKFRUIT	130
APPLES	900	GUAVA	420
PEARS	390	LOQUATS	900
QUINCES	156	LYCHEES	200
NASHI	970	MANGOES	125
OTHER POME	400	RAMBUTAN	150
APRICOTS	278	LONGANS	200
CHERRIES	390	MACADAMIA	310
FIGS	420	ALMONDS	280
NECTARINES	440	CASHEWS	200
OLIVES	290	CHESTNUTS	100
PEACHES	440	FILBERTS	450
PEACHARINES	440	PECANS	100
PERSIMMONS	333	PISTACHIOS	420
PLUMS	390	WALNUTS	180
PRUNES	390	OTHER NUTS	300
OTHER STONE FRUIT	375		

Table 2 – Conversion rates for numbers of trees recorded by ABS in AgStats to areas of orchards in Hectares.

Significant processing was also required to estimate livestock areas reliably for use in the profit function. This is summarised as two tasks:

- Estimate the total area of livestock grazing in each SLA
- Estimate the effective AgStats area of Beef Cattle, Dairy Cattle and Sheep in each SLA in a way that allows robust inter-annual comparison

As discussed earlier, the ABS does not report actual areas of livestock grazing but rather, total numbers of animals. AgStats (ABS 1997, 2001) report total areas of sown and native pasture which is intended to indicate the areas of livestock grazing. However, a major problem was encountered using this data in that the total area of pasture is grossly underreported in the 1997 AgStats database (ABS 1997). Underreporting is variable but occurs across most SLAs. The total amount of pasture in 1996/97 was recorded as 20.6 million ha – less than half of the 42.2 million ha recorded in 2000/01. The fact that the number of DSE reported in 1996/97 (176 million) was very similar to that reported in 2000/01 (179 million) suggests that the reported pasture areas are suspect. The reason for the underreporting is unknown but is generally attributed to ambiguity in the wording of the pasture questions and differences in interpretation by farmers (G. Cameron, ABS, pers. comm. 2004). Hence, the pasture area statistics reported in AgStats were not suitable for use.

As an alternative to using pasture statistics to estimate the total area of livestock, we use the Total Areas of Holdings data from the ABS. The total area of livestock for each SLA was estimated as the Total Area of Holdings minus the sum of the area under non-livestock agricultural land use (cropping) as reported by the ABS (Appendix 2). Use of the Total Area of Holdings data to estimate livestock area assumes that all agricultural land holdings not under crops may be grazed by livestock. This is often not the case as significant parts of agricultural holdings may be unsuitable for grazing (e.g. dense vegetation, steep slopes, lakes etc.). However, the Total Area of Holdings question in the ABS Agricultural Census is less ambiguous and therefore less open to interpretation by landholders. Hence, this data, as reported in AgStats, provides a more reliable measure of agricultural area and can be used to estimate the areas of livestock.

To break down the total area of livestock in areas of each SLA into each livestock type Hajkowicz and Young (2001) first classified the pixels mapped as pasture by BRS as Beef Cattle, Dairy Cattle or Sheep according to the proportion of the DSE of each livestock type in each SLA (as in Section 2.2.6.2) then summed the area of pixels. However, whilst this technique makes a useful snapshot estimate, for technical reasons this method does not enable reliable inter-annual comparison of areas of each livestock type nor consequently, of any derived economic measures.

A new method of estimating areas of each livestock type was devised that assumes stocking rates are constant over time and that any changes in DSE numbers reflects a concomitant change in the area of livestock. In other words, it assumes that change in DSE numbers occur with agricultural land being taken into and out of production rather than changes to the stocking rate. This is also often not the case as farm managers may vary stocking rates in accordance with pasture availability which varies from season to season. However, this assumption is necessary to enable reliable comparison of the economic returns to livestock between agricultural census years. Other methods using fixed areas and variable stocking rates resulted in complex and exaggerated changes in the areas of livestock. These errors permeated through to the economic analyses as the profit function cost parameters are critically reliant upon the area of agricultural landuse, and made the results unreliable. Thus, changes in the estimated area of livestock reported in this study are dependent on the assumption of constant stocking rates and should be interpreted with appropriate caution and in full cognisance of this assumption. The impact of these assumptions on the analysis is expected to be limited to the derived areas of livestock which should be interpreted as estimated areas only. The economic analyses in this study are relatively robust to these assumptions.

Thus, the total areas of each livestock type (Beef Cattle, Dairy Cattle and Sheep) were estimated by SLA for 1996/97 and 2000/01 in two stages. First, the areas of each livestock type were calculated for 2000/01 using the proportional method of Hajkowicz and Young (2001) as described above. The areas of each livestock type for 1996/97 are then calculated based on the areas for 2000/01 and the ratio of DSE in 1996/97 to DSE in 2000/01 and concorded for disparities in SLA boundaries between the 1996/97 and 2000/01 census years (for simplicity, this part of the process is described in terms of a

single focus pixel mapped as Dairy in 1996/97, the same process was repeated for all pixels mapped as Dairy Cattle, Beef Cattle and Sheep in 1996/97).

To expand, the area of a focus pixel mapped as Dairy in 1996/97 was estimated by multiplying the area of Dairy per pixel in the 2000/01 SLA that coincides with the focus pixel by the ratio of the DSE of Dairy per pixel in 1996/97 over the DSE of Dairy per pixel of the coincident 2000/01 SLA. A process of areal interpolation was then used to spatially concord the 1996/97 SLAs (ABS 1996) with the 2000/01 SLAs (ABS 2001b). Concordance was achieved by first multiplying the result of the above process for the focus 1996/97 Dairy pixel by the ratio of the number of Dairy pixels mapped in 2000/01 that occur within the 1996/97 SLA of the focus pixel over the total number of Dairy pixels mapped in 2000/01 occurring in the 2000/01 SLA of the focus pixel. This was subsequently multiplied by the ratio of the number of Dairy pixels mapped in 2000/01 occurring within the 1996/97 SLA of the focus pixel over the total number of 1996/97 Dairy pixels occurring within the 1996/97 SLA of the focus pixel.

The result of the above processing is a layer of effective AgStats areas in hectares for all Commodities. Most pixels have an effective AgStats area less than the actual area of the pixel due to the scaling employed by BRS. Conversely, some pixels have much higher effective AgStats areas because of factors like multiple cropping of some Commodities, mixed farming and other effects. The effective AgStats area layer is a key layer in calculating the gross revenue and profit values for aggregated areas. The result is that when pixels are reaggregated by SLA, the aggregated areas of each Commodity concord with the AgStats data. Hence, it is also expected that the results will be more robust when reaggregated by other spatial units.

2.2.8 Agricultural Land Use Classes for Mapping and Reporting

Described above in various sections are the at times complex processes of aggregation and disaggregation of agricultural land use classes for various purposes. To clarify, firstly, the ABS publishes data for hundreds of individual agricultural items and aggregates these to more than 100 *ABS Level 3* classes. BRS have produced a *Broad Land Use* classification which distinguishes dryland and irrigated agricultural land uses from other land uses including conservation, forestry and urban areas. To further discriminate agricultural land uses, BRS aggregate the ABS Level 3 classes to 21 *SPREAD* classes for land use mapping using SPREAD II. In this study we also aggregate the ABS Level 3 classes to our 48 class *Commodity* classification for calculating the profit function. Some area and economic statistics are presented for these classes in the Appendices. For simplicity, we further aggregate the Commodity classes into a 16-class *Agricultural Land Use* classification for tabulation and an 8-class *Broad Agricultural Land Use* classification for mapping. Appendix 1 summarises the relationships between classes in the different agricultural land use classifications. Capitalisation is used where these classes are referred to directly in the text.

2.2.9 Pixel Level Uncertainty in Land Use Mapping

In the land use maps each cell is assigned a SPREAD class and the areas concord with the AgStats data at the SLA level after modification by BRS (see Section 2.2.7). Although, the BRS land use maps are spatially robust at the SPREAD classification level, the disaggregated maps of Commodities are less spatially robust. Commodity-level maps are useful as input into the profit function, for visualisation purposes at small scales, and for reaggregation by various spatial units. However, they are not suitable for pixel-level use due to the uncertainty associated with Commodity class allocation on a pixel basis.

Uncertainty in the allocation of SPREAD level and Commodity level land use classes to pixels in the land use maps is often high and needs to be made explicit. The uncertainty involved in land use mapping using SPREAD II is readily quantifiable as SPREAD II creates probability surfaces for each of the 42 SPREAD classes. These probability surfaces quantify the Bayesian posterior probability that each SPREAD class occurs in each cell based on the modified AgStats areas and NDVI data. Using these probability surfaces, the allocation algorithm assigns a single land use to each particular pixel. We quantify the uncertainty associated with the allocation of the SPREAD class to each pixel. This is done by extracting and mapping the probability of the allocation of the particular SPREAD class to each pixel from the 42 probability layers output by SPREAD II. Thus, each pixel is not only assigned a SPREAD class but also an associated indicator of uncertainty which can be visualised spatially.

Compounding the uncertainty associated with land use mapping with SPREAD II is the uncertainty associated with the further allocation of Commodity types to each pixel using areal interpolation. Allocating a Commodity type to each pixel is simply based on the proportional areas of Commodities occurring in the particular SPREAD class and SLA of each pixel. We quantify the uncertainty associated with the allocation of each commodity to each pixel as the probability derived from the relative proportion of the Commodity occurring within the SPREAD class and SLA of the pixel. For example, consider that a particular pixel has a SPREAD class of *Stone Fruit* and that the total area of Stone Fruit in that SLA is composed of 700 ha of the Commodity class *Apricots* and 300 ha of *Cherries*. By chance, the process of areal interpolation allocates the pixel the Commodity class of *Cherries*. Then the probability of Commodity allocation of the pixel equals 300/(700+300) or 0.3. If the pixel had been allocated the Commodity of Apricots, then the probability would be 0.7. The total uncertainty involved in mapping each cell to a Commodity is equal to the probability of the SPREAD class allocation multiplied by the probability of Commodity allocation. Awareness of the uncertainty of land use and commodity mapping is essential for interpretation of any analyses based on these datasets.

2.3 Calculating Agricultural Returns

Estimating the economic returns to agriculture involves calculating a profit function. Broadly, profit at full equity equals gross revenue (price x yield) less variable costs (area dependent costs, quantity dependent costs, water costs) and fixed costs (operating, depreciation and labour costs). Calculating net economic returns involves subtracting

government support to agriculture from profit at full equity. The profit function and the process of assembling profit function parameters are described in detail below and are illustrated in Figure 3.

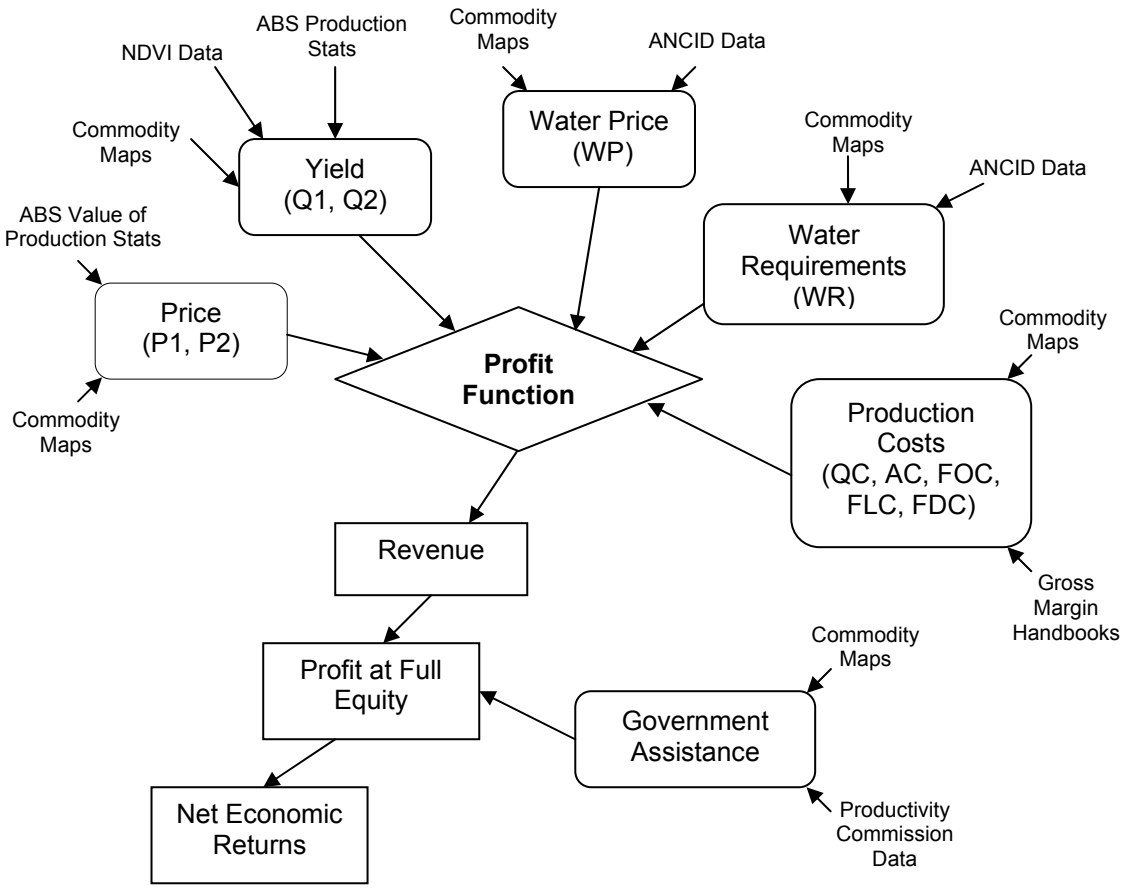


Figure 3 – Structure of the profit function used in this study including data inputs and outputs. The profit function is based on a Commodity level agricultural land use map for 1996/97 and 2000/01 and integrates a variety of other data sources to model the spatial distribution of gross revenue, profit at full equity and net economic returns to agriculture in the MDB.

2.3.1 The Profit Function

Profit at full equity is a measure of the net returns to land and water resources used for agriculture and the managerial skill of land managers. The definition of PFE used in this study is similar to that used by ABARE in its farm surveys and the ABS. But there are some minor differences. Whereas ABARE and ABS estimate this measure for a farm unit including all income earned by all members of the farm family, the measure here is derived with reference to a square kilometre of agricultural land classified by Commodity type as represented in the land use maps. Also, off farm income (net revenue derived off farm from the use of farm resources, for example, carting grain or contracting to help repair a shire road) is included in the ABARE and ABS estimates but there is no allowance for this here. In this study, PFE is measured in $/ha and is defined as:

$$PFE = Revenue - (Variable\ Costs + Fixed\ Costs)$$

Gross revenue equals the price of the product multiplied by the yield (quantity of production) per hectare. Price and yield data was sourced from AgStats and is described later. For the non-livestock agricultural commodities, gross revenue equals the price of the primary product in $/tonne multiplied by the yield of the primary product per hectare in tonnes/ha. Gross revenue for livestock equals the price of the primary product (cattle, sheep sales) in $/DSE multiplied by the yield of the primary product in DSE/ha and the proportion of the herd sold. In addition, Dairy Cattle and Sheep have secondary products namely, milk and wool, respectively. For Dairy Cattle and Sheep we add the price of the secondary product (milk, wool) in $/litre of milk or $/kg of wool multiplied by the yield of the secondary product in litres/DSE for milk or kg/DSE for wool, and the yield of the primary product in DSE/ha. When multiplied out, gross revenue is represented in $/ha. The formula for calculating gross revenue is described below:

$$Revenue = (P_1 \times Q_1 \times TRN) + (P_2 \times Q_2 \times Q_1)$$

Where:
Revenue = Gross revenue from agricultural land use ($/ha)
P_1 = Price of primary product ($/t for non-livestock or $/DSE for livestock)
Q_1 = Yield of primary product (t/ha for non-livestock or DSE/ha for livestock)
TRN = Turn-Off Rate or proportion of primary product sold (0<= TRN <= 1 for livestock, TRN = 1 for non-livestock land uses)
P_2 = Price of secondary product ($/l for milk and $/kg for wool)
Q_2 = Yield of secondary product (l/DSE for milk or kg/DSE for wool)

Gross revenue is the most robust measure of returns to agriculture as it is derived from price and yield figures reported by the ABS and is subject to fewer assumptions. Profit at full equity is arguably a more informative measure of economic returns to agriculture than gross revenue as it estimates the net returns to the farmer. However, it is less robust because, as it is applied in this study, it relies on cost parameters that do not account for nuances in cost savings by farmers in response to variations in season and price.

Variable costs include the quantity dependent costs, area dependent costs and water costs. Quantity dependent variable costs include costs that increase with the quantity of yield such as storage or handling costs and are measured in $/tonne or $/DSE for livestock. Quantity dependent variable costs are multiplied by the quantity of production in tonnes/ha or DSE/ha to get a $/ha figure. Area dependent variable costs include costs that vary with the area of production such as the cost of seed or fertiliser, or harvesting costs. Area dependent variable costs are represented as $/ha. Water costs apply only to irrigated agricultural land uses as defined in the land use maps. Water costs equal the typical water requirements in ML/ha of each land use derived from irrigation benchmarking studies multiplied by the price of water in $/ML. The water costs units are $/ha.

$$\textit{Variable Costs} = (QC \times Q_1) + AC + (WR \times WP)$$

Where:
Variable Costs = Variable costs of agricultural land use ($/ha)
QC = Quantity dependent variable costs ($/t or $/DSE)
AC = Area dependent variable costs ($/ha)
WR = Water requirement of land use (ML/ha)
WP = Water price ($/ML)

Fixed costs include operating, depreciation and labour costs. These costs are also represented in $/ha. Cost data was acquired from numerous sources including Gross Margin Handbooks.

$$\textit{Fixed Costs} = (FOC + FDC + FLC)$$

Where:
Fixed Costs = Fixed costs of agricultural land use ($/ha)
FOC = Fixed Operating Costs ($/ha)
FDC = Fixed Depreciation Costs ($/ha)
FLC = Fixed labour costs ($/ha)

Hence, the full function for calculating Profit at Full Equity (PFE) is:

$$PFE = ((P_1 \times Q_1 \times TRN) + (P_2 \times Q_2 \times Q_1)) - ((QC \times Q_1) + AC + (WR \times WP) + FOC + FDC + FLC)$$

The profit at full equity measure incorporates significant levels of government support. Levels of government support vary by industry and by geographic area. The net economic returns (NER) to agriculture can be calculated as profit at full equity less the amount of government support on a per hectare basis. Net economic returns provide an indication of the unassisted or standardised agricultural returns to land and water resources and is measured in $/ha. The function for calculating net economic returns is:

$$NER = PFE - \textit{Government Assistance}$$

A full description of each of the profit function parameters and their derivation is described in the sections below.

2.3.2 Price

In the profit function there are two price parameters. P_1 is the price of the primary product and P_2 is the price of the secondary product. The price parameters represent the farm gate price of the produce of each agricultural Commodity; they do not include transport and marketing costs. Price is measured on a per unit of production basis. All Commodities have primary product whereas only Dairy Cattle and Sheep have a secondary product, namely milk and wool.

For each Commodity class and product, price figures are derived from AgStats data by dividing the total value of production ($) by the total production for each SLA. Figures for total value of production ($) for each Commodity class in each SLA were calculated by summing the total value of production ($) figures for all of the component ABS Level 3 classes comprising each Commodity class (Appendix 2). The total value of production is the market value in dollars of the agricultural produce derived from the Commodity. In AgStats, the total value of production items are derived by State and dollar values are allocated to each SLA according to the proportion of the total State production occurring in the SLA. Hence, each SLA in each state has the same price for each Commodity.

Likewise, figures for total production of the primary product (tonnes and DSE) for each Commodity class in each SLA were also calculated by summing the total production figures for all of the component ABS Level 3 classes comprising each Commodity class (Appendix 2). For non-livestock Commodities, total production is reported in terms of the weight of produce sold. Items reported in AgStats in kilograms and tonnes are converted to tonnes. For livestock Commodities, total production of the primary product is the total number of animals sold and/or slaughtered which is converted to DSE using the process described in Section 2.2.6.2 . Total production of the secondary products of milk and wool are recorded in litres and kilograms, respectively.

For non-livestock Commodities P_1 is represented in $/tonne. For livestock (Beef Cattle, Dairy Cattle and Sheep production), P_1 is measured in $/DSE. For Dairy Cattle and Sheep a P_2 is also calculated in $/l for milk and $/kg for wool. GIS-based price surfaces were created for both P_1 and P_2 by attaching the price to each pixel according to Commodity class, product and SLA.

2.3.3 Yield

Yield is measured in terms of production per unit area for the profit function. GIS-based yield surfaces were created in two stages. Firstly, ABS production and area statistics at the SLA level were used to derive the yield for each Commodity in each SLA. ABS data was also used to quantify the proportion of the herd sold (or *Turn-Off Rate*) for livestock. Secondly, the yield for each Commodity within each SLA was reapportioned according to NDVI, such that greener pixels were given proportionally higher yields. This processing is described below.

In a similar way to the price parameters, there are two yield parameters in the profit function. Q_1 is the quantity or yield of the primary product and Q_2 the quantity or yield of

the secondary product. Yield of the primary product for each Commodity in each SLA is calculated by dividing the total production (tonnes, DSE) for each Commodity class by the total area (ha) of the Commodity class (Appendix 2). For non-livestock Commodities Q_1 is represented in tonnes/ha whereas for livestock Q_1 represents the stocking rate per unit area and is measured in DSE/ha. Note that Q_1 is the same standard stocking rate calculated in Section 2.2.7 and is constant for both years. As Dairy Cattle and Sheep have a secondary product, we calculate the yield of the secondary product for Dairy Cattle and Sheep by dividing the total production of milk and wool (litres and kg) by the number of DSE of Dairy Cattle and Sheep, respectively. Q_2 is measured in litres/DSE for milk and kg/DSE for wool. GIS-based yield surfaces were created for both Q_1 and Q_2 by attaching the yield to each pixel according to Commodity class, product and SLA.

The Turn-Off Rate (*TRN*) is the proportion of livestock sold in the financial year in each SLA. For non-livestock Commodities, the Turn-Off Rate is set at 1.00. For livestock, the Turn-Off Rate is calculated from AgStats livestock production items. For Dairy Cattle and Beef Cattle, the Turn-Off Rate equals the Number of Cattle Sales divided by the total number of cattle and cattle sales (i.e. the Number of Dairy Cattle plus the Number of Meat Cattle plus the Number of Cattle Sales). For Sheep, the Turn-Off Rate equals the Number of Sheep Sales divided by the total number of sheep and sheep sales (i.e. the Number of Sheep and Lambs plus the Number of Sheep Sales).

The yield surface calculated above from AgStats data has constant values for pixels of each Commodity class within each SLA. In reality, production of Commodities varies spatially according to variations in soil, climate, managerial skill and other factors. NDVI has been shown to be a good indicator of agricultural yield (Shanahan *et al*. 2001; Bastiaanssena and Alib 2003). This relationship is well established for a variety of crops including maize (Baez-Gonzalez *et al*. 2002), cotton (Dalezios *et al*. 2001; Domenikiotis *et al*. 2004), wheat (Labus *et al*. 2002; Kalubarme *et al*. 2003), nuts (Knudby 2004), soybeans (Liu and Kogan 2002), and a variety of other crops (Samarasinghe 2003).

Spatial variation in yield for 1996/97 and 2000/01 is captured by adjusting the values for Q_1 and Q_2 for pixels within each Commodity class and SLA using the NDVI data. The Q_1 and Q_2 of each pixel are in essence an average yield per hectare in tonnes/ha, DSE/ha, litres/DSE, kg/DSE. We considered that the maximum greenness value for each cell would be a good proxy indicator of the relative yield of pixels. A GIS operation was used to create a surface of maximum NDVI values for 1996/97 for each pixel from the 13 NDVI images for 1996/97 (Figure 4) and a surface of maximum NDVI for 2000/01 from the 13 NDVI images for 2000/01 (Figure 5). The maximum NDVI values ($NDVI_{max}$) of irrigated pixels were weighted by a factor of 1.3. The average maximum NDVI value was then calculated for pixels for each Commodity within each SLA. Finally, the yield surfaces (Q_1 and Q_2) of each pixel for both years were then adjusted up or down by multiplying by the ratio of the maximum $NDVI_{max}$ of each pixel to the average $NDVI_{max}$ for the Commodity and SLA combination. As a result, the Q_1 and Q_2 surfaces vary spatially according to maximum NDVI. This reapportioning process preserves the original aggregate yield values as can be demonstrated by reaggregating by SLA.

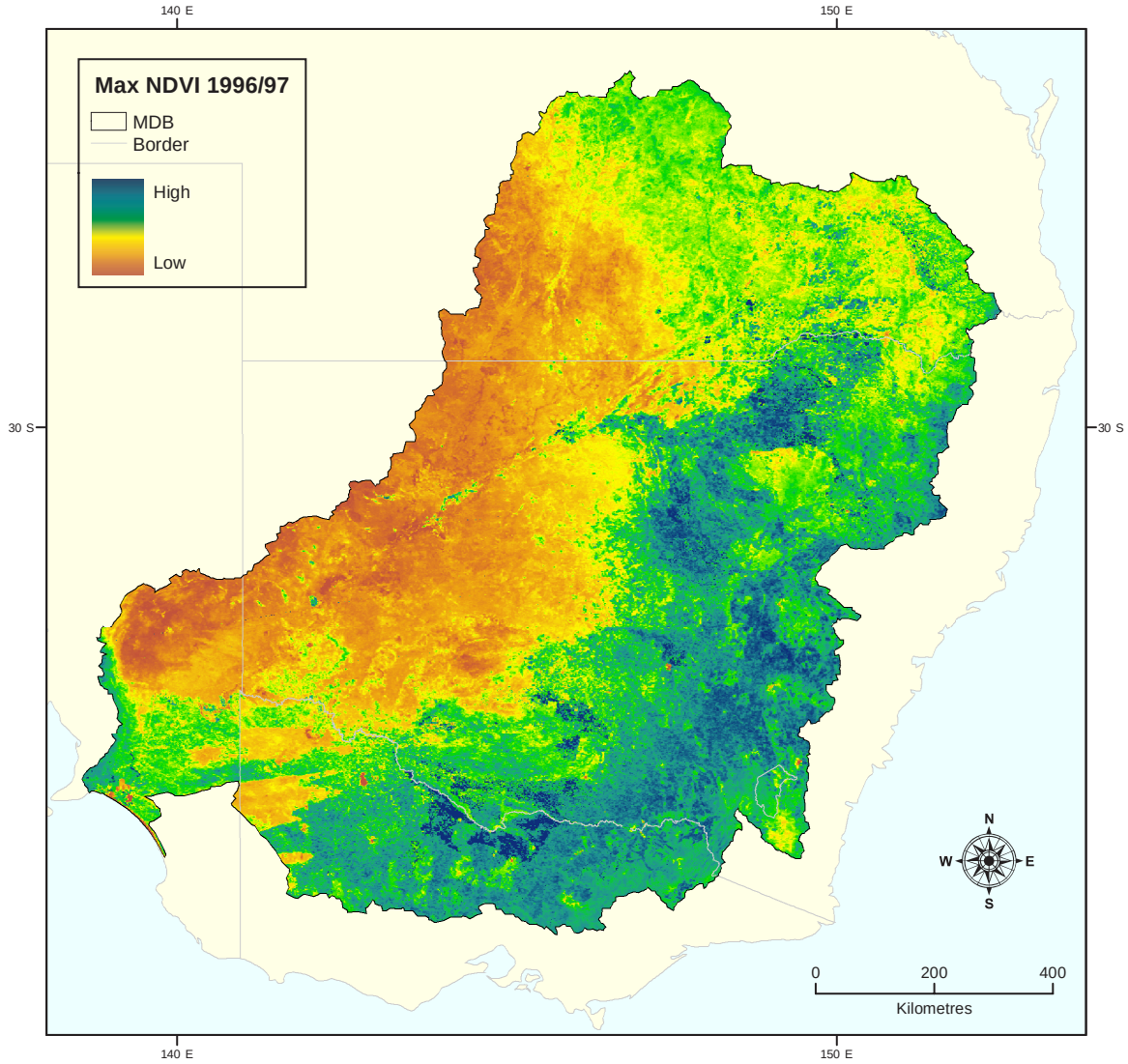


Figure 4 – Maximum NDVI values from the 13 monthly NDV images from 1996/97 in the Murray-Darling Basin.

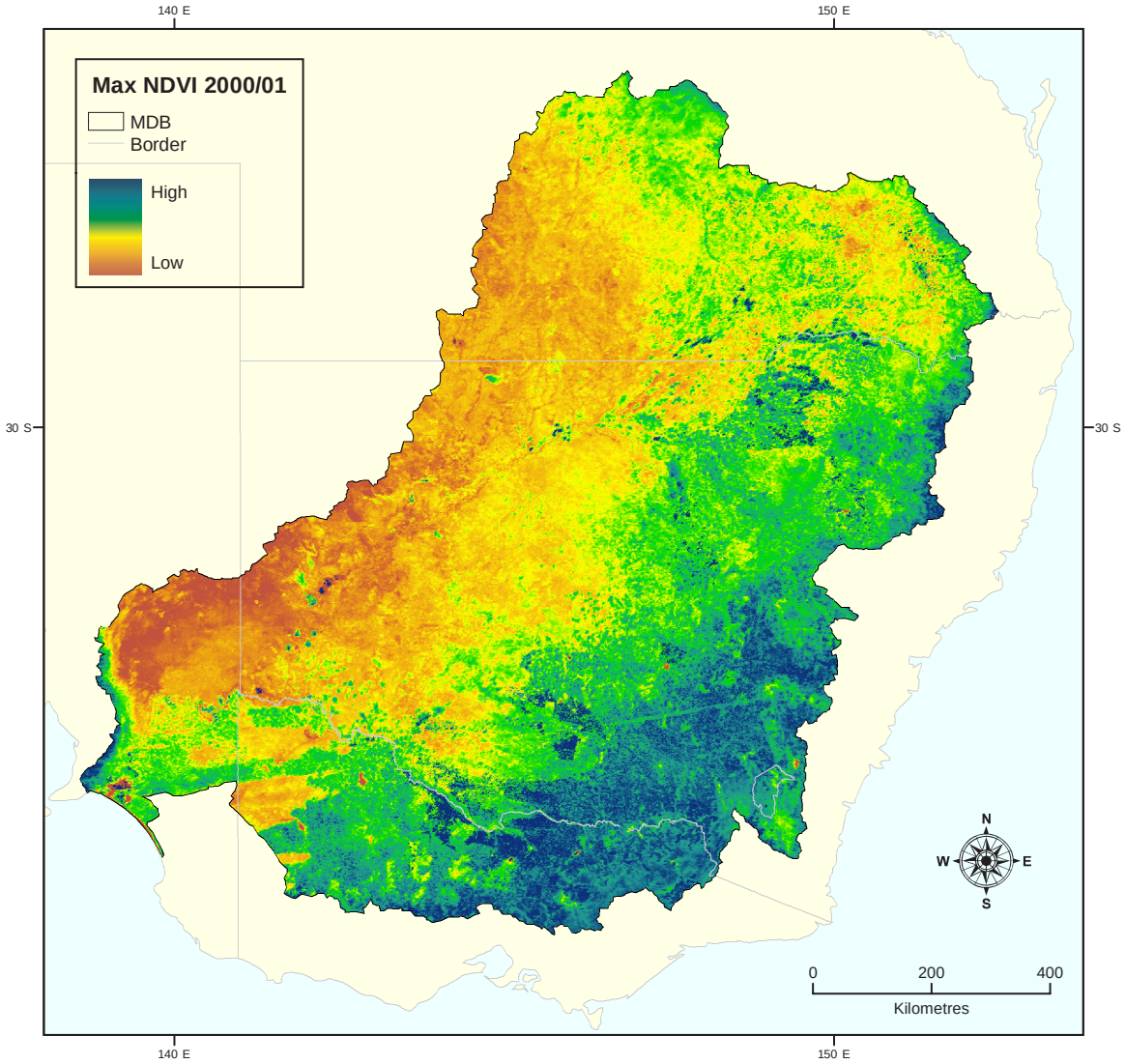


Figure 5 – Maximum NDVI values from the 13 monthly NDV images from 2000/01 in the Murray-Darling Basin.

2.3.4 Costs

Cost parameters in the profit function include variable costs - quantity dependent costs (QC), area dependent costs (AC) and water costs; and fixed costs – fixed operating costs (*FOC*), fixed depreciation costs (*FDC*) and fixed labour costs (*FLC*). Data for cost parameters except water costs was sourced primarily from Gross Margin Handbooks and other agricultural publications (Table 3) and modified to concord with actual data on price and yield from the ABS. Cost parameters were assembled for irrigated and dryland versions of each Commodity class. Cost parameter values are estimates of costs for typical farms growing each individual Commodity in each ABARE region (Appendix 3). Actual cost parameter values used in the profit functions for each Commodity class by ABARE region are presented in Appendix 4. Cost parameters are described in more detail below.

Source
New South Wales
NSW Agriculture Farm Budget Handbook 1997
NSW Citrus
NSW Agriculture Farm Budget Handbook 1998
Northern NSW - summer Crops
NSW Agriculture Southern Winter Dryland Cropping Gross Margin Budgets 1999
NSW Agriculture Northern Winter Dryland Cropping Gross Margin Budgets 1999
NSW Agriculture North East Summer Dryland Cropping Gross Margin Budgets 1999
NSW Agriculture Central Winter Irrigated Cropping Gross Margin Budgets 1998
NSW Agriculture Summer Dryland Cropping Gross Margin Budgets 99/00
NSW Agriculture Summer Irrigated Cropping Gross Margin Budgets 99/00
NSW Agriculture Vegetable Gross Margin Budgets 1999
NSW Agriculture Livestock Gross Margin Budgets 1998
NSW Agriculture Beef Gross Margin Budgets 1999
NSW Agriculture Sheep Gross Margin Budgets 1999
Victoria
NRE (Vic) North-East Gross Margins 97/98
NRE (Vic) Northern Irrigation Cropping Gross Margins 97/98
NRE (Vic) Wimmera Gross Margins 98/99
NRE (Vic) Mallee Gross Margins 98/99
NRE (Vic) Horticultural Gross Margins for the Loddon Murray Region 99/00
NRE (Vic) North Central Gross Margins 98/99
NRE (Vic) South West Gross Margins 98/99
Queensland
DPI Qld Horticultural Crops Gross Margins 97/98
DPI Qld Central Queensland Field Crops Gross Margins 97/98
DPI Qld Soybeans on the Darling Downs Gross Margins 1998
DPI Qld Cotton Growing on the Darling Downs Gross Margins 1998
DPI Qld Mungbeans on the Darling Downs Gross Margins 1998
DPI Qld DPI Qld Soybeans on the Darling Downs Gross Margins 1998
DPI Qld Sunflowers on the Darling Downs Gross Margins 1998
DPI Qld Triticale on the Darling Downs Gross Margins 1998 etc, etc Winter Crops, Lucerne for Hay, Grain Sorghum
DPI Qld Profitability of Forage Crops 1998
DPI Qld Growing Citrus 1999
South Australia
SA Mid and Upper South East Gross Margins - Dryland Crops Sheep and Cattle 1998
SA The Grower 1999 Horticultural Budget Guide
SA DPI Crop and Livestock Gross Margin Estimates 350-400 mm Rain Fall Area 1998
SA DPI Crop and Livestock Gross Margin Estimates 400 mm plus Rain Fall Area 1990

Table 3 – Sources of cost parameter data for the profit function.

2.3.4.1 Quantity and Area Dependant Variable Costs

Quantity dependant variable costs (*QC*) are costs that vary with the quantity of output produced such as the tonnes of Barley or the number of Beef Cattle in DSE. Typical quantity dependent costs include harvest costs, storage costs, handling costs, and product treatment costs. QC is quantified for the Commodity class as a whole and there is no distinction between primary and secondary product for Dairy Cattle and Sheep. Quantity costs are represented in $/tonne for non-livestock and $/DSE for livestock. QC is

multiplied by the production of the primary product (Q_1) to arrive at a cost per unit area ($/ha).

Area dependant variable costs (AC) are costs that vary with the area of production of each Commodity class. Area dependent costs are most common and include seeding costs, fertiliser and pesticide treatment costs. Area costs are represented in $/ha and again, there is no distinction between primary and secondary product for Dairy Cattle and Sheep.

2.3.4.2 Water Requirements, Price and Cost

The profit function requires information on water requirement (*WR*) and Water Price (*WP*) parameters for each Commodity. Several sources of information on irrigation exist for the MDB but currently there is no authoritative data on the areas and amounts of water used by agricultural land use type. Hence, this information needs to be modelled from the available data sources.

The *water requirements* of agricultural Commodities in this study is defined as an estimate of the typical irrigation water application rates per unit area for each Commodity and is represented in ML/ha. Water requirements represent the typical evapotranspirative requirements of the land use, plus typical losses including seepage, percolation and leakage. It does not represent the *actual amount* of irrigation diversions, rates of application, or crop water use but rather an *estimate*. Typical water requirements for each irrigated Commodity were determined for each major irrigation area within each ABARE region (Appendix 3; Appendix 4). Climate is taken into account insofar as similar Commodities in moister climates require lower irrigation rates than in drier climates within the MDB. This data was sourced primarily from the ANCID Australian Irrigation Water Provider Benchmarking Reports for 1998/99 and 2000/01 (ANCID 2000, 2002) and augmented using expert knowledge and experience.

There was no data available on the nature of variations in water requirements of Commodities between 1996/97 and 2000/01. Variations in water requirements may result from seasonal climatic differences and uptake of irrigation technology and associated gains in water use efficiency leading to reduced water requirements of irrigated Commodities in 2000/01. Hence, the water requirement figures (ML/ha) are remain constant between 1996/97 and 2000/01. The impact of this assumption may be overestimation of water requirements in 2000/01 and the changes in water requirements from 1996/97 to 2000/01. Interpretation of water requirement figures in this study should be done with full cognisance of this assumption.

The MDBC's *Basin Irrigation and Salinity Mapping* (BISM) database contains information on irrigation infrastructure (drains, supply channels etc.) and areas designated "irrigable" but does not contain any information on actual areas irrigated and water use. The AgStats data from the ABS contains information on total areas irrigated and has a limited breakdown by major land use type. The MDBC's annual *Water Audit and Monitoring* reports contain information about the total amounts of irrigation water used by Catchment Management Area and State but does not break this down by land use type. These three data sets are complementary and can be used to help quantify and cross check the

irrigation water requirement estimates. In Version 2 of the land use maps used in this study, BRS use the areas of irrigation reported in AgStats as a constraint in SPREAD II such that the total areas mapped as irrigated match those reported by SLA in AgStats. BRS further constrain the land use mapping such that irrigated pixels may occur only within those areas designated as "irrigable" in the BISM. Total water requirements data as modelled in this study is cross checked against the total amounts of irrigation diversions by state as reported in the Water Audit and Monitoring reports.

Water Price (*WP*) is the cost per megalitre of irrigation water ($/ML). It reflects the price paid for the supply of water to the property by an irrigation company or government. It assumes that any necessary water entitlement is held at the location supplied and that no water trading occurs or trading occurs at zero cost. Water Prices were determined for each major irrigation area within each ABARE region. This data was also sourced primarily from ANCID (2000, 2002). Estimates of the price of water to farmers are based on ANCID data on "revenue per ML of irrigation water". This includes volumetric, water delivery and environmental charges. Use of this information aims to capture the full cost to purchasers rather than the marginal cost of volumetric charges. The price of supply from various water authorities were based on the associations shown in Table 4. Where possible water authorities are based in target regions but otherwise they are allocated because of limitation in having consistent data for both sets of years.

Region	Irrigation Authority	96/97	00/01
NSW (Central North)	Jemalong	17.77	27.43
NSW (Central South)	Murrumbidgee	17.19	31.38
NSW (Central)	Jemalong	17.77	27.43
NSW (prev Sth Murray)	Murray	13.81	26.4
NSW (Western Division)	First Mildura	72.44	86.32
QLD (Central Qld)	St George	25.29	23.17
QLD (Darling Downs)	St George	25.29	23.17
QLD (Western Downs)	St George	25.29	23.17
QLD (Western Qld)	St George	25.29	23.17
SA (350-400mm)	Central Irrigation	40.23	57.06
SA (400mm PLUS)	Central Irrigation	40.23	57.06
SA (Rangelands)	Central Irrigation	40.23	57.06
VIC (Mallee)	First Mildura	72.44	86.32
VIC (Nth Cent/Nth Irrig)	Central Goulburn	25.55	32.01
VIC (South)	First Mildura	72.44	86.32
VIC (Wimmera)	First Mildura	72.44	86.32

Table 4 – Water costs in $/ML for irrigation from specific irrigation water authorities by ABARE region.

2.3.4.3 Fixed Costs

Fixed costs are costs of production that are fixed per unit area for typical farm types and are represented in $/ha for each Commodity class. Fixed Operating Costs (*FOC*) include land rates, accountant fees, costs for energy, waste disposal, maintenance, insurance and administrative overheads. Fixed Depreciation Costs (*FDC*) include depreciation of farm machinery such as tractors, harvesters and sprayers, and infrastructure such as irrigation

pipes and fences. Fixed Labour Costs (*FLC*) include the total cost per hectare of labour required in the production of each Commodity class.

2.3.4.4 Cost Adjustment

Cost parameter values were required for both 1996/97 and 2000/01 that are consistent and allow comparability in agricultural profits. It was considered that there are no appreciable differences between Commodity types in terms of the rates of increase of fixed and variable costs of agricultural production. Hence, a cost inflation factor was used to increase the cost estimates for 1996/97 to the year 2000/01. A comparison was made between national consumer price indexes (CPI) and producer price indexes between 1996/97 and 2000/01, based on ABS estimates. The producer price indexes measure changes in the prices received, or paid, by producers of commodities and providers of services. No difference was shown between them. As a result, to create cost parameter values for 2000/01 we increase the cost parameter values assembled for the year 1996/97 by a constant cost inflation factor of 1.1.

2.3.5 Government Assistance

Net Economic Return (NER) is the Profit at Full Equity less the amount of government assistance to the agricultural enterprise. Data on Government Assistance ($/ha) was assembled for each Commodity class in each ABARE region. Government support includes direct expenditure on research and advisory. Government assistance data was sourced from the “Trade and Assistance Review 1997-98” and “Trade and Assistance Review 2000-01”, published by the Productivity Commission (1998, 2001). The estimates of government assistance by Young *et al.* (2003) for 1996/97 provided estimates for both Commonwealth and State assistance. However, because the 2000/01 data did not provide a breakdown of assistance at the State level, the data presented in this study only includes levels of Commonwealth assistance for the 1996/97 and the 2000/01 years, excluding expenditure through the Natural Heritage Trust and the National Action Plan for Salinity and Water Quality.

Again, to enable consistent data for both years the rate of assistance measure used is the “effective rate of assistance”. Young *et al.* (2003) used a “nominal rate of assistance” but this was not available for 2000/01 data across a sufficient number of commodity categories. The effective rate of assistance is the percentage change in returns per unit of output to an activity’s value-adding factors due to the assistance structure. The effective rate measures net assistance, by taking into account the costs and benefits of government intervention on inputs, direct assistance to value-adding factors, and output assistance. Government assistance values for each Commodity class are listed by ABARE region in Appendix 5.

3. Results and Discussion

3.1 Agricultural Land Use and Commodities

3.1.1 Broad Land Use Types

The Murray-Darling Basin has a land area of approximately 106 million hectares. In very broad terms, the SPREAD II-based BRS land use maps for 1996/97 classify nearly 77% of the MDB as dryland agriculture (including extensive livestock grazing) and 1.5% as irrigated agriculture (Table 5). The BRS land use maps also show that between 1996/97 and 2000/01 the area of dryland agriculture decreased by some 353,000 ha whilst the area of irrigation increased by 276,000 ha, urban areas increased by 25,000 ha, and forestry increased by 52,000 ha. Note that this is a broad interpretation of the land use maps. Figure 6 and Figure 7 map the distribution of the broad land use types in the Murray-Darling Basin for 1996/97 and 2000/01. Dryland agriculture occurs across the MDB with irrigated agriculture predominately occurring in the NSW and Victorian irrigation districts along the Murrumbidgee River and in the Murray and Goulburn Valleys with other significant areas of irrigation occurring in South Australia's Riverland area, the Sunraysia district near Mildura, in northern NSW and in southern Queensland.

Broad Land Use	1996/97 Area ('000ha)	1996/97 Proportion of Total (%)	2000/01 Area ('000ha)	2000/01 Proportion of Total (%)	1996/97 – 2000/01 Change in Area ('000 ha)	1996/97 – 2000/01 Proportional Change (%)
Conservation & Other Minimal Use	17,257	16.3	17,257	16.3	0	0.0
Dryland Agriculture	81,386	76.9	81,033	76.6	-353	-0.4
Irrigated Agriculture	1,639	1.5	1,915	1.8	276	16.8
Built Environment	251	0.2	276	0.3	25	10.2
Water	987	0.9	987	0.9	0	0.0
Forestry	4,333	4.1	4,385	4.1	52	1.2
TOTAL	**105,853**	**100.0**	**105,853**	**100.0**	**0**	**0**

Table 5 - Broad land use and land use change in the Murray-Darling Basin 1996/97 – 2000/01. Source: BRS (2004) Land Use Maps of Australia 1996/97 and 2000/01. Broad land use categories interpreted using the method of Stewart *et al.* (2001).

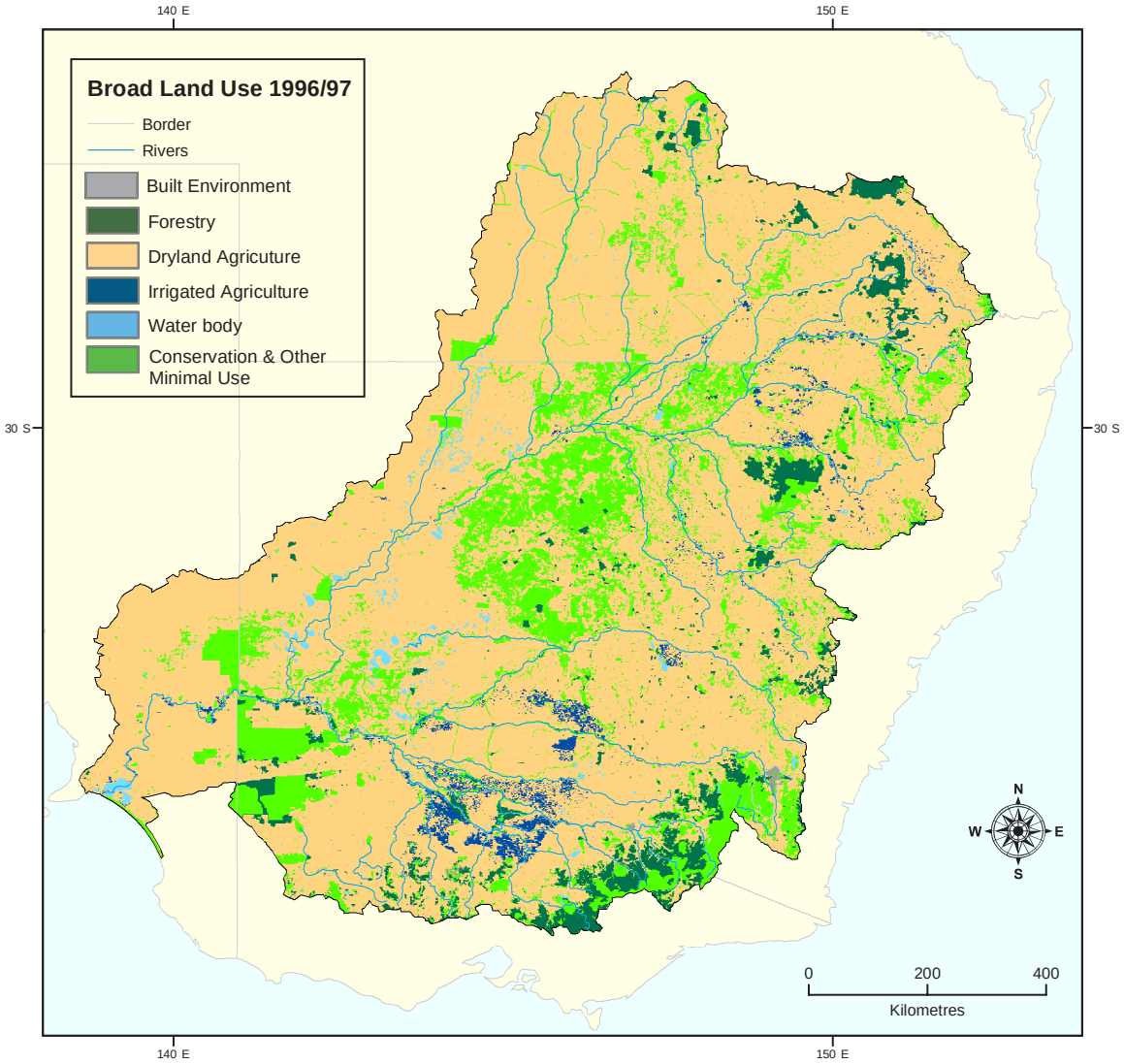


Figure 6 – Broad land use in the Murray-Darling Basin 1996/97. Source: BRS (2004). Broad land use categories interpreted using the method of Stewart *et al.* (2001).

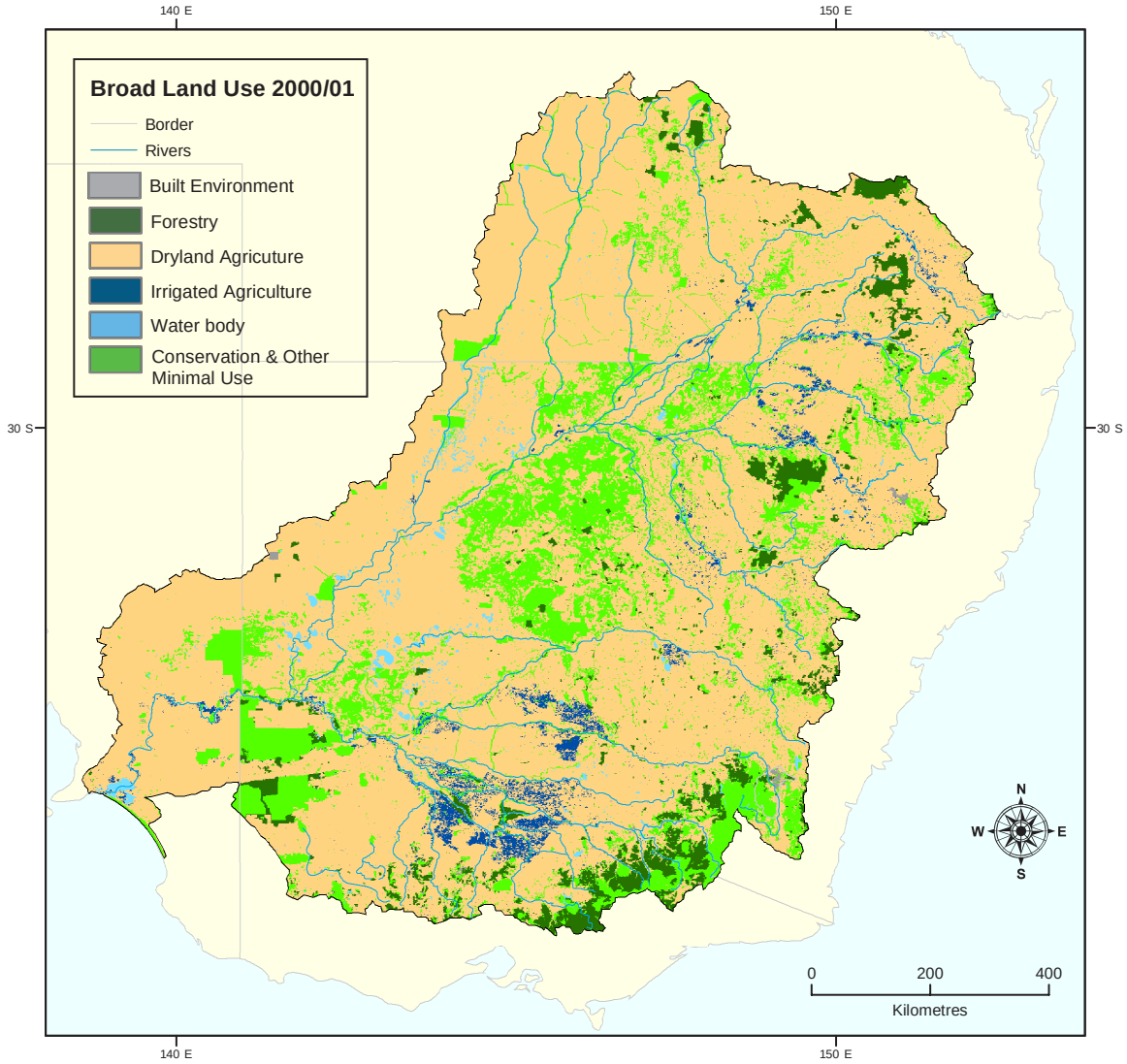


Figure 7 – Broad land use in the Murray-Darling Basin 2000/01. Source: BRS (2004). Broad land use categories interpreted using the method of Stewart *et al.* (2001).

3.1.2 Agricultural Land Uses

Over 100 different types of agricultural crops and livestock are produced in the MDB (ABS (2001); Appendix 2). From the ABS (1997) AgStats database (with processing of livestock and orchard areas as described in Section 2.2.7), the total area of agricultural holdings in 1996/97 was 87.3 million ha. The total area of agricultural holdings increased 1.5% to 88.7 million ha in 2000/01. Areas of agricultural Commodities for 1996/97 and 2000/01 are tabulated by Catchment Management Region in Appendix 6 and Agricultural Land Uses are summarised and graphed in Table 6 and Figure 8, and tabulated by Catchment Management Region in Table 7. The spatial distribution of Broad Agricultural Land Uses is mapped for 1996/97 and 2000/01 in Figure 9 - Figure 12 and the changes assessed in Figure 13. Note that the area statistics for livestock (Beef Cattle, Dairy Cattle and Sheep) and horticultural crops should be interpreted with full cognisance of the processing required to derive area statistics from the items reported in AgStats (ABS 1997; see Section 2.2.7).

Areas of Agricultural Land Uses in the MDB are dominated by livestock grazing, particularly Sheep and Beef (Table 6). The total area of Beef Cattle grazing has increased by 11.7% from 1996/97 to 2000/01 over the MDB. Increases in area mainly occurred in the northern NSW/southern Queensland areas including the Warrego-Paroo (Qld), Western (NSW), Lachlan (NSW), Border Rivers (QLD), and Maranoa/Balonne (QLD) CMRs with decreases in the southern CMRs such as the Lower Murray-Darling (NSW), River Murray (SA), ACT, Mallee (Vic), North Central (Vic), Murrumbidgee (NSW) and the Goulburn (Vic) CMRs (Table 7). Conversely, areas of Sheep grazing have decreased by 7.1% over the MDB with the largest decreases occurring in the Warrego-Paroo (Qld), Western (NSW), Border Rivers (NSW and Qld), Lachlan (NSW) and River Murray (SA) CMRs. Increases in the area of sheep grazing occurred in some other CMRs with the largest increases occurring in the Lower Murray-Darling (NSW) and Murray (NSW) CMRs. This suggests that significant areas of livestock grazing converted from Sheep to Beef grazing between 1996/97 and 2000/01 especially in the north and west of the MDB.

Cereals are also a dominant Agricultural Land Use in the MDB. The area of Cereals has increased 5% over the MDB over the five year period from 1996/97 to 2000/01. Increases were seen in the Lachlan (NSW), River Murray (SA), Mallee (Vic) and Murray (NSW). The largest decreases in the area of Cereals were found in the northern parts of the MDB including the Queensland CMRs and the Border Rivers (NSW), Namoi (NSW), Condamine (Qld) and Central West (NSW) CMRs (Table 7).

Dairy is the next dominant Agricultural Land Use in terms of its area and displayed a 19% increase in area from 1996/97 – 2000/01 (Table 6). The dairy industry expanded both in the traditional dairying regions such as the Murray (NSW), River Murray (SA), Goulburn (Vic), and the newer areas opening up to irrigation such as the Central West (NSW) and Western (NSW) CMRs. No significant reductions in the areas of Dairy Cattle by CMR have occurred (Table 7).

The Agricultural Land Uses of Legumes, Oilseeds, Coarse Grains and Cotton have similar areal extents and displayed significant increases over the five years to 2000/01 (Table 6). These crops increased in area between 28 and 44% except for Oilseeds which increased 141% largely due to the increase in Canola (Appendix 6). Legumes have increased in area in the Central West (NSW), the Border Rivers (Qld and NSW), Gwydir (NSW), Namoi (NSW) and Maranoa-Balonne (Qld) but decreased in the Mallee (Vic), Murray (Vic) and Wimmera (Vic). Oilseeds have boomed in most southern CMRs especially the Lachlan (NSW), Murray (NSW) and Murrumbidgee (NSW) CMRs which have each seen increases in the order of 100,000 ha. Decreases in the area of oilseeds have occurred in some of the northern CMRs such as Border Rivers (NSW) and Condamine (Qld). The greatest increases in areas of Coarse Grains have occurred in the Border Rivers (Qld and NSW), Gwydir (NSW), and Namoi (NSW). Decreases have occurred mostly in the Goulburn (Vic), Lachlan (NSW) and Murrumbidgee (NSW) CMRs (Table 7). Cotton has increased in area by 39% over the MDB with the greatest increases occurring in the Maranoa-Balonne (Qld), Gwydir (NSW) and Namoi (NSW) CMRs (Table 7). Cotton has also begun to appear further south in areas such as the Lachlan (NSW) and Murrumbidgee (NSW) CMRs. Negligible decreases in the area of Cotton occurred.

Crops grown for Hay were the next abundant Agricultural Land Use but displayed a decrease in area of 36% over the MDB from 1996/97 – 2000/01 (Table 6). Decreases occurred in most CMRs, especially the Central West (NSW), Lachlan (NSW) and Condamine (Qld). Rice is similarly abundant and occurs mainly in the Murray (NSW) and Murrumbidgee (NSW) CMRs. Rice increased in area by nearly 16% over the 5 years to 2000/01 with the greatest increases occurring in the Murray (NSW) and the Murrumbidgee (NSW) (Table 7). Areas of Rice increased in the Goulburn and Lachlan CMRs and small areas appeared in North Central (Vic) and North East (Vic) in 2000/01.

Grapes, Fruit and Vegetables occur in areas of around 30,000 – 90,000 ha in the MDB and have all increased significantly from 1996/97 – 2000/01 (Table 6). The area of Grapes has increased by 60% across the MDB. The largest increases occurred in the River Murray (SA), Mallee (Vic) and Murrumbidgee (NSW) CMRs whilst negligible decreases occurred. The area of Fruit increased by 22% across the MDB with the largest increases occurring in the established fruit growing regions of Goulburn (Vic) and River Murray (SA). Areas of Fruit crops also increased in the northern Border Rivers (Qld) and Condamine (Qld) CMRs. The area of Vegetables increased 22% across the MDB from 1996/97 – 2000/01 (Table 6). The largest increases occurred in the Murrumbidgee (NSW), Goulburn (Vic) and North Central (Vic) in the south and also the Border Rivers (Qld) and Condamine (Qld) CMRs in the north. Decreases in the area of vegetables occurred in the more marginal CMRs such as Maranoa-Balonne (Qld) and Central West (NSW) (Table 7). Tree Nuts, Peanuts and Other are the least common Agricultural Land Uses in the MDB.

The CMRs with the largest areas of agriculture are the Western (NSW), Warrego-Paroo (Qld), Central West (NSW), Lachlan (NSW), Murrumbidgee (NSW) and Maranoa-Balonne (Qld). The Lachland (NSW) and Western (NSW) CMRs have experienced the greatest increases in area of agriculture. Agricultural areas in the southern CMRs (apart from River Murray (SA) and North East (Vic)) tend to be increasing especially in the Victorian CMRs amongst others. This is contrasted by the Queensland and north-eastern NSW CMRs where agriculture tends to be decreasing in area (Figure 13). This pattern is largely driven by changes in livestock and Cereals and should be interpreted with full cognisance of the assumptions used in livestock mapping (see Section 2.2.7).

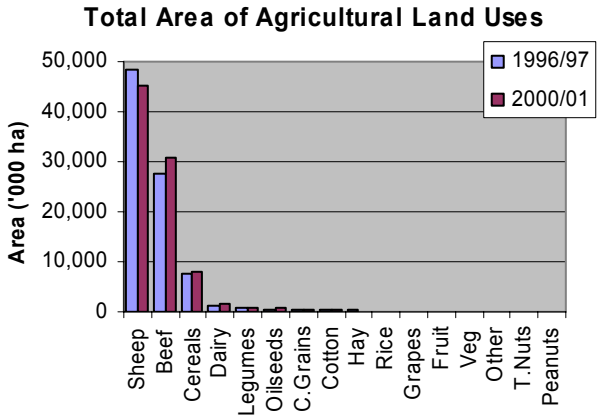


Figure 8 – Areas of agricultural land uses in the Murray-Darling Basin 1996/97 and 2000/01.

Agricultural Land Use	Total Area (ha)	% of Total Agricultural Area	Total Irrigated Area (ha)	% of Area Irrigated	Gross Revenue ($'000)	% of Gross Revenue	Avg. Revenue/ha ($/ha)	Total PFE ($'000)	% of Total PFE	Avg. PFE/ha ($/ha)	Total Govt. Asst. ($'000)	% of Total Govt. Asst.	Avg. Govt. Asst./ha ($/ha)	Total NER ($'000)	% of Total NER	Avg. NER/ha ($/ha)
1996/97																
Beef	27,673,901	31.7	229,104	15.4	976,059	8.4	35	63,945	1.7	2	66,177	10.0	2	-2,232	-0.1	0
Cereals	7,454,482	8.5	139,561	9.4	3,468,739	29.7	465	1,315,871	34.0	177	117,063	17.7	16	1,198,808	37.4	161
Coarse Grains	383,610	0.4	13,045	0.9	241,443	2.1	629	99,493	2.6	259	3,672	0.6	10	95,822	3.0	250
Cotton	355,764	0.4	297,148	20.0	1,266,400	10.8	3,560	622,587	16.1	1750	0	0.0	0	622,587	19.4	1750
Dairy	1,387,535	1.6	305,740	20.6	1,307,395	11.2	942	438,935	11.3	316	19,799	3.0	14	419,136	13.1	302
Fruit	39,920	0.0	31,074	2.1	682,333	5.8	17,092	253,471	6.5	6349	28,142	4.2	705	225,329	7.0	5644
Grapes	54,240	0.1	46,818	3.2	517,855	4.4	9,547	121,772	3.1	2245	48,337	7.3	891	73,434	2.3	1354
Hay	285,861	0.3	8,421	0.6	55,612	0.5	195	14,370	0.4	50	1,289	0.2	5	13,081	0.4	46
Legumes	612,791	0.7	15,427	1.0	219,516	1.9	358	94,688	2.4	155	4,710	0.7	8	89,978	2.8	147
Oilseeds	322,400	0.4	22,366	1.5	190,315	1.6	590	89,355	2.3	277	3,346	0.5	10	86,009	2.7	267
Other	8,550	0.0	2,612	0.2	377,746	3.2	44,180	153,865	4.0	17996	26,115	3.9	3054	127,750	4.0	14941
Peanuts	2,508	0.0	212	0.0	3,261	0.0	1,300	1,110	0.0	443	48	0.0	19	1,062	0.0	423
Rice	151,868	0.2	151,868	10.2	309,553	2.6	2,038	110,270	2.8	726	25,618	3.9	169	84,652	2.6	557
Sheep	48,559,060	56	190,881	12.9	1,687,440	14	35	364,479	9	8	315,964	48	7	48,515	2	1
Tree Nuts	4,015	0	3,684	0.2	37,692	0	9,388	21,376	1	5,324	4,265	1	1,062	17,110	1	4,262
Vegetables	29,748	0	27,226	1.8	341,464	3	11,479	91,056	2	3,061	0	0	0	91,056	3	3,061
TOTAL	**87,326,253**	**100**	**1,485,186**	**100**	**11,682,823**	**100**	**134**	**3,856,643**	**100**	**44**	**664,546**	**100**	**8**	**3,192,097**	**100**	**37**
2000/01																
Beef	30,915,091	34.9	206,016	11.3	1,873,276	13.8	61	804,734	21.5	26	13,786	2.6	0	790,949	24.6	26
Cereals	7,826,006	8.8	229,305	12.6	3,280,917	24.1	419	710,717	19.0	91	37,752	7.1	5	672,965	20.9	86
Coarse Grains	549,625	0.6	16,315	0.9	234,298	1.7	426	34,853	0.9	63	5,122	1.0	9	29,730	0.9	54
Cotton	490,283	0.6	404,911	22.3	1,199,778	8.8	2,447	277,564	7.4	566	33,564	6.3	68	244,000	7.6	498
Dairy	1,653,410	1.9	522,972	28.8	1,789,630	13.2	1,082	592,692	15.8	358	17,025	3.2	10	575,668	17.9	348
Fruit	48,636	0.1	40,371	2.2	674,098	5.0	13,860	155,995	4.2	3207	11,503	2.2	237	144,492	4.5	2971
Grapes	86,552	0.1	80,018	4.4	997,631	7.3	11,526	289,872	7.7	3349	66,958	12.6	774	222,914	6.9	2575
Hay	184,004	0.2	9,403	0.5	80,492	0.6	437	43,070	1.2	234	867	0.2	5	42,203	1.3	229
Legumes	785,024	0.9	9,685	0.5	273,832	2.0	349	58,267	1.6	74	6,920	1.3	9	51,347	1.6	65
Oilseeds	776,236	0.9	8,320	0.5	357,691	2.6	461	83,550	2.2	108	8,669	1.6	11	74,881	2.3	96
Other	3,680	0.0	2,355	0.1	120,525	0.9	32,754	24,475	0.7	6651	251	0.0	68	24,224	0.8	6583
Peanuts	1,869	0.0	0	0.0	2,464	0.0	1,318	749	0.0	401	29	0.0	15	720	0.0	385
Rice	175,608	0.2	175,608	9.7	348,866	2.6	1,987	71,895	1.9	409	17,773	3.3	101	54,123	1.7	308
Sheep	45,123,688	51	73,284	4.0	1,842,950	14	41	429,091	11	10	307,145	58	7	121,946	4	3
Tree Nuts	6,398	0	5,834	0.3	41,872	0	6,545	12,169	0	1,902	1,921	0	300	10,248	0	1,602
Vegetables	36,174	0	34,160	1.9	480,877	4	13,293	142,709	4	3,945	3,253	1	90	139,457	4	3,855
TOTAL	**88,662,284**	**100**	**1,818,557**	**100**	**13,599,197**	**100**	**153**	**3,732,403**	**100**	**42**	**532,536**	**100**	**6**	**3,199,867**	**100**	**36**
Total Change 1996/97 - 2000/01																
Beef	3,241,190	3.2	-23,088	-4.1	897,217	5.4	25.32	740,790	19.8	24	-52,391	-7.4	-2	793,181	24.7	26
Cereals	371,524	0.3	89,744	3.2	-187,823	-5.6	-46.09	-605,154	-15.0	-86	-79,311	-10.6	-11	-525,843	-16.4	-75
Coarse Grains	166,014	0.2	3,270	0.0	-7,144	-0.3	-203.11	-64,641	-1.6	-196	1,451	0.4	0	-66,091	-2.1	-196
Cotton	134,519	0.1	107,763	2.3	-66,622	-2.0	-1,112.55	-345,023	-8.7	-1184	33,564	6.3	68	-378,587	-11.8	-1252
Dairy	265,875	0.3	217,232	8.2	482,235	2.0	140.14	153,757	4.5	42	-2,775	0.2	-4	156,532	4.9	46
Fruit	8,716	0.0	9,297	0.1	-8,235	-0.9	-3,232.41	-97,476	-2.4	-3142	-16,639	-2.1	-468	-80,837	-2.5	-2674
Grapes	32,312	0.0	33,200	1.2	479,776	2.9	1,978.88	168,101	4.6	1104	18,621	5.3	-118	149,480	4.7	1222
Hay	-101,857	-0.1	982	0.0	24,880	0.1	242.90	28,700	0.8	184	-422	0.0	0	29,122	0.9	184
Legumes	172,233	0.2	-5,741	-0.5	54,316	0.1	-9.40	-36,421	-0.9	-80	2,210	0.6	1	-38,630	-1.2	-81
Oilseeds	453,836	0.5	-14,045	-1.0	167,376	1.0	-129.50	-5,805	-0.1	-170	5,323	1.1	1	-11,127	-0.3	-170
Other	-4,870	0.0	-257	0.0	-257,221	-2.3	-11,426.48	-129,390	-3.3	-11344	-25,864	-3.9	-2986	-103,526	-3.2	-8358
Peanuts	-639	0.0	-212	0.0	-797	0.0	18.01	-362	0.0	-42	-19	0.0	-4	-342	0.0	-38
Rice	23,740	0.0	23,740	-0.6	39,314	-0.1	-51.68	-38,375	-0.9	-317	-7,846	-0.5	-67	-30,529	-1.0	-249
Sheep	-3,435,371	-5	-117,597	-9	155,510	-1	6	64,612	2	2	-8,819	10	0	73,431	2	2
Tree Nuts	2,383	0	2,150	0	4,180	0	-2,843	-9,207	0	-3,422	-2,345	0	-762	-6,862	0	-2,660
Vegetables	6,426	0	6,935	0	139,412	1	1,815	51,653	1	884	3,253	1	90	48,400	2	794
TOTAL	**1,336,032**	**-**	**333,371**	**-**	**1,916,374**	**-**	**20**	**-124,240**	**-**	**-2**	**-132,010**	**-**	**-2**	**7,770**	**-**	**0**
% Change 1996/97 - 2000/01																
Beef	11.7	10.0	-10.1	-	91.9	-	71.8	1,158.5	-	1027	-79.2	-	-81	-35,535.5	-	-31820
Cereals	5.0	3.4	64.3	-	-5.4	-	-9.9	-46.0	-	-49	-67.8	-	-69	-43.9	-	-47
Coarse Grains	43.3	41.1	25.1	-	-3.0	-	-32.3	-65.0	-	-76	39.5	-	-3	-69.0	-	-78
Cotton	37.8	35.7	36.3	-	-5.3	-	-31.3	-55.4	-	-68	-	-	-	-60.8	-	-72
Dairy	19.2	17.4	71.1	-	36.9	-	14.9	35.0	-	13	-14.0	-	-28	37.3	-	15
Fruit	21.8	20.0	29.9	-	-1.2	-	-18.9	-38.5	-	-49	-59.1	-	-66	-35.9	-	-47
Grapes	59.6	57.2	70.9	-	92.6	-	20.7	138.0	-	49	38.5	-	-13	203.6	-	90
Hay	-35.6	-36.6	11.7	-	44.7	-	124.9	199.7	-	366	-32.7	-	5	222.6	-	401
Legumes	28.1	26.2	-37.2	-	24.7	-	-2.6	-38.5	-	-52	46.9	-	15	-42.9	-	-55
Oilseeds	140.8	137.1	-62.8	-	87.9	-	-21.9	-6.5	-	-61	159.1	-	8	-12.9	-	-64
Other	-57.0	-57.6	-9.9	-	-68.1	-	-25.9	-84.1	-	-63	-99.0	-	-98	-81.0	-	-56
Peanuts	-25.5	-26.6	-100.0	-	-24.4	-	1.4	-32.6	-	-10	-40.2	-	-20	-32.2	-	-9
Rice	15.6	13.9	15.6	-	12.7	-	-2.5	-34.8	-	-44	-30.6	-	-40	-36.1	-	-45
Sheep	-7.1	-8.5	-61.6	-	9.2	-	17.5	17.7	-	26.7	-2.8	-	4.6	151.4	-	170.5
Tree Nuts	59.3	56.9	58.4	-	11.1	-	-30.3	-43.1	-	-64.3	-55.0	-	-71.7	-40.1	-	-62.4
Vegetables	21.6	19.8	25.5	-	40.8	-	15.8	56.7	-	28.9	-	-	-	53.2	-	25.9
TOTAL	1.5	-	22.4	-	16.4	-	14.6	-3.2	-	-4.7	-19.9	-	-21.1	0.2	-	-1.3

Table 6 – Summary of total areas of Agricultural Land Uses, area of irrigated agriculture, and returns to agriculture for 1996/97 and 2000/01 including assessment of change.

Agricultural Land Use	Area (ha)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	Grand Total
Beef	1996/97	22,519	967,972	1,946,651	2,259,316	1,389,105	378,265	1,214,834	1,457,029	999,596	200,713	4,333,814	799,783	1,539,425	1,611,684	252,772	601,529	650,576	4,832,458	2,171,347	44,512	**27,673,901**
	2000/01	19,367	960,919	2,194,582	2,473,914	1,415,800	381,837	1,127,275	2,001,035	721,152	146,589	4,667,303	749,123	1,439,605	1,744,641	274,161	543,461	535,318	6,355,069	3,117,988	45,955	**30,915,091**
	% Change	-14.0	-0.7	12.7	9.5	1.9	0.9	-7.2	37.3	-27.9	-27.0	7.7	-6.3	-6.5	8.2	8.5	-9.7	-17.7	31.5	43.6	3.2	**11.7**
Cereals	1996/97	0	351,025	347,579	962,101	252,762	97,534	369,693	896,128	55,335	753,084	258,437	403,150	721,148	466,876	408,819	12,976	636,156	12,113	100,425	349,139	**7,454,482**
	2000/01	550	288,575	279,562	934,943	187,104	113,367	381,097	1,007,524	84,872	820,370	224,991	510,772	780,600	392,714	483,786	13,471	739,161	13,488	170,516	398,543	**7,826,006**
	% Change	-	-17.8	-19.6	-2.8	-26.0	16.2	3.1	12.4	53.4	8.9	-12.9	26.7	8.2	-15.9	18.3	3.8	16.2	11.3	69.8	14.2	**5.0**
Coarse Grains	1996/97		33,661	37,705	5,336	164,331	657	22,236	6,715	500	444	35,767	1,013	14,579	56,541	1,875	72		682	799	696	**383,610**
	2000/01		67,806	62,592	13,404	159,453	296	68,935	4,188	432	1,076	45,687	1,434	10,084	100,121	919	0		1,930	11,087	181	**549,625**
	% Change		101.4	66.0	151.2	-3.0	-55.0	210.0	-37.6	-13.5	142.0	27.7	41.5	-30.8	77.1	-51.0	-100.0		183.0	1,288.1	-74.0	**43.3**
Cotton	1996/97		43,925	22,087	33,148	60,405		84,216	0	210		23,315		266	69,476				1,201	17,514		**355,764**
	2000/01		55,850	32,231	57,031	59,657		114,952	2,489	0		47,862		14,897	84,295				293	20,727		**490,283**
	% Change		27.1	45.9	72.1	-1.2		36.5	-	-100.0		105.3		5,500.2	21.3				-75.6	18.3		**37.8**
Dairy	1996/97	612	6,632	7,406	27,859	158,198	293,094	3,385	17,654		30,759	7,446	149,136	25,486	15,626	294,801	127,260	207,669	11,856	59	2,596	**1,387,535**
	2000/01	0	5,840	5,244	54,787	162,728	339,278	3,377	40,238		44,403	16,352	220,654	27,994	21,266	310,326	142,595	235,666	15,055	3,446	4,160	**1,653,410**
	% Change	-100.0	-11.9	-29.2	96.7	2.9	15.8	-0.2	127.9		44.4	119.6	48.0	9.8	36.1	5.3	12.1	13.5	27.0	5,775.1	60.2	**19.2**
Fruit	1996/97		54	2,526	1,200	44	7,970	0	1,977	1,968	5,139		248	10,108		483	175	7,904		0	124	**39,920**
	2000/01		18	3,491	1,289	1,165	11,049	143	2,506	1,949	5,190		312	10,293		1,777	165	8,923		243	123	**48,636**
	% Change		-66.4	38.2	7.4	2,530.7	38.6	-	26.8	-1.0	1.0		25.9	1.8		268.0	-5.8	12.9		-	-0.5	**21.8**
Grapes	1996/97			316	1,068		851		1,127	3,969	19,181	166	663	8,073		828	1,171	16,126	0	457	244	**54,240**
	2000/01			534	2,321		2,095		2,574	6,272	24,092	0	1,102	15,123		1,540	2,836	26,486	286	678	613	**86,552**
	% Change			69.3	117.3		146.3		128.5	58.0	25.6	-100.0	66.1	87.3		86.0	142.2	64.2	-	48.5	150.6	**59.6**
Hay	1996/97		11,988	14,467	34,094	36,820	14,606	11,099	24,227	2,598	8,350	14,744	12,788	18,403	16,873	18,710	1,892	36,304	2,483	1,134	4,281	**285,861**
	2000/01		3,919	7,707	4,259	24,789	18,007	2,821	10,033	1,980	6,232	14,107	9,633	11,586	2,962	27,189	688	29,005	1,804	1,103	6,177	**184,004**
	% Change		-67.3	-46.7	-87.5	-32.7	23.3	-74.6	-58.6	-23.8	-25.4	-4.3	-24.7	-37.0	-82.4	45.3	-63.6	-20.1	-27.4	-2.7	44.3	**-35.6**
Legumes	1996/97		21,904	6,993	9,793	25,796	8,619	15,969	17,329	182	125,394	5,296	29,586	36,999	9,000	94,676	657	27,941	0	5,215	171,441	**612,791**
	2000/01		37,307	32,896	45,761	35,242	5,626	62,822	34,180	84	89,928	18,869	19,903	54,912	35,396	90,985	871	37,122	4,017	27,946	151,157	**785,024**
	% Change		70.3	370.4	367.3	36.6	-34.7	293.4	97.2	-53.8	-28.3	256.3	-32.7	48.4	293.3	-3.9	32.5	32.9	-	435.8	-11.8	**28.1**
Oilseeds	1996/97	0	5,574	637	11,198	14,441	4,609	9,959	62,105	4,326	7,072	660	33,031	74,031	20,142	29,793	391	1,354	0	2,031	41,047	**322,400**
	2000/01	500	4,925	1,199	61,866	5,974	25,056	5,639	162,800	1,592	27,984	1,143	130,139	151,087	20,205	75,424	1,386	19,824	241	5,858	73,393	**776,236**
	% Change	-	-11.6	88.4	452.5	-58.6	443.7	-43.4	162.1	-63.2	295.7	73.1	294.0	104.1	0.3	153.2	254.9	1,364.3	-	188.4	78.8	**140.8**
Other	1996/97		756	49	168	640	643	535	209	5	99	880	27	355	221	794	1,747	90	894		437	**8,550**
	2000/01		0	10	129	292	341	1	32	0	54	1	17	108	13	5	1,681	296	1		698	**3,680**
	% Change		-100.0	-80.3	-23.1	-54.5	-47.0	-99.9	-84.8	-100.0	-45.5	-99.9	-37.2	-69.5	-94.1	-99.3	-3.8	230.9	-99.9		59.8	**-57.0**
Peanuts	1996/97		0	412		1,059		45				410			135				0	447		**2,508**
	2000/01		183	134		759		0				67			202				376	148		**1,869**
	% Change		-	-67.6		-28.4		-100.0				-83.7			49.6				-	-66.8		**-25.5**
Rice	1996/97						640		547				69,522	81,158		0	0					**151,868**
	2000/01						1,259		1,103				82,826	89,919		395	105					**175,608**
	% Change						96.7		101.6				19.1	10.8		-	-					**15.6**
Sheep	1996/97	20,532	746,147	1,111,207	3,704,514	213,977	446,306	673,263	4,208,608	4,396,934	1,221,494	1,563,251	1,151,466	3,092,385	974,841	889,796	199,147	4,247,529	7,604,917	11,449,272	643,470	**48,559,060**
	2000/01	29,190	567,774	749,721	3,578,501	152,049	474,512	536,406	4,154,858	4,713,626	1,239,294	946,117	1,224,899	3,075,074	882,887	976,280	163,449	3,731,850	5,972,568	11,297,401	657,232	**45,123,688**
	% Change	42.2	-23.9	-32.5	-3.4	-28.9	6.3	-20.3	-1.3	7.2	1.5	-39.5	6.4	-0.6	-9.4	9.7	-17.9	-12.1	-21.5	-1.3	2.1	**-7.1**
Tree Nuts	1996/97		196					489	0		1,484			133				1,712				**4,015**
	2000/01		348					348	170		3,222			155				2,153				**6,398**
	% Change		78.0					-28.8	-		117.1			16.5				25.8				**59.3**
Vegetables	1996/97		152	1,735	1,772	1,516	2,226		2,232	269	2,625	141	2,046	7,661	0	2,373		5,000			0	**29,748**
	2000/01		206	2,254	628	2,167	3,693		1,126	218	3,249	0	1,710	10,412	103	3,980		6,328			101	**36,174**
	% Change		35.1	29.9	-64.6	42.9	65.9		-49.6	-18.7	23.8	-100.0	-16.4	35.9	-	67.7		26.6			-	**21.6**
Total 1996/97 Area (ha)		**43,663**	**2,189,985**	**3,499,769**	**7,051,568**	**2,319,095**	**1,256,020**	**2,405,725**	**6,695,888**	**5,465,893**	**2,375,839**	**6,244,328**	**2,652,458**	**5,630,213**	**3,241,417**	**1,995,720**	**947,017**	**5,838,360**	**12,466,605**	**13,748,700**	**1,257,988**	**87,326,253**
Total 2000/01 Area (ha)		**49,608**	**1,993,671**	**3,372,158**	**7,228,833**	**2,207,177**	**1,376,417**	**2,303,816**	**7,424,857**	**5,532,177**	**2,411,684**	**5,982,498**	**2,952,523**	**5,691,848**	**3,284,804**	**2,246,769**	**870,709**	**5,372,132**	**12,365,130**	**14,657,142**	**1,338,332**	**88,662,284**
Total % Change		**13.6**	**-9.0**	**-3.6**	**2.5**	**-4.8**	**9.6**	**-4.2**	**10.9**	**1.2**	**1.5**	**-4.2**	**11.3**	**1.1**	**1.3**	**12.6**	**-8.1**	**-8.0**	**-0.8**	**6.6**	**6.4**	**1.5**

Table 7 – Areas of agricultural land use in the Murray-Darling Basin by Catchment Management Region 1996/97 and 2000/01 including % change.
Note that percentage change should be interpreted together with absolute change as large % values can occur when low numbers are involved, and percentages cannot be calculated when 1996/97 values are <= 0.

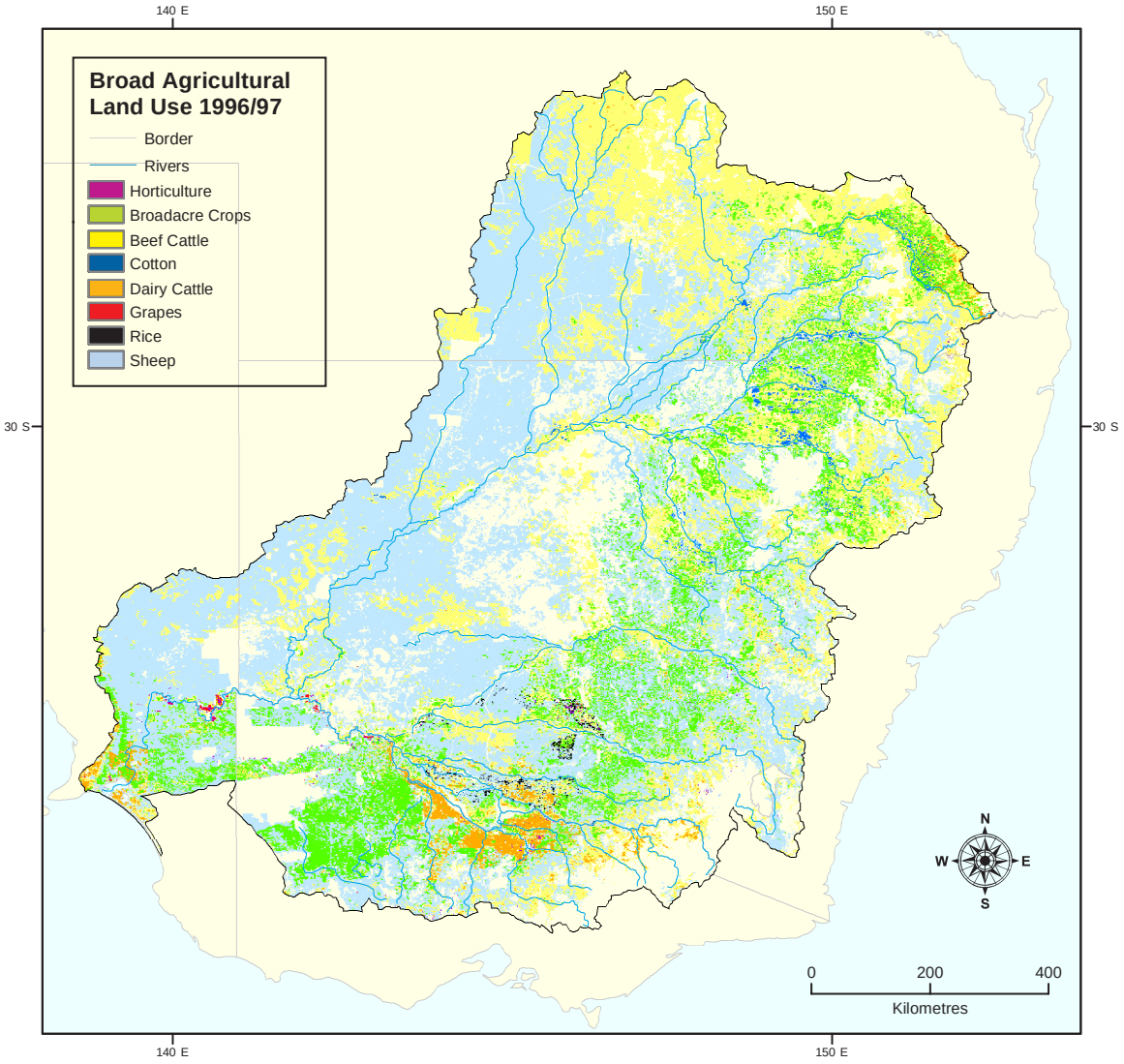


Figure 9 – Broad agricultural land use in the Murray-Darling Basin 1996/97.

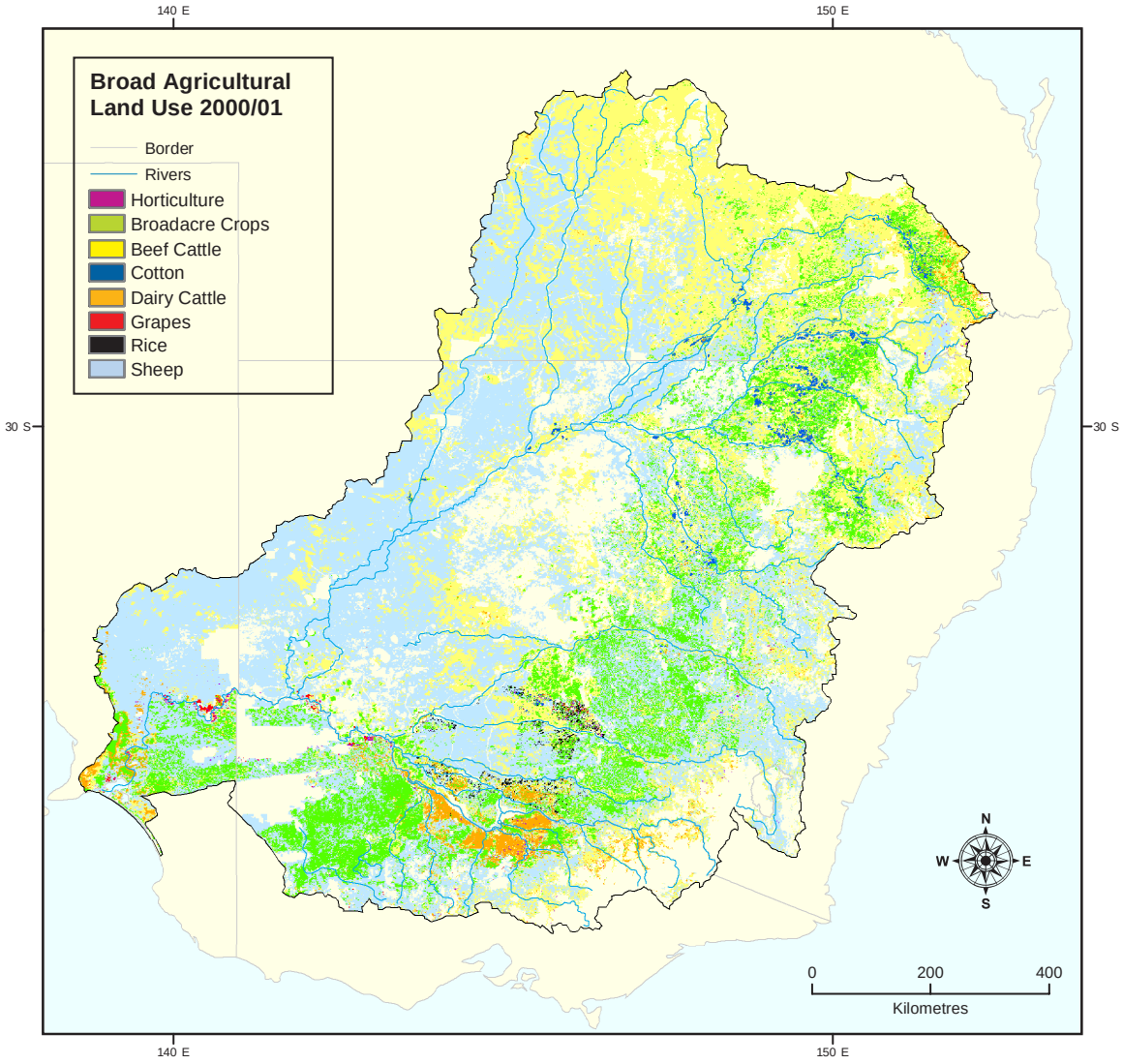


Figure 10 - Broad agricultural land use in the Murray-Darling Basin 2000/01.

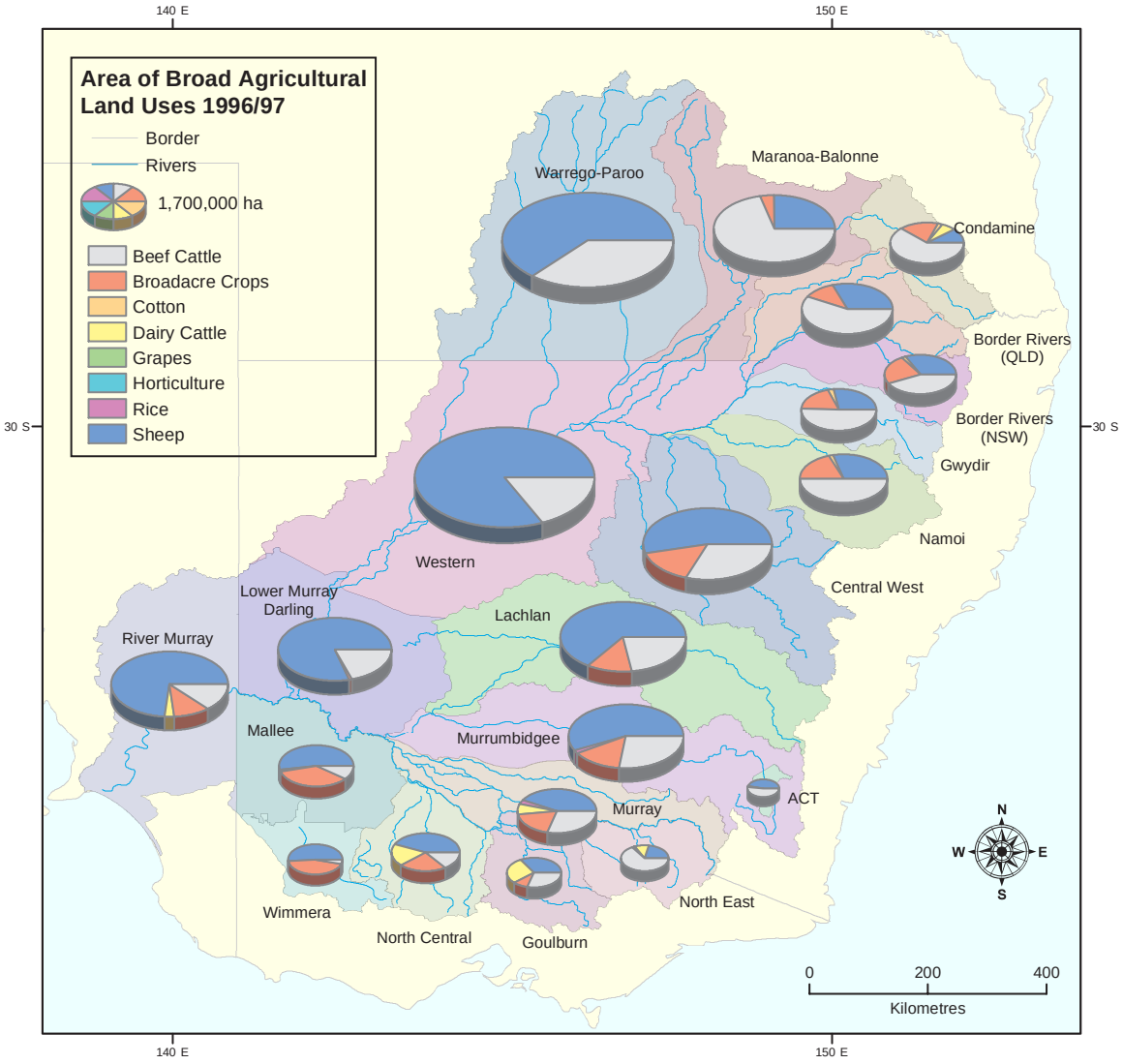


Figure 11 – Areas and proportions of broad agricultural land use by Catchment Management Region in the Murray-Darling Basin 1996/97. Note: the area of the ACT is exaggerated 10 times.

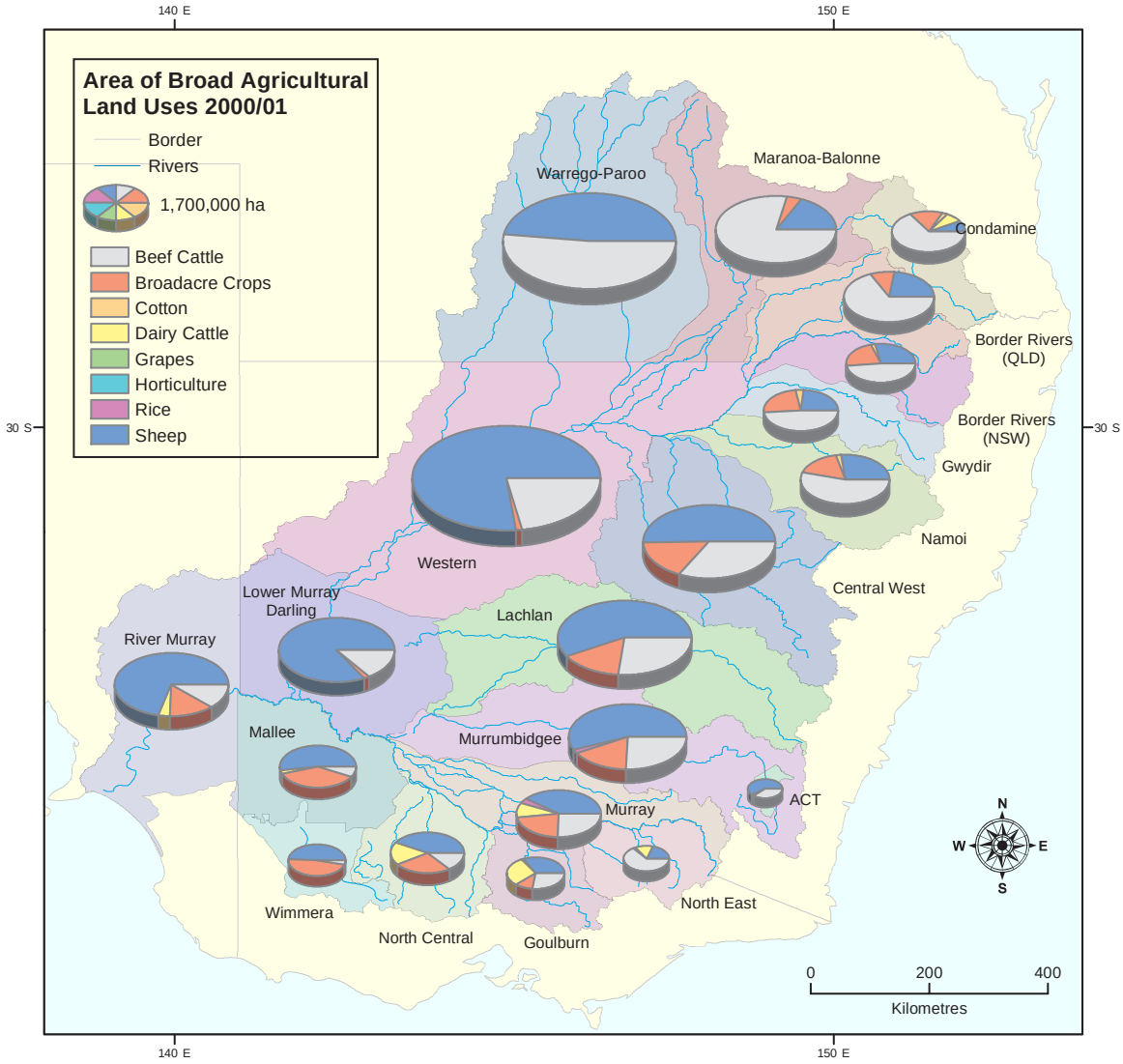


Figure 12 – Areas and proportions of broad agricultural land use by Catchment Management Region in the Murray-Darling Basin 2000/01. Note: the area of the ACT is exaggerated 10 times.

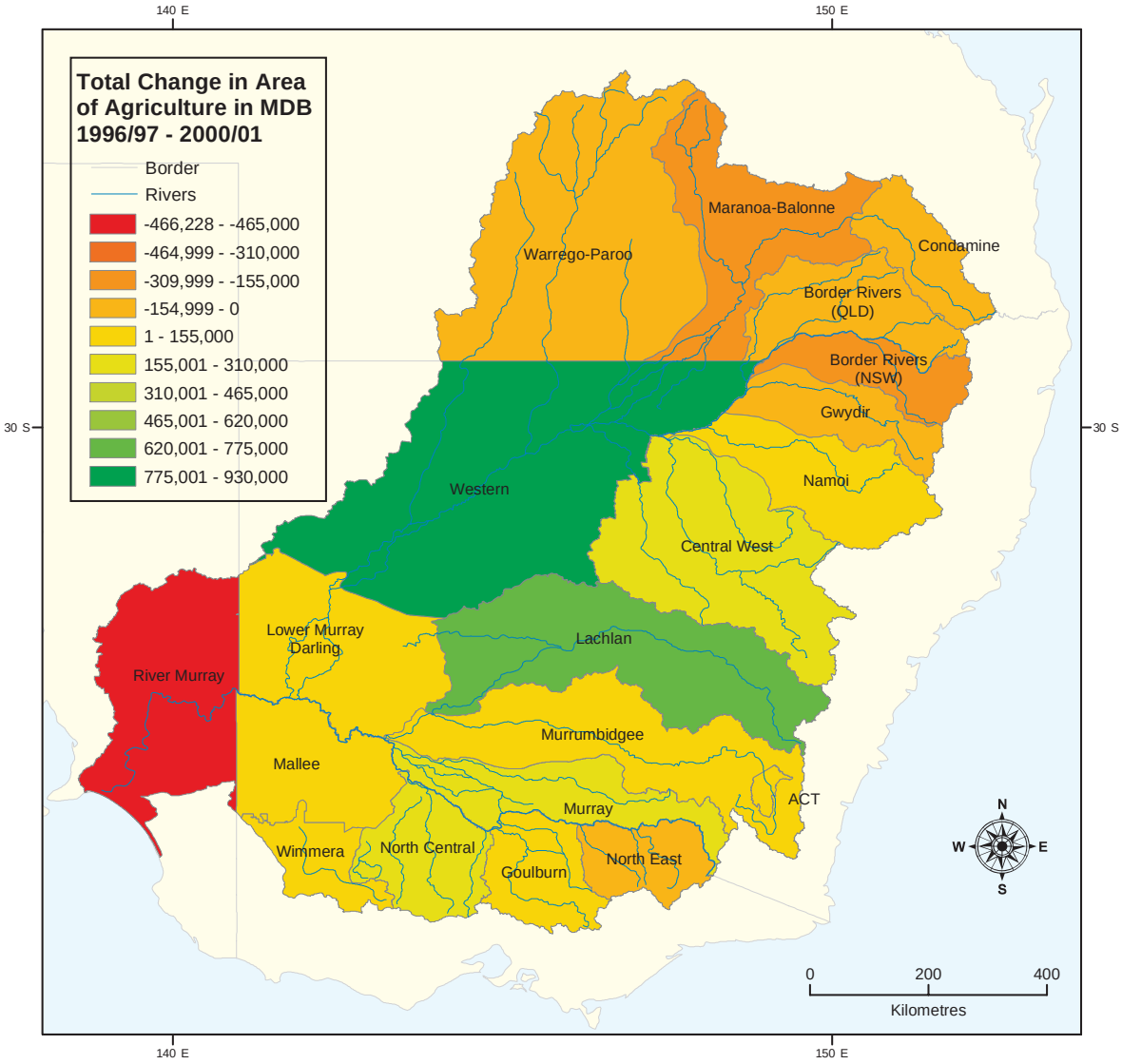


Figure 13 – Total change in area of agricultural land use by Catchment Management Region in the Murray-Darling Basin 2000/01. Green areas indicate an increase in agricultural area, red indicates a decrease in hectares.

3.1.3 Pixel Level Uncertainty in Land Use and Commodity Mapping

The 2-stage process used to arrive at a Commodity level map suitable for economic modelling involves land use mapping using SPREAD II and subsequent allocation of Commodity classes to pixels. Uncertainty in mapping exists at the SPREAD mapping level and is compounded at the Commodity mapping level. We know at the SPREAD level and Commodity level the aggregate areas roughly concord to the AgStats reported area figures by SLA. Thus, we know the areas mapped of each class are roughly correct. However, the pixel level mapping accuracy of SPREAD classes and Commodity classes is variable. The uncertainty involved in SPREAD class and Commodity class mapping at the pixel level is quantified below.

A useful analogy for quantifying the uncertainty in land use mapping is that of a jigsaw puzzle. Consider that we have just tipped out the jigsaw pieces onto the table. Each

jigsaw piece can be thought of as a particular pixel of agricultural land use and the table is the SLA. AgStats tell us that the number of jigsaw pieces is correct but it doesn't tell us where they go. SPREAD tries to tell us where each agricultural land use pixel goes to make the picture, but it does so with varying degrees of accuracy. Each jigsaw piece can be given a measure of uncertainty according to how strongly we believe it is in the correct position. The analysis below attempts to quantify how correct SPREAD has been in putting the agricultural land use jigsaw pieces in the right place.

Cells allocated to different SPREAD classes have different average posterior probabilities as output from the SPREAD II process (Figure 14). The SPREAD class Native Pasture has the highest average probability of correct classification with Cotton next highest. Grapes, Cereals Excluding Rice, Rice, Sown Pastures have an average probability of correct classification around 0.4. Oilseeds, Potatoes, Apples and Non-Cereal Forage Crops have a low average probability of correct classification. The probabilities of correct SPREAD class allocation are not randomly distributed over the MDB (Figure 15 - Figure 17). A high degree of uncertainty of land use allocation occurs in those CMRs where there are diverse and more intensive land uses. These areas of higher uncertainty are concentrated in the crescentic band of high value land uses around the moister climate regions of the southern and eastern MDB. Higher probabilities of correct allocation occur in the drier, more marginal areas of the interior where there are less complex agricultural land uses.

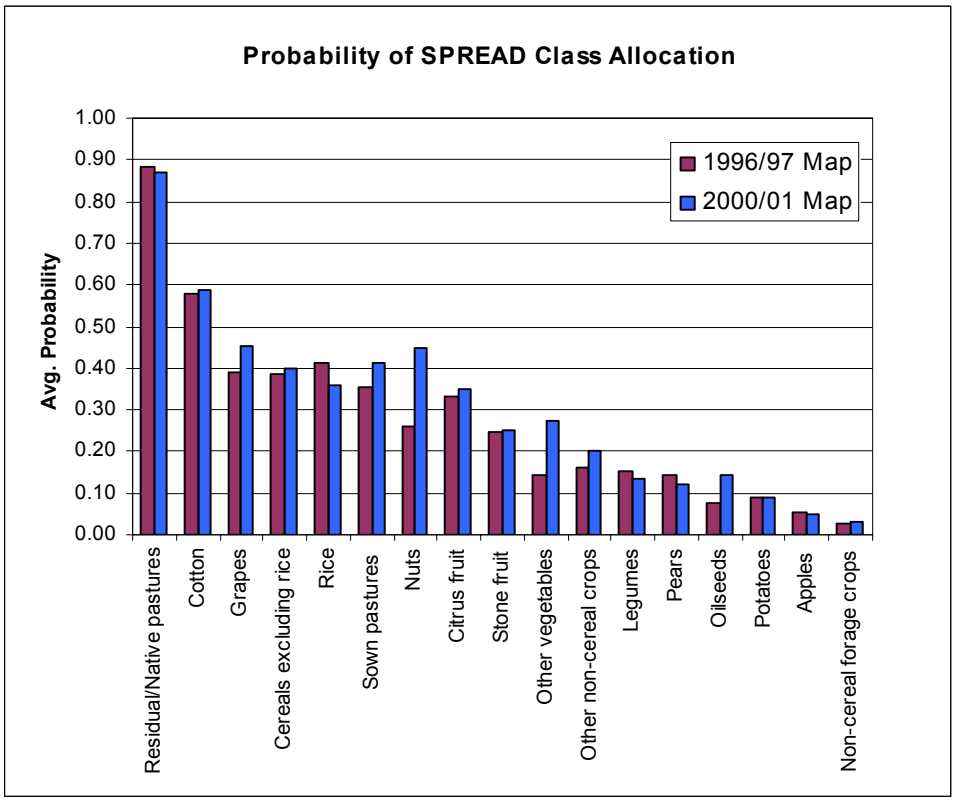


Figure 14 – Average probability of allocation of SPREAD class agricultural land uses in the Murray-Darling Basin 1996/97 and 2000/01 from SPREAD II.

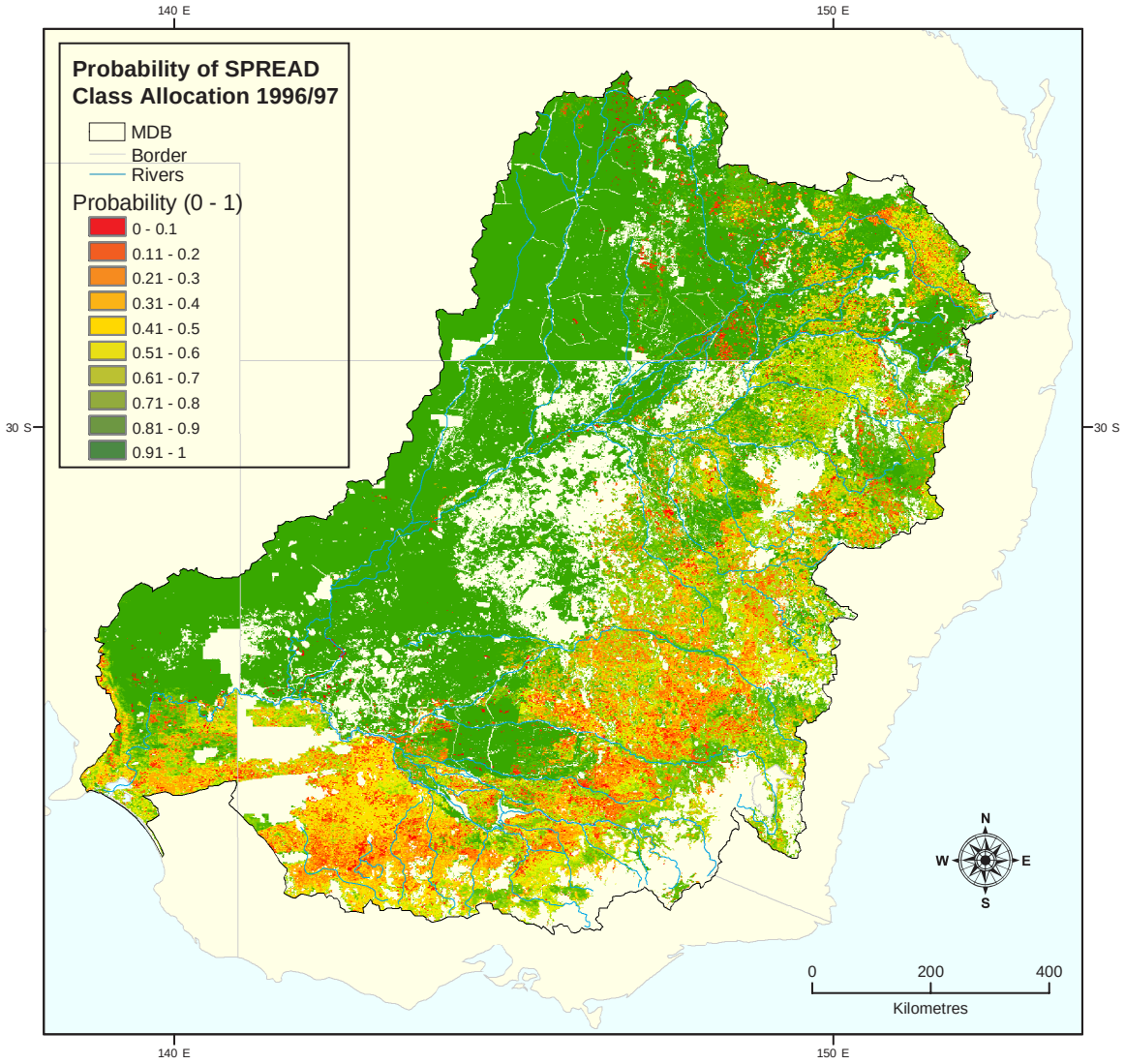


Figure 15 – Uncertainty in spatial allocation of SPREAD class agricultural land uses in the Murray-Darling Basin 1996/97. Red pixels have low probability of allocation and high uncertainty grading through to green pixels with high probability and low uncertainty.

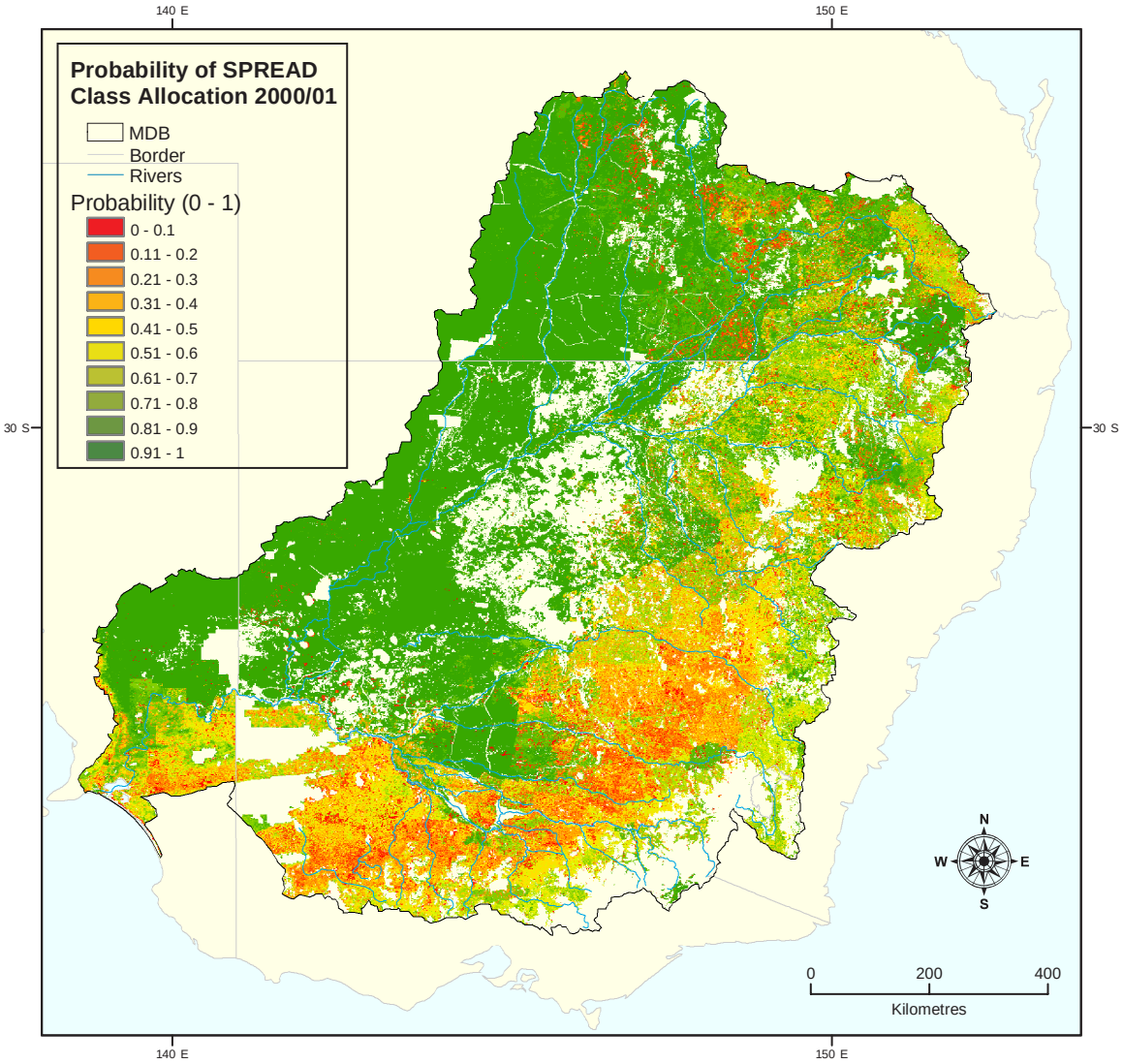


Figure 16 – Uncertainty in spatial allocation of SPREAD class agricultural land uses in the Murray-Darling Basin 2000/01. Red pixels have low probability of allocation and high uncertainty grading through to green pixels with high probability and low uncertainty.

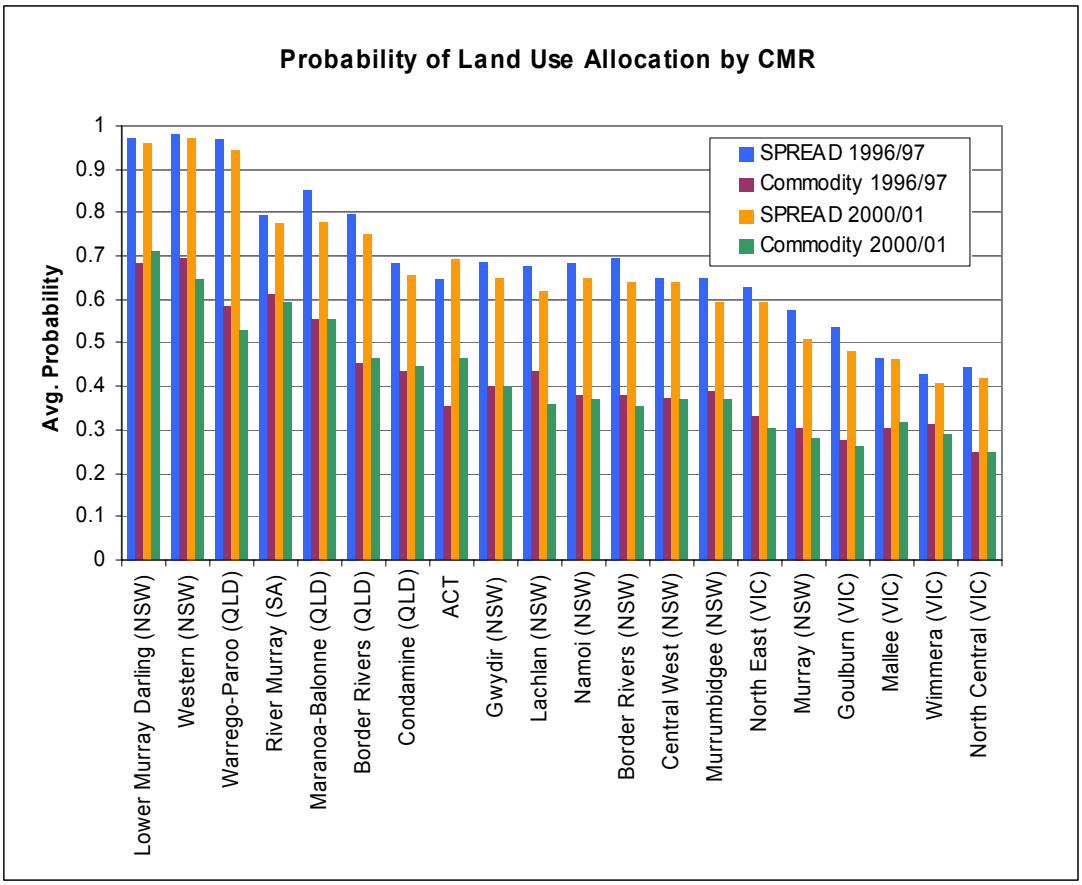


Figure 17 – Average probability of allocation of SPREAD class and Commodity agricultural land uses in the Murray-Darling Basin 1996/97 and 2000/01 by Catchment Management Region.

When Commodity classes are allocated to pixels the average probabilities of correct classification is lower because of the increased uncertainty associated with the allocation of Commodity classes (Figure 18). The Commodities with the highest average probability are Sheep, Cotton, Grapes, Beef Cattle and Rice. High probabilities of correct allocation occur because of a combination of factors including the area of the Commodity (Commodities with larger areas naturally have a higher probability), and the distinctiveness of the NDVI signature of the land use. Probabilities are also higher for Commodities which have their own unique SPREAD class (e.g. Rice, Cotton, Grapes etc. (see Appendix 1)) because the average probability of SPREAD allocation is the same as the average probability of Commodity allocation. More than half of all Commodity classes have an average probability of correct classification of < 0.1.

The spatial distribution of the probability of correct Commodity class allocation follows similar patterns to that of the SPREAD class probabilities (Figure 19; Figure 20). Specifically, the areas of diverse land uses have a much lower probability of correct allocation because there is more Commodities to choose from and hence, more uncertainty in allocation to a single Commodity. In the interior of the MDB there are highly variable probabilities. Patches of high probability occur alongside patches of very low

probability. This all suggests that pixel level analysis of Commodity maps and their economic derivatives produced in this study is subject to significant spatial uncertainty at the intra-SLA scale. As a rule of thumb the pixel level maps produced in this study are robust to aggregation by spatial units of similar scale to the SLA and coarser such as sub-catchment, local government, CMR, state or basin. Any future use of both the SPREAD class land use maps and the Commodity maps and their derivatives should be done with full cognisance of the spatial uncertainty of spatial allocation.

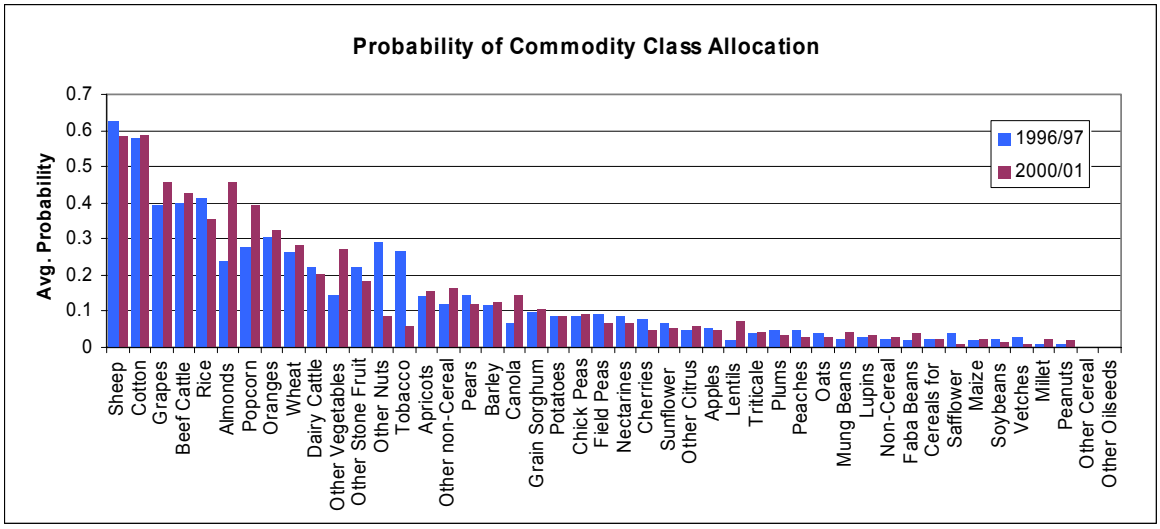


Figure 18 – Average probability of allocation of Commodities in the Murray-Darling Basin 1996/97 and 2000/01. Derived from a combination of SPREAD II probabilities and proportional area probabilities.

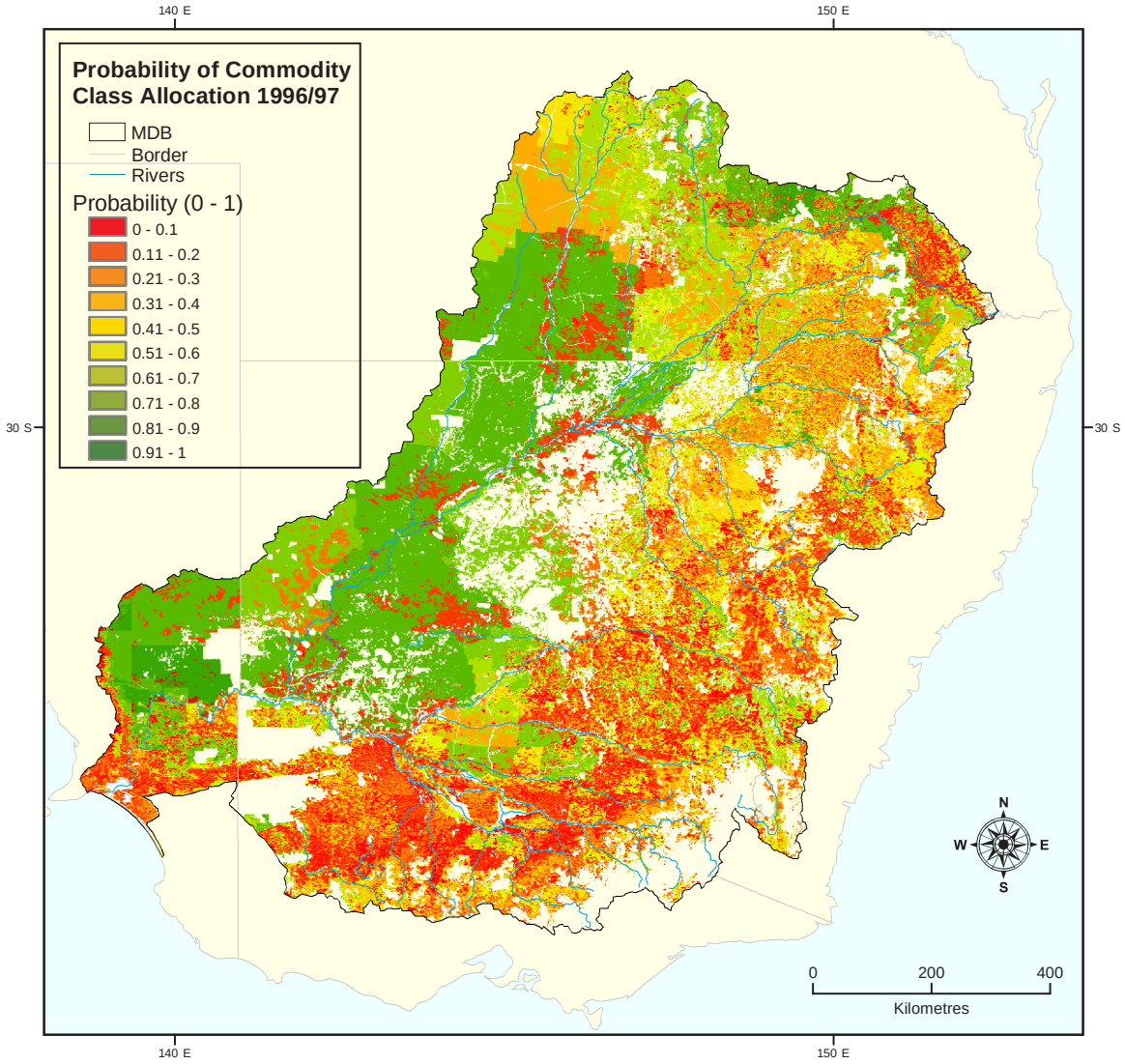


Figure 19 – Uncertainty in allocation of Commodities in the Murray-Darling Basin 1996/97. Red pixels have low probability of allocation and high uncertainty grading through to green pixels with high probability and low uncertainty.

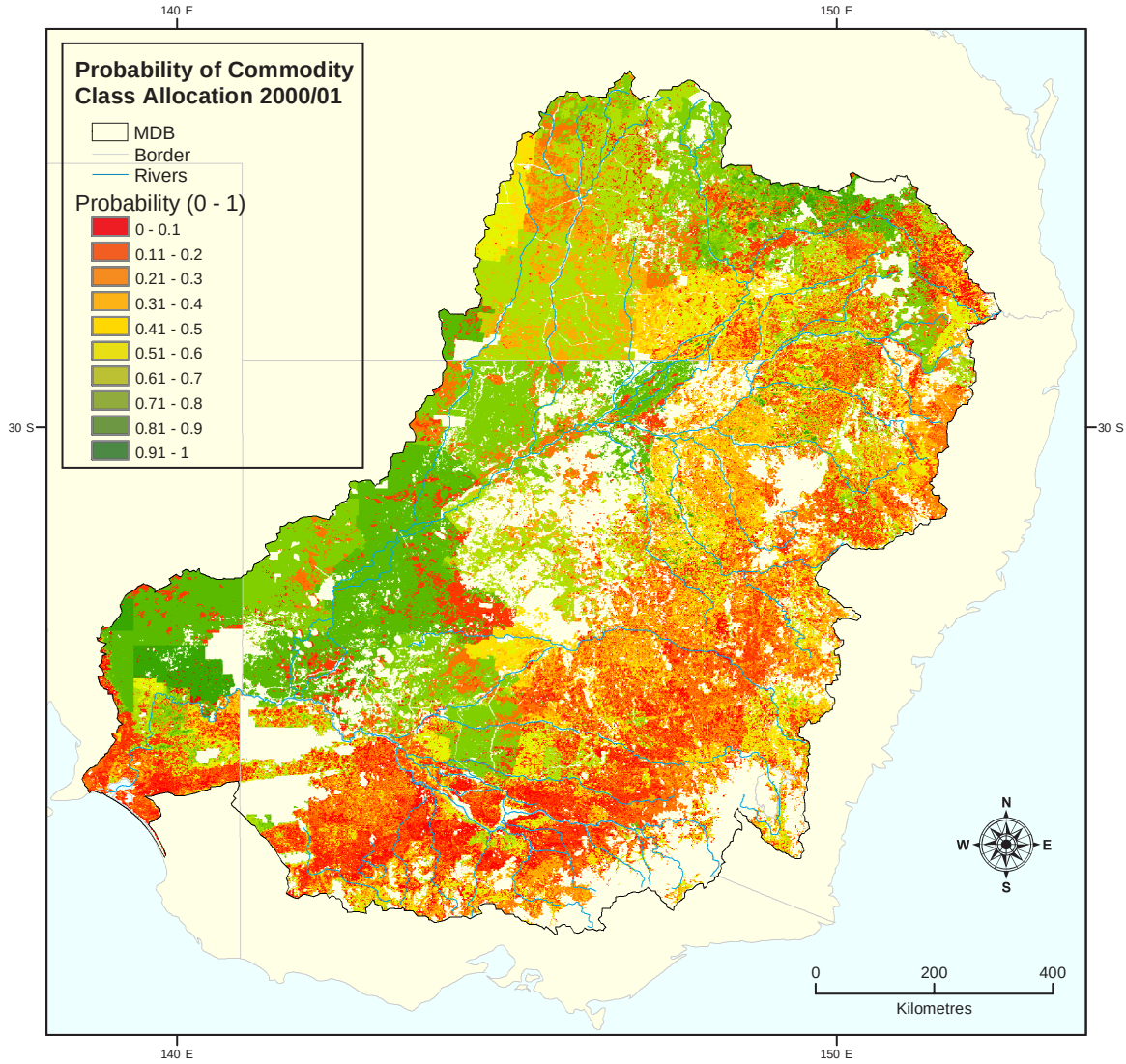


Figure 20 – Uncertainty in allocation of Commodity class agricultural land uses in the Murray-Darling Basin 2000/01. Red pixels have low probability of allocation and high uncertainty grading through to green pixels with high probability and low uncertainty.

3.2 Water Resources and Use

3.2.1 Areas of Irrigated Agriculture

In the land use maps which include the area scaling (see Section 2.2.7), BRS estimate the total area of irrigated land in the Murray-Darling Basin at around 1.6 million hectares in 1996/97 and 1.9 million hectares in 2000/01, an increase of 16% (Table 5). Slightly different figures were obtained from the unmodified AgStats areas used throughout this study (1.5 million ha in 1996/97 and 1.8 million ha in 2000/01 – an increase of 22%; Table 8).

Estimates of areas of irrigated Commodities should be interpreted with caution due to the uncertainty involved in mapping Agricultural Land Uses and Commodities discussed in Section 3.1.3 . With this caveat in mind, the results of this study suggest that of the total irrigated area in the MDB in 1996/97, 21% was under Dairy, 20% was under Cotton, 15% was under Beef, 13% was under Sheep and 10% was under Rice (Table 8, Figure 21, Table 9). Significant changes in the character of irrigated agriculture occurred between 1996/97 and 2000/01. The area of irrigated Dairy expanded by approximately 217,000 ha (to 29% of MDB irrigated area). The expansion of irrigated Dairy pasture (71% increase) far outpaced the expansion of Dairy pasture on the whole (19% increase) suggesting a large scale shift from dryland to irrigated pastures. However, there is some uncertainty surrounding these estimates and more research is required to verify this change.

Cotton expanded by around 108,000 ha (to 22% of MDB irrigated area). Irrigated Cereals expanded by around 90,000 ha (to 13% of MDB irrigated area), Grapes expanded by around 33,000 ha and Rice by some 24,000 ha. Irrigated Sheep pasture contracted by 118,000 ha and Beef pasture contracted by 23,000 ha (Table 8). To summarise, in the southern parts of the MDB it seems that irrigated pasture is being used less for grazing Beef Cattle and Sheep and may be being converted to Dairy Cattle pastures or higher value crops such as Cereals, Grapes and Rice. The results also suggest that significant new areas have also opened up to irrigation. In the southern CMRs, newly irrigated areas are opening up with a variety of land uses including Dairy, Cereals, Grapes and Fruit. In the northern CMRs these areas previously used for dryland agriculture are being opened up to irrigation largely for Cotton.

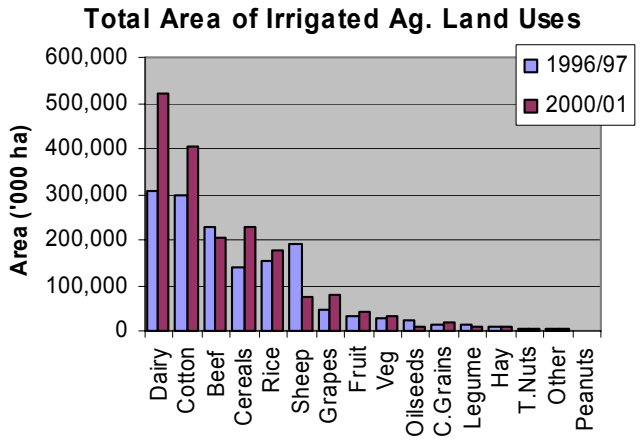


Figure 21 – Estimated total area of irrigated Agricultural Land Uses in the Murray-Darling Basin 1996/97 and 2000/01.

Irrigated Agricultural Land Use	Total Irrigated Area(ha)	% of Total MDB Irr. Area	Water Req (ML/ha)	Total Water Req (ML)	% of Total MDB Water Req.	Gross Revenue ($'000)	% of Gross Irrigation Revenue	% of Gross MDB Revenue	Returns to Water ($Rev/ML)	Total PFE ($'000)	% of Total Irrigation PFE	% of Total MDB PFE	Returns to Water ($PFE/ML)	Total NER ($'000)	% of Total Irrigation NER	% of Total MDB NER	Returns to Water ($NER/ML)
1996/97																	
Beef	229,104	15.4	4.1	930,127	10.3	20,250	0.6	0.2	22	-15,339	-1.1	-0.4	-16	-16,041	-1.3	-0.5	-17
Cereals	139,561	9.4	3.1	433,812	4.8	92,270	2.5	0.8	213	27,652	2.0	0.7	64	25,771	2.0	0.8	59
Coarse Grains	13,045	0.9	4.9	64,361	0.7	18,269	0.5	0.2	284	5,005	0.4	0.1	78	4,762	0.4	0.1	74
Cotton	297,148	20.0	7.2	2,126,495	23.6	1,126,010	30.9	9.6	530	549,038	39.2	14.2	258	549,038	42.8	17.1	258
Dairy	305,740	20.6	8.1	2,464,170	27.4	521,878	14.3	4.5	212	234,743	16.7	6.1	95	229,548	17.9	7.2	93
Fruit	31,074	2.1	7.8	242,972	2.7	588,294	16.1	5.0	2421	226,941	16.2	5.9	934	208,446	16.3	6.5	858
Grapes	46,818	3.2	6.5	304,605	3.4	468,111	12.8	4.0	1537	122,790	8.8	3.2	403	81,116	6.3	2.5	266
Hay	8,421	0.6	9.9	83,377	0.9	2,760	0.1	0.0	33	-779	-0.1	0.0	-9	-825	-0.1	0.0	-10
Legumes	15,427	1.0	4.2	64,134	0.7	9,954	0.3	0.1	155	2,389	0.2	0.1	37	2,231	0.2	0.1	35
Oilseeds	22,366	1.5	3.2	71,224	0.8	13,415	0.4	0.1	188	3,088	0.2	0.1	43	2,870	0.2	0.1	40
Other	2,612	0.2	3.6	9,413	0.1	96,810	2.7	0.8	10285	22,256	1.6	0.6	2364	3,190	0.2	0.1	339
Peanuts	212	0.0	2.9	615	0.0	553	0.0	0.0	900	240	0.0	0.0	391	231	0.0	0.0	376
Rice	151,868	10.2	10.8	1,640,170	18.2	309,553	8.5	2.6	189	110,270	7.9	2.8	67	84,652	6.6	2.6	52
Sheep	190,881	12.9	4.0	763,523	8.2	26,142	0.7	0.2	34	-5,454	-0.4	-0.1	-7	-10,091	-0.8	-0.3	-13
Tree Nuts	3,684	0.2	7.0	25,787	0.3	35,581	1.0	0.3	1380	20,319	1.5	0.5	788	16,192	1.3	0.5	628
Vegetables	27,226	1.8	4.5	122,131	1.3	315,221	8.6	2.7	2581	83,439	6.0	2.2	683	83,439	6.6	2.6	683
TOTAL	**1,485,186**	**100.0**	**6.3**	**9,346,916**	**100.0**	**3,645,071**	**100.0**	**31.2**	**390**	**1,386,598**	**100.0**	**36.0**	**148**	**1,264,528**	**100.0**	**39.6**	**135**
2000/01																	
Beef	206,016	11.3	4.1	848,961	7.2	25,454	0.6	0.2	30	-16,041	-1.3	-0.4	-19	-16,164	-1.5	-0.5	-19
Cereals	229,305	12.6	3.0	684,032	5.8	133,027	2.9	1.0	194	10,466	0.8	0.3	15	9,300	0.8	0.3	14
Coarse Grains	16,315	0.9	5.0	81,237	0.7	19,096	0.4	0.1	235	2,273	0.2	0.1	28	2,013	0.2	0.1	25
Cotton	404,911	22.3	7.1	2,855,619	24.2	1,072,267	23.3	7.9	375	247,871	20.0	6.6	87	218,149	19.7	6.8	76
Dairy	522,972	28.8	8.0	4,194,619	35.5	866,938	18.8	6.4	207	326,809	26.4	8.7	78	320,791	29.0	10.0	76
Fruit	40,371	2.2	7.7	310,462	2.6	593,892	12.9	4.4	1913	134,546	10.9	3.6	433	126,490	11.4	3.9	407
Grapes	80,018	4.4	6.5	523,693	4.4	951,613	20.6	7.0	1817	293,853	23.8	7.8	561	231,512	20.9	7.2	442
Hay	9,403	0.5	9.8	91,994	0.8	5,126	0.1	0.0	56	-334	0.0	0.0	-4	-383	0.0	0.0	-4
Legumes	9,685	0.5	3.8	36,802	0.3	5,213	0.1	0.0	142	149	0.0	0.0	4	60	0.0	0.0	2
Oilseeds	8,320	0.5	3.3	27,042	0.2	4,520	0.1	0.0	167	-4	0.0	0.0	0	-93	0.0	0.0	-3
Other	2,355	0.1	3.7	8,724	0.1	71,388	1.5	0.5	8183	6,509	0.5	0.2	746	6,270	0.6	0.2	719
Peanuts	0	0.0		0	0.0	0	0.0	0.0		0	0.0	0.0		0	0.0	0.0	
Rice	175,608	9.7	10.8	1,896,562	16.0	348,866	7.6	2.6	184	71,895	5.8	1.9	38	54,123	4.9	1.7	29
Sheep	73,284	4.0	4.0	293,135	2.4	13,310	0.3	0.1	45	-3,634	-0.3	-0.1	-12	-5,428	-0.5	-0.2	-19
Tree Nuts	5,834	0.3	7.0	40,835	0.3	38,026	0.8	0.3	931	10,181	0.8	0.3	249	8,328	0.8	0.3	204
Vegetables	34,160	1.9	4.6	156,750	1.3	462,469	10.0	3.4	2950	140,997	11.5	3.8	900	137,936	12.6	4.3	880
TOTAL	**1,818,557**	**100.0**	**6.6**	**12,050,467**	**100.0**	**4,611,205**	**100.0**	**33.9**	**383**	**1,225,537**	**100.0**	**32.8**	**102**	**1,092,903**	**100.0**	**34.2**	**91**
Total Change 1996/97 - 2000/01																	
Beef	-23,088	-4.1	-	-81,165	-3.2	5,204	0.0	0.0	8	-701.13	-0.2	0.0	-2	-123	-0.2	0.0	-2
Cereals	89,744	3.2	-	250,220	1.0	40,758	0.4	0.2	-18	-17,185.69	-1.1	-0.4	-48	-16,471	-1.2	-0.5	-46
Coarse Grains	3,270	0.0	-	16,876	0.0	827	-0.1	0.0	-49	-2,731.40	-0.2	-0.1	-50	-2,749	-0.2	-0.1	-49
Cotton	107,763	2.3	-	729,124	0.5	-53,743	-7.6	-1.8	-154	-301,167.03	-19.1	-7.6	-171	-330,889	-23.1	-10.3	-182
Dairy	217,232	8.2	-	1,730,449	8.1	345,060	4.5	1.9	-5	92,065.35	9.7	2.7	-17	91,243	11.1	2.8	-17
Fruit	9,297	0.1	-	67,490	-0.1	5,598	-3.3	-0.7	-508	-92,394.23	-5.3	-2.3	-501	-81,956	-4.8	-2.6	-450
Grapes	33,200	1.2	-	219,088	1.0	483,502	7.8	3.0	280	171,062.74	15.0	4.7	158	150,396	14.6	4.7	176
Hay	982	0.0	-	8,617	-0.1	2,365	0.0	0.0	23	445.32	0.0	0.0	6	441	0.0	0.0	6
Legumes	-5,741	-0.5	-	-27,332	-0.4	-4,742	-0.2	0.0	-14	-2,240.10	-0.2	-0.1	-33	-2,171	-0.2	-0.1	-33
Oilseeds	-14,045	-1.0	-	-44,182	-0.6	-8,895	-0.3	-0.1	-21	-3,091.92	-0.2	-0.1	-43	-2,962	-0.2	-0.1	-44
Other	-257	0.0	-	-689	0.0	-25,422	-1.1	-0.3	-2102	-15,746.61	-1.1	-0.4	-1618	3,081	0.3	0.1	380
Peanuts	-212	0.0	-	-615	0.0	-553	0.0	0.0	-900	-240.32	0.0	0.0	-391	-231	0.0	0.0	-376
Rice	23,740	-0.6	-	256,391	-2.2	39,314	-0.9	-0.1	-5	-38,374.92	-2.1	-0.9	-29	-30,529	-1.7	-1.0	-23
Sheep	-117,597	-8.8	-	-470,388	-5.7	-12,832	-0.4	-0.1	11	1,820	0.1	0.0	-5	4,662	0.3	0.1	-5
Tree Nuts	2,150	0.1	-	15,047	0.1	2,445	-0.2	0.0	-449	-10,138	-0.6	-0.3	-539	-7,864	-0.5	-0.2	-424
Vegetables	6,935	0.0	-	34,619	0.0	147,249	1.4	0.7	369	57,558	5.5	1.6	216	54,496	6.0	1.7	197
TOTAL	**333,371**	**-**	**-**	**2,703,551**		**966,134**		**2.7**	**-7**	**-161,061**		**-3.1**	**-47**	**-171,625**	**-**	**-5.5**	**-45**
% Change 1996/97 - 2000/01																	
Beef	-10.1	-	-	-8.7	-	25.7	-	-	38	4.6	-	-	15	0.8	-	-	10
Cereals	64.3	-	-	57.7	-	44.2	-	-	-9	-62.1	-	-	-76	-63.9	-	-	-77
Coarse Grains	25.1	-	-	26.2	-	4.5	-	-	-17	-54.6	-	-	-64	-57.7	-	-	-67
Cotton	36.3	-	-	34.3	-	-4.8	-	-	-29	-54.9	-	-	-66	-60.3	-	-	-70
Dairy	71.1	-	-	70.2	-	66.1	-	-	-2	39.2	-	-	-18	39.7	-	-	-18
Fruit	29.9	-	-	27.8	-	1.0	-	-	-21	-40.7	-	-	-54	-39.3	-	-	-53
Grapes	70.9	-	-	71.9	-	103.3	-	-	18	139.3	-	-	39	185.4	-	-	66
Hay	11.7	-	-	10.3	-	85.7	-	-	68	-57.1	-	-	-61	-53.5	-	-	-58
Legumes	-37.2	-	-	-42.6	-	-47.6	-	-	-9	-93.8	-	-	-89	-97.3	-	-	-95
Oilseeds	-62.8	-	-	-62.0	-	-66.3	-	-	-11	-100.1	-	-	-100	-103.2	-	-	-108
Other	-9.9	-	-	-7.3	-	-26.3	-	-	-20	-70.8	-	-	-68	96.6	-	-	112
Peanuts	-100.0	-	-	-100.0	-	-100.0	-	-	-100	-100.0	-	-	-100	-100.0	-	-	-100
Rice	15.6	-	-	15.6	-	12.7	-	-	-3	-34.8	-	-	-44	-36.1	-	-	-45
Sheep	-61.6	-	-	-61.6	-	-49.1	-	-	33	-33.4	-	-	74	-46.2	-	-	40
Tree Nuts	58.4	-	-	58.4	-	6.9	-	-	-33	-49.9	-	-	-68	-48.6	-	-	-68
Vegetables	25.5	-	-	28.3	-	46.7	-	-	14	69.0	-	-	32	65.3	-	-	29
TOTAL	**22.4**	**-**	**-**	**28.9**	**-**	**26.5**	**-**	**-**	**-2**	**-11.6**	**-**	**-**	**-31**	**-13.6**	**-**	**-**	**-33**

Table 8 – Summary of estimated water requirements and returns to water from irrigated areas of Agricultural Land Use in 1996/97 and 2000/01 including assessment of change.

Agricultural Land Use	Irrigated Area (ha)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	Grand Total
Beef	1996/97		1,640	1,304	7,081	4,082	19,117	308	15,584	659	95	226	80,264	65,546	4,140	21,847	4,539	1,825	0	497	350	**229,104**
	2000/01		2,431	5,284	6,573	354	13,476	1,592	10,159	1,358	1,467	5,615	43,279	76,053	7,024	12,905	5,643	6,510	5,290	840	163	**206,016**
	% Change		48.2	305.2	-7.2	-91.3	-29.5	416.3	-34.8	106.1	1,439.7	2,382.6	-46.1	16.0	69.6	-40.9	24.3	256.7	-	69.1	-53.5	**-10.1**
Cereals	1996/97		1,350	755	5,716	5,546	2,318	4,009	9,331	306	546	2,158	12,447	62,384	14,058	11,473		274		6,718	173	**139,561**
	2000/01		2,651	1,013	9,089	6,340	5,510	2,858	10,045	830	450	989	56,038	102,171	13,494	16,910		723		107	88	**229,305**
	% Change		96.3	34.1	59.0	14.3	137.7	-28.7	7.6	171.5	-17.7	-54.2	350.2	63.8	-4.0	47.4		163.6		-98.4	-49.5	**64.3**
Coarse Grains	1996/97		383	168	0	4,448	59	70	0			171	51	5,795	1,686	215						**13,045**
	2000/01		463	423	218	4,946	0	564	276			0	127	5,773	3,440	85						**16,315**
	% Change		21.1	151.3	-	11.2	-100.0	712.0	-			-99.9	150.5	-0.4	104.0	-60.5						**25.1**
Cotton	1996/97		37,844	19,346	32,754	31,062		76,900	0	210		20,366		266	59,683				1,201	17,514		**297,148**
	2000/01		40,481	28,896	55,951	33,670		94,101	2,489	0		43,803		14,897	70,470				293	19,859		**404,911**
	% Change		7.0	49.4	70.8	8.4		22.4	-	-100.0		115.1		5,500.2	18.1				-75.6	13.4		**36.3**
Dairy	1996/97			0	1,057	1,527	143,158	0	453		1,807		27,306	687	1,010	119,682	0	8,817		0	236	**305,740**
	2000/01			94	1,825	8,307	184,063	253	6,026		2,510		127,015	7,772	1,295	170,989	3,193	9,335		297	0	**522,972**
	% Change			-	72.6	443.9	28.6	-	1,231.1		38.9		365.2	1,031.4	28.2	42.9	-	5.9		-	-100.0	**71.1**
Fruit	1996/97		0	1,817	954	44	6,758	0	794	1,488	4,639		175	7,301		483	132	6,489		0		**31,074**
	2000/01		18	2,570	1,143	583	9,855	143	1,480	1,778	4,365		225	8,216		1,445	165	8,272		112		**40,371**
	% Change		-	41.5	19.8	1,215.3	45.8	-	86.5	19.5	-5.9		28.8	12.5		199.4	25.0	27.5		-		**29.9**
Grapes	1996/97			105	846		760		1,127	3,408	16,387	166	358	7,477		828	888	14,106	0	297	65	**46,818**
	2000/01			534	2,321		1,790		2,023	5,935	23,305	0	901	13,883		726	2,514	24,580	286	678	543	**80,018**
	% Change			407.9	174.2		135.6		79.5	74.1	42.2	-100.0	151.8	85.7		-12.3	183.2	74.3	-	128.5	734.1	**70.9**
Hay	1996/97		163	206	75	661	1,047	0	948	86		83	991	1,656	503	1,329		602		72		**8,421**
	2000/01		44	129	0	815	1,287	99	687	0		204	2,144	775	0	3,065		154		0		**9,403**
	% Change		-72.9	-37.5	-100.0	23.2	23.0	-	-27.5	-100.0		144.3	116.3	-53.2	-100.0	130.7		-74.4		-100.0		**11.7**
Legumes	1996/97		212	479	235	114	1,450	0	1,254				4,828	6,361	0	198		295				**15,427**
	2000/01		215	283	414	606	815	152	695				1,490	3,700	774	452		89				**9,685**
	% Change		1.5	-41.0	76.2	431.7	-43.8	-	-44.6				-69.1	-41.8	-	128.0		-69.7				**-37.2**
Oilseeds	1996/97		93		506	0	160	0	1,197			142	5,518	11,753	234	1,767		0		997		**22,366**
	2000/01		173		285	422	0	206	1,194			0	1,153	2,443	1,819	451		173		0		**8,320**
	% Change		86.8		-43.7	-	-100.0	-	-0.3			-100.0	-79.1	-79.2	676.8	-74.5		-		-100.0		**-62.8**
Other	1996/97		0	4	57	485	347		0		11		27	55		198	1,338	90	0		0	**2,612**
	2000/01		0	3	71	156	150		7		54		17	107		5	1,614	169	1		0	**2,355**
	% Change		-	-11.4	24.1	-67.9	-56.7		-		398.5		-37.2	95.7		-97.4	20.6	88.7	-		-	**-9.9**
Peanuts	1996/97			212																		**212**
	2000/01			0																		**0**
	% Change			-100.0																		**-100.0**
Rice	1996/97						640		547				69,522	81,158		0	0					**151,868**
	2000/01						1,259		1,103				82,826	89,919		395	105					**175,608**
	% Change						96.7		101.6				19.1	10.8		-	-					**15.6**
Sheep	1996/97		139		5,296		14,741	451	8,182	358	956		61,481	43,183	1,143	47,015	4,313	2,464			1,157	**190,881**
	2000/01		0		1,645		8,797	0	9,740	0	99		6,160	9,032	0	35,352	410	1,315			734	**73,284**
	% Change		-100.0		-68.9		-40.3	-100.0	19.0	-100.0	-89.6		-90.0	-79.1	-100.0	-24.8	-90.5	-46.7			-36.6	**-61.6**
Tree Nuts	1996/97		196					489			1,296			133				1,569				**3,684**
	2000/01		348					232			3,099			155				1,999				**5,834**
	% Change		78.0					-52.5			139.1			16.5				27.4				**58.4**
Vegetables	1996/97		152	1,735	1,772	1,296	2,089		2,232	269	2,625	141	1,611	7,459	0	2,259		3,586			0	**27,226**
	2000/01		206	2,254	628	2,035	3,693		1,126	218	3,249	0	1,379	9,284	103	3,710		6,175			101	**34,160**
	% Change		35.1	29.9	-64.6	57.0	76.8		-49.6	-18.7	23.8	-100.0	-14.4	24.5	-	64.2		72.2			-	**25.5**
1996/97 Irrigated Area (ha)		**0**	**42,173**	**26,132**	**56,348**	**49,266**	**192,643**	**82,227**	**41,649**	**6,783**	**28,363**	**23,455**	**264,578**	**301,214**	**82,457**	**207,294**	**11,210**	**40,117**	**1,201**	**26,094**	**1,981**	**1,485,186**
2000/01 Irrigated Area (ha)		**0**	**47,031**	**41,483**	**80,163**	**58,233**	**230,696**	**100,201**	**47,051**	**10,118**	**38,599**	**50,611**	**322,754**	**344,180**	**98,418**	**246,490**	**13,645**	**59,493**	**5,870**	**21,893**	**1,628**	**1,818,557**
% Change		**0**	**11.5**	**58.7**	**42.3**	**18.2**	**19.8**	**21.9**	**13.0**	**49.2**	**36.1**	**115.8**	**22.0**	**14.3**	**19.4**	**18.9**	**21.7**	**48.3**	**388.7**	**-16.1**	**-17.8**	**22.4**

Table 9 – Estimated areas of agricultural land use under irrigation in the Murray-Darling Basin by Catchment Management Region 1996/97 and 2000/01 including % change.

Dairy is the major irrigated Agricultural Land Use and its distribution is described in Section 3.1.2 Cotton is the second major irrigated crop in the MDB. Cotton occurs mostly in the northern parts of the MDB. The largest areas occur in the Gwydir (NSW), Namoi (NSW) and Central West (NSW) CMRs with significant areas also occurring in the Border Rivers (Qld and NSW) and Maranoa-Balonne (Qld) CMRs. Areas of irrigated Cotton increased by 36% from 1996/97 to 2000/01 with several CMRs experiencing expansion of up to 30,000 ha. Other CMRs such as the Lachlan (NSW) and Murrumbidgee (NSW) had smaller areas of Cotton in 1996/97 but experienced rapid expansion to 2000/01 (Table 9).

Irrigated Beef pasture occurs in many parts of the MDB with large areas occurring in the Murrumbidgee (NSW), Murray (NSW) and North Central (Vic) CMRs. Reductions in the area of irrigated Beef pasture occurred in many CMRs with the largest decreases occurring in the Murray (NSW) which decreased by 46% (37,000 ha). The total area of irrigated Beef pasture decreased by 10% across the MDB between 1996/97 and 2000/01. Similarly, the total area of irrigated Sheep pasture has decreased substantially (62%) across the MDB presumably as increasingly precious irrigation water is used for and traded to higher value land uses. Irrigated Sheep pasture largely occurs within the Murray (NSW) and Murrumbidgee (NSW) CMRs and both CMRs experienced large decreases in the area of irrigated Sheep pasture. Irrigated Cereals also mostly occur in the Murrumbidgee (NSW) and Murray (NSW) with substantial areas in the North Central (Vic) and other CMRs (Table 9). Increases in irrigated Cereals occurred in most CMRs with an increase in area across the MDB of around 90,000 ha (64%). The distribution of Rice and Grapes are described in Section 3.1.2

Areas of irrigated Fruit crops are concentrated in the Goulburn (Vic), Murrumbidgee (NSW), Mallee (NSW) and River Murray (SA) CMRs. Irrigated Fruit has increased in area by 30% from 1996/97 to 2000/01 over the MDB. Increases occurred in most CMRs, especially Goulburn (Vic) and River Murray (SA). Significant increases in irrigated Fruit have also occurred in other CMRs such as Lachlan (NSW) and Border Rivers (Qld) (Table 9). The area of irrigated Vegetables has increased by 7,000 ha (26%) across the MDB from 1996/97 to 2000/01. This has largely occurred in the Goulburn (Vic) and River Murray (SA) CMRs. Coarse Grains and other minor irrigated Agricultural Land Uses in the MDB and occur largely in the Murrumbidgee (NSW), Goulburn (Vic) and Murray (NSW) CMRs which tend to support a diversity of irrigated Agricultural Land Uses (Table 9).

Table 10 summarises the area of agriculture by CMR and state. NSW accounts for about 60% of the total irrigated area in the MDB with most irrigation occurring in the Murrumbidgee and Murray CMRs. Victoria accounts for 30% of the total irrigated area of agriculture with most occurring in the North Central and Goulburn CMRs. Queensland accounts for about 7% and South Australia 3% of the total area of irrigated agriculture in the MDB. The ACT has negligible irrigated agriculture.

State	Catchment Management Region	Total Area (Ha)	% of MDB Area	1996/97						2000/01					
				Total Area of Agriculture (Ha)	% of Total Area of Agriculture in MDB	Area of Irrigated Agriculture (Ha)	% of Area of Irrigated Agriculture in MDB	Total Water Requirements (ML)	% of Total Water Requirements in MDB	Total Area of Agriculture (Ha)	% of Total Area of Agriculture in MDB	Area of Irrigated Agriculture (Ha)	% of Area of Irrigated Agriculture in MDB	Total Water Requirements (ML)	% of Total Water Requirements in MDB
ACT	ACT	235,785	0.2	43,663	0.0	0	0.0	0	0.0	49,608	0.1	0	0.0	0	0.0
ACT Total		**235,785**	**0.2**	**43,663**	**0.0**	**0**	**0.0**	**0**	**0.0**	**49,608**	**0.1**	**0**	**0.0**	**0**	**0.0**
NSW	Border Rivers (NSW)	2,417,520	2.3	2,189,985	2.5	42,173	2.8	296,135	3.2	1,993,671	2.2	47,031	2.6	323,874	2.7
NSW	Central West (NSW)	8,494,920	8.0	7,051,568	8.1	56,348	3.8	342,517	3.7	7,228,833	8.2	80,163	4.4	518,208	4.3
NSW	Gwydir (NSW)	2,659,640	2.5	2,405,725	2.8	82,227	5.5	583,942	6.2	2,303,816	2.6	100,201	5.5	715,054	5.9
NSW	Lachlan (NSW)	8,627,050	8.1	6,695,888	7.7	41,649	2.8	178,185	1.9	7,424,857	8.4	47,051	2.6	234,818	1.9
NSW	Lower Murray Darling (NSW)	6,279,860	5.9	5,465,893	6.3	6,783	0.5	47,573	0.5	5,532,177	6.2	10,118	0.6	68,306	0.6
NSW	Murray (NSW)	3,537,820	3.3	2,652,458	3.0	264,578	17.8	1,619,295	17.3	2,952,523	3.3	322,754	17.7	2,279,846	18.9
NSW	Murrumbidgee (NSW)	6,971,920	6.6	5,630,213	6.4	301,214	20.3	1,745,310	18.7	5,691,848	6.4	344,180	18.9	2,009,207	16.7
NSW	Namoi (NSW)	4,199,940	4.0	3,241,417	3.7	82,457	5.6	536,382	5.7	3,284,804	3.7	98,418	5.4	637,041	5.3
NSW	Western (NSW)	16,621,400	15.7	13,748,700	15.7	26,094	1.8	260,298	2.8	14,657,142	16.5	21,893	1.2	266,592	2.2
NSW Total		**59,810,070**	**56.5**	**49,081,848**	**56.2**	**903,523**	**60.8**	**5,609,637**	**60.0**	**51,069,671**	**57.6**	**1,071,808**	**58.9**	**7,052,946**	**58.5**
QLD	Border Rivers (QLD)	3,744,660	3.5	3,499,769	4.0	26,132	1.8	152,775	1.6	3,372,158	3.8	41,483	2.3	241,079	2.0
QLD	Condamine (QLD)	2,441,860	2.3	2,319,095	2.7	49,266	3.3	225,953	2.4	2,207,177	2.5	58,233	3.2	295,359	2.5
QLD	Maranoa-Balonne (QLD)	6,422,140	6.1	6,244,328	7.2	23,455	1.6	132,782	1.4	5,982,498	6.7	50,611	2.8	296,571	2.5
QLD	Warrego-Paroo (QLD)	13,299,800	12.6	12,466,605	14.3	1,201	0.1	7,207	0.1	12,365,130	13.9	5,870	0.3	31,859	0.3
QLD Total		**25,908,460**	**24.5**	**24,529,798**	**28.1**	**100,054**	**6.7**	**518,717**	**5.5**	**23,926,963**	**27.0**	**156,198**	**8.6**	**864,867**	**7.2**
SA	River Murray (SA)	6,928,010	6.5	5,838,360	6.7	40,117	2.7	274,080	2.9	5,372,132	6.1	59,493	3.3	394,597	3.3
SA Total		**6,928,010**	**6.5**	**5,838,360**	**6.7**	**40,117**	**2.7**	**274,080**	**2.9**	**5,372,132**	**6.1**	**59,493**	**3.3**	**394,597**	**3.3**
VIC	Goulburn (VIC)	2,408,210	2.3	1,256,020	1.4	192,643	13.0	1,346,686	14.4	1,376,417	1.6	230,696	12.7	1,669,919	13.9
VIC	Mallee (VIC)	3,922,100	3.7	2,375,839	2.7	28,363	1.9	166,270	1.8	2,411,684	2.7	38,599	2.1	222,202	1.8
VIC	North Central (VIC)	2,964,530	2.8	1,995,720	2.3	207,294	14.0	1,381,024	14.8	2,246,769	2.5	246,490	13.6	1,789,492	14.8
VIC	North East (VIC)	1,981,940	1.9	947,017	1.1	11,210	0.8	41,274	0.4	870,709	1.0	13,645	0.8	49,306	0.4
VIC	Wimmera (VIC)	1,699,280	1.6	1,257,988	1.4	1,981	0.1	9,228	0.1	1,338,332	1.5	1,628	0.1	7,138	0.1
VIC Total		**12,976,060**	**12.3**	**7,832,584**	**9.0**	**441,492**	**29.7**	**2,944,482**	**31.5**	**8,243,910**	**9.3**	**531,058**	**29.2**	**3,738,057**	**31.0**
Grand Total		105,858,385	100.0	87,326,253	100.0	1,485,186	100.0	9,346,916	100.0	88,662,284	100.0	1,818,557	100.0	12,050,467	100.0

Table 10 – Summary of area, agricultural area, irrigated area and water requirements (ML) by Catchment Management Region and state 1996/97 and 2000/01 including proportional information.

3.2.2 Water Requirements of Irrigated Agriculture

As a corollary to the 22% increase in the area of irrigated agriculture in the MDB between 1996/97 and 2000/01, total water requirements of irrigated agriculture also increased significantly. Total water requirement figures should be treated as estimates and should be interpreted with due caution as results are dependent upon the assumptions made in both mapping livestock (see Section 2.2.7) and modelling water requirements (see Section 2.3.4.2).

The total water requirements of agricultural land uses in the MDB in 1996/97 were estimated in this study to be around 9,346 GL and 12,050 GL in 2000/01 – an increase of just under 29%. This increase in irrigation water requirements reflects not only the increase in area, but also the change in the types of agricultural land uses that are irrigated in the MDB. Specifically, water seems to have moved from lower value, less intensive irrigated land uses like Beef and Sheep pasture to higher value land uses with a greater water requirement such as Fruit, Grapes, Dairy, Cotton and Rice.

These modelled estimations of the water requirements of irrigated agricultural crops in the MDB suggest a significant increase in actual irrigation water use from 1996/97 to 2000/01. However, this does not seem to be the case (Table 11). In the MDB, water requirements for irrigated agriculture are met from a combination of rainfall, surface water and groundwater. The MDB experienced fairly average rainfall in both 1996/97 and 2000/01. Total surface water diversion for irrigation in 1996/97 was 11,825 GL (MDBC 1998), compared to 11,369 GL in 2000/01 (MDBC 2002). Basin level groundwater figures are not available for 1996/97 but the figure for 1999/00 (the first year for which data was collected) is 1,052 GL compared with 1,240 GL in 2000/01. Thus, whilst rainfall remained fairly constant between 1996/97 and 2000/01, the reported diversion of surface water for irrigation decreased by 456 GL whilst the use of groundwater increased over this period.

Although there is significant uncertainty surrounding both the estimates of total water requirements used in this study and the MDBC water audit reporting it is clear that irrigation has expanded significantly between 1996/97 and 2000/01 whilst total surface water diversions have decreased. An increase in groundwater may account for some of the increase in the area of irrigated agriculture. We suggest that significant efficency gains both on-farm and in the water delivery systems may have also enabled the increase in irrigated agriculture in the MDB without requiring significant change in the quantities of water diverted. In particular:

- Improvements in water delivery mechanisms (e.g. piped delivery replacing open channels) may have significantly reduced losses through leakages and evaporation, hence and a greater proportion of diverted water actually reaches farms;

- Many on-farm improvements in irrigation technologies and management techniques (e.g. water re-use, more efficient water application methods, soil moisture metering) may have also resulted in significant increases in water use

efficiency. The surplus water leftover from efficiency gains may then used to expand irrigation either on the same farm or traded elsewhere.

These results suggest that larger areas of crops are being grown with the same amount of water. The result of the postulated increases in groundwater usage and increases in irrigation efficiency is that, on aggregate, more water is being used by the evapotranspirative requirements of agricultural land uses and there are less return flows to the river through run off and through groundwater systems. This eventuality has been predicted by Young and McColl (2003) and this study provides some of the first evidence of this effect. However, the magnitude of the effect as suggested by our water requirement figures, may be larger than the 1072 GL loss predicted by Young and McColl (2003). These findings have important implications for environmental flows and water policy and more research is required to understand and manage the effects of increased groundwater use in irrigation and increases in irrigation efficiency.

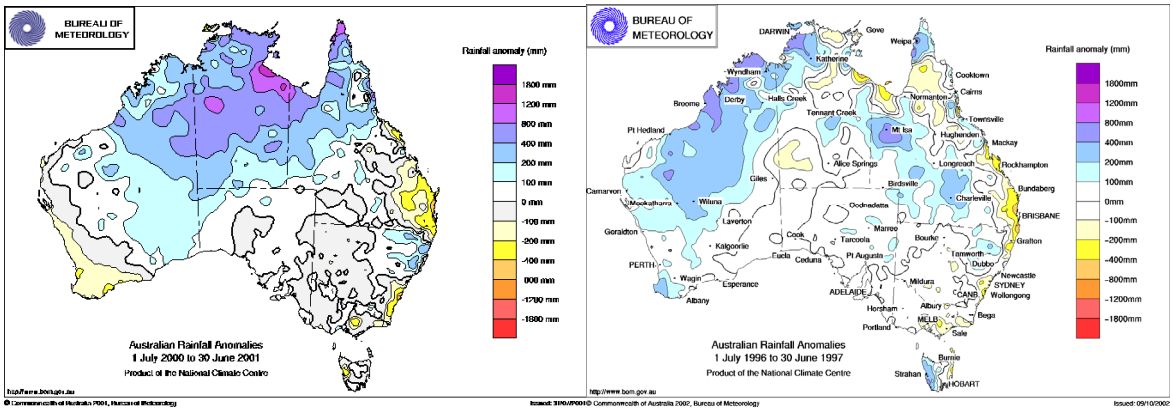


Figure 22 – Rainfall anomaly maps from the Bureau of meteorology displaying very little departure from long term average annual rainfall in the Murray-Darling Basin for both 1996/97 and 2000/01.

State	1996/97 MDBC Water Audit	1996/97 Water Requirement	% Difference	2000/01 MDBC Water Audit	2000/01 Water Requirement	% Difference
New South Wales	7,034	5,610	-20.2	6,943	7,053	1.6
Victoria	3,851	2,944	-23.6	3,230	3,738	15.7
Queensland	456	519	13.8	674	865	28.3
South Australia	479	274	-42.8	517	395	-23.6
ACT	5	0	-100	5	0	-100
Total	**11,825**	**9,347**	**-20.9**	**11,369**	**12,051**	**6**

Table 11 – Comparison of water requirements (GL) estimates as modelled in this study to published data on water diversions from MDBC (1998, 2002). See Section 3.2.2 for a discussion of the uncertainty surrounding estimates of water requirements. Note that the ACT figures are net figures and irrigation is mostly for urban uses.

Different Agricultural Land Uses have different water requirements (Figure 23). Rice is the largest user of irrigation water quantities per hectare at 10.8 (ML/ha) on average. Hay is also high at 9.9 ML/ha. Dairy and Fruit require around 8 ML/ha and Cotton, Tree Nuts and Grapes require around 7 ML/ha. Cereals, Beef and Sheep pasture, Oilseeds and Vegetables require lower quantities of irrigation water per hectare (Table 8).

The total water requirements of the different Agricultural Land Uses follow the same general pattern as the irrigated areas (Table 8, Figure 23, Table 12). At 2,464 GL, Dairy had the largest total water requirement in 1996/97, accounting for 27% of the total WR in the MDB. The results show an increase in the water requirements of Dairy of 1,730 GL, thereby accounting for over 35% of the total MDB agricultural water requirements by 2000/01. This has resulted from both reported increases in total Dairy herd size and the apparent large scale conversion of dryland Dairy pastures to irrigated pastures as suggested by land use mapping. However, it is suspected that these figures are an overestimation caused by several factors and more research is required to verify these results. These factors include:

- the uncertainty involved in livestock and irrigated areas mapping;
- the failure of the mapping techniques used to account for large-scale advances in dairy farming techniques in the MDB that have led to increases in stocking rates of dairy cattle, and;
- the failure of water requirement modelling to account for improvements in irrigation technology such as water re-use and subsequent improvements in water use efficiency.

Cotton has the next largest water requirement and in 1996/97 accounted for 24% of the total water requirements in the MDB. Total water requirements of Cotton in the MDB increased by 730 GL in 2000/01 but the proportional share remained at 24%. Rice also has significant water requirements (18% of MDB total in 1996/97). Whilst the total water requirements of Rice in the MDB increased by 256 GL to 2000/01 the proportional share decreased to 16% as the expansion of other irrigated Agricultural Land Uses outstripped that of Rice. Other significant increases in water requirements occurred for Cereals and Grapes whilst the total water requirement of irrigated Sheep pasture decreased by 470 GL and Beef pasture by decreased by 81 GL (Table 8, Figure 23, Table 12).

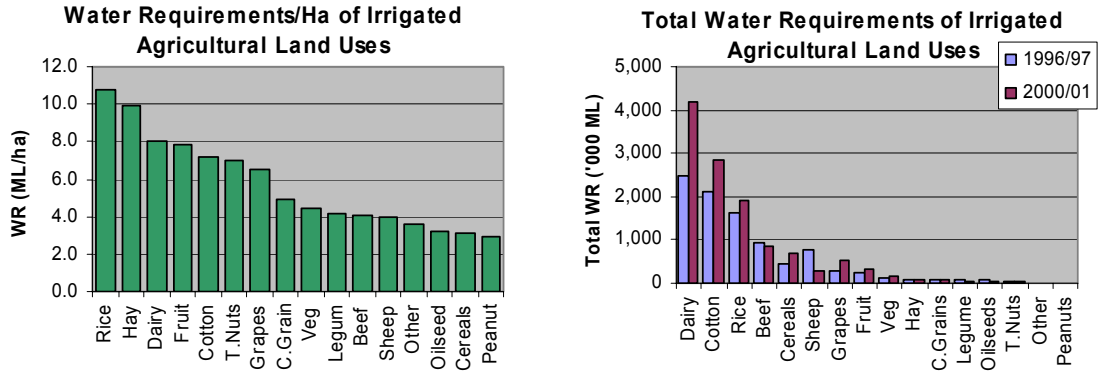


Figure 23 – Estimated water requirements per hectare (WR), and total water requirements of irrigated Agricultural Land Uses in the Murray-Darling Basin 1996/97 and 2000/01.

Catchment Management Regions have their own irrigation character which can clearly be seen in Figure 24 and Figure 25 which illustrate the mix of irrigated land uses by CMR in the MDB. To summarise, the bulk of the irrigation occurs in the south-eastern parts of the MDB. These areas are dairy farming areas. Irrigation in the south-western parts of the MDB is dominated by Grapes and Fruit orchards. Irrigation in the Murrumbidgee and to lesser extent, the Murray, is dominated by Rice growing and the northern parts of the MDB are Cotton growing areas.

Assessment of the spatial pattern of changes in water requirements from 1996/97 to 2000/01 (Figure 26) reveals that most southern CMRs experienced significant increases in total water requirements of irrigated agriculture. The Murray (NSW) CMR experienced an increase in total irrigation water requirements of over 650 GL, North Central (Vic) increased over 400 GL, whilst the Murrumbidgee (NSW) and Goulburn (Vic) CMRs increased around 300 GL. However, Wimmera (Vic) was a special case where total water requirements decreased largely because of decreases in irrigated Dairy and Beef pastures. Increases in water requirements were experienced in the Maranoa-Balonne (Qld) which more than doubled its water requirements over the 5 years to 2000/01 due to the boom in Cotton production. The Central West (NSW), Gwydir (NSW) and Namoi (NSW) CMRs increased their water requirements by well over 100 GL owing largely to Cotton expansion. Water requirements in the River Murray (SA) also increased by a similar amount mainly due to the expansion of Grapes (Figure 26, Table 9, Table 10).

Agricultural Land Use	Water Requirements (ML)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	Grand Total
Beef	1996/97		6,774	6,984	30,547	22,450	76,075	1,326	67,474	2,963	381	1,244	321,031	263,537	17,703	87,388	13,618	6,997	0	2,235	1,401	**930,127**
	2000/01		10,070	28,899	28,233	1,946	52,749	6,658	43,538	6,109	5,868	30,882	173,116	305,742	29,853	51,545	17,132	23,094	29,095	3,778	652	**848,961**
	% Change		48.7	313.8	-7.6	-91.3	-30.7	402.2	-35.5	106.1	1,439.7	2,382.6	-46.1	16.0	68.6	-41.0	25.8	230.1	-	69.1	-53.5	**-8.7**
Cereals	1996/97		5,266	2,189	19,394	15,847	8,809	15,634	27,811	828	2,076	6,259	33,748	169,509	54,753	43,596		1,234		26,201	658	**433,812**
	2000/01		10,292	2,936	29,724	18,220	20,939	11,147	30,052	3,236	1,710	2,869	151,426	280,593	52,627	64,258		3,252		417	333	**684,032**
	% Change		95.5	34.1	53.3	15.0	137.7	-28.7	8.1	290.8	-17.7	-54.2	348.7	65.5	-3.9	47.4		163.6		-98.4	-49.5	**57.7**
Coarse Grains	1996/97		2,007	673	0	17,792	223	382	0			941	279	31,872	9,274	918						**64,361**
	2000/01		2,548	1,682	1,197	19,702	0	3,104	1,518			1	343	31,753	18,920	468						**81,237**
	% Change		27.0	150.0	-	10.7	-100.0	712.0	-			-99.9	23.0	-0.4	104.0	-49.0						**26.2**
Cotton	1996/97		276,265	116,205	239,106	140,044		561,371	0	2,688		122,199		1,543	435,685				7,207	224,185		**2,126,495**
	2000/01		295,363	172,886	408,446	152,160		686,937	18,821	0		262,818		89,435	512,795				1,760	254,198		**2,855,619**
	% Change		6.9	48.8	70.8	8.7		22.4	-	-100.0		115.1		5,696.9	17.7				-75.6	13.4		**34.3**
Dairy	1996/97			0	8,410	14,510	1,116,632	0	3,622		16,986		213,139	5,358	8,077	1,020,970	0	54,252		0	2,215	**2,464,170**
	2000/01			892	14,603	78,916	1,435,690	2,022	48,211		23,599		990,864	60,619	10,358	1,461,226	9,578	55,669		2,372	0	**4,194,619**
	% Change			-	73.6	443.9	28.6	-	1,231.1		38.9		364.9	1,031.4	28.2	43.1	-	2.6		-	-100.0	**70.2**
Fruit	1996/97		0	12,208	6,339	310	45,992	0	5,528	13,392	38,829		1,339	60,008		3,138	880	55,009		0		**242,972**
	2000/01		126	17,406	8,167	4,079	67,305	1,004	9,776	15,843	35,958		1,144	68,095		10,414	1,111	69,024		1,009		**310,462**
	% Change		-	42.6	28.8	1,215.3	46.3	-	76.8	18.3	-7.4		-14.6	13.5		231.9	26.2	25.5		-		**27.8**
Grapes	1996/97			368	6,008		3,799		8,000	24,199	81,935	582	2,540	53,090		4,139	4,438	113,074	0	2,108	325	**304,605**
	2000/01			1,870	16,476		8,949		14,363	42,136	116,526	0	6,396	98,566		3,628	12,571	193,680	1,002	4,816	2,714	**523,693**
	% Change			407.9	174.2		135.6		79.5	74.1	42.2	-100.0	151.8	85.7		-12.3	183.2	71.3	-	128.5	734.1	**71.9**
Hay	1996/97		1,627	2,064	745	6,611	10,466	0	9,481	861			9,911	16,556	5,030	13,289		6,017		717		**83,377**
	2000/01		441	1,290	0	8,147	12,873	990	6,870	0			21,441	7,750	0	30,654		1,538		0		**91,994**
	% Change		-72.9	-37.5	-100.0	23.2	23.0	-	-27.5	-100.0			116.3	-53.2	-100.0	130.7		-74.4		-100.0		**10.3**
Legumes	1996/97		1,167	1,917	1,119	456	6,443	0	4,228				18,773	28,777	0	397		858				**64,134**
	2000/01		840	811	1,242	547	3,593	592	2,351				7,279	14,690	3,113	1,343		401				**36,802**
	% Change		-28.0	-57.7	11.0	19.9	-44.2	-	-44.4				-61.2	-49.0	-	238.3		-53.2				**-42.6**
Oilseeds	1996/97		510		2,070	0	607	0	3,842			782	15,256	34,936	1,288	7,078		0		4,853		**71,224**
	2000/01		953		855	0	0	973	3,581			0	3,114	6,139	8,932	1,714		780		0		**27,042**
	% Change		86.8		-58.7	-	-100.0	-	-6.8			-100.0	-79.6	-82.4	593.5	-75.8		-		-100.0		**-62.0**
Other	1996/97		0	10	172	1,407	1,320		0		41		74	148		752	5,086	403	0		0	**9,413**
	2000/01		0	9	213	452	571		20		206		46	289		19	6,135	761	2		0	**8,724**
	% Change		-	-11.4	24.1	-67.9	-56.7		-		398.5		-37.2	95.7		-97.4	20.6	88.7	-		-	**-7.3**
Peanuts	1996/97			615																		**615**
	2000/01			0																		**0**
	% Change			-100.0																		**-100.0**
Rice	1996/97						6,912		5,911				750,836	876,511		0	0					**1,640,170**
	2000/01						13,597		11,914				894,521	971,127		4,265	1,137					**1,896,562**
	% Change						96.7		101.6				19.1	10.8		-	-					**15.6**
Sheep	1996/97		556		21,183		58,963	1,804	32,729	1,433	3,824		245,926	172,733	4,574	188,062	17,252	9,858			4,628	**763,523**
	2000/01		0		6,581		35,187	0	38,961	0	397		24,638	36,128	0	141,407	1,641	5,259			2,936	**293,135**
	% Change		-100.0		-68.9		-40.3	-100.0	19.0	-100.0	-89.6		-90.0	-79.1	-100.0	-24.8	-90.5	-46.7			-36.6	**-61.6**
Tree Nuts	1996/97		1,370					3,425			9,075			933				10,984				**25,787**
	2000/01		2,438					1,625			21,694			1,087				13,990				**40,835**
	% Change		78.0					-52.5			139.1			16.5				27.4				**58.4**
Vegetables	1996/97		594	9,542	7,425	6,526	10,446		9,559	1,208	13,123	774	6,443	29,799	0	11,297		15,394			0	**122,131**
	2000/01		802	12,398	2,471	11,190	18,465		4,842	982	16,244	0	5,518	37,194	442	18,551		27,147			503	**156,750**
	% Change		35.1	29.9	-66.7	71.5	76.8		-49.3	-18.7	23.8	-100.0	-14.4	24.8	-	64.2		76.3			-	**28.3**
Total 1996/97 Water Req. (ML)		0	296,135	152,775	342,517	225,953	1,346,686	583,942	178,185	47,573	166,270	132,782	1,619,295	1,745,310	536,382	1,381,024	41,274	274,080	7,207	260,298	9,228	**9,346,916**
Total 2000/01 Water Req. (ML)		0	323,874	241,079	518,208	295,359	1,669,919	715,054	234,818	68,306	222,202	296,571	2,279,846	2,009,207	637,041	1,789,492	49,306	394,597	31,859	266,592	7,138	**12,050,467**
Total % Change		0	9.4	57.8	51.3	30.7	24.0	22.5	31.8	43.6	33.6	123.4	40.8	15.1	18.8	29.6	19.5	44.0	342.0	2.4	-22.7	**28.9**

Table 12 – Estimated total irrigation water requirements (ML) of agricultural land uses by Catchment Management Region 1996/97 and 2000/01 including % change.

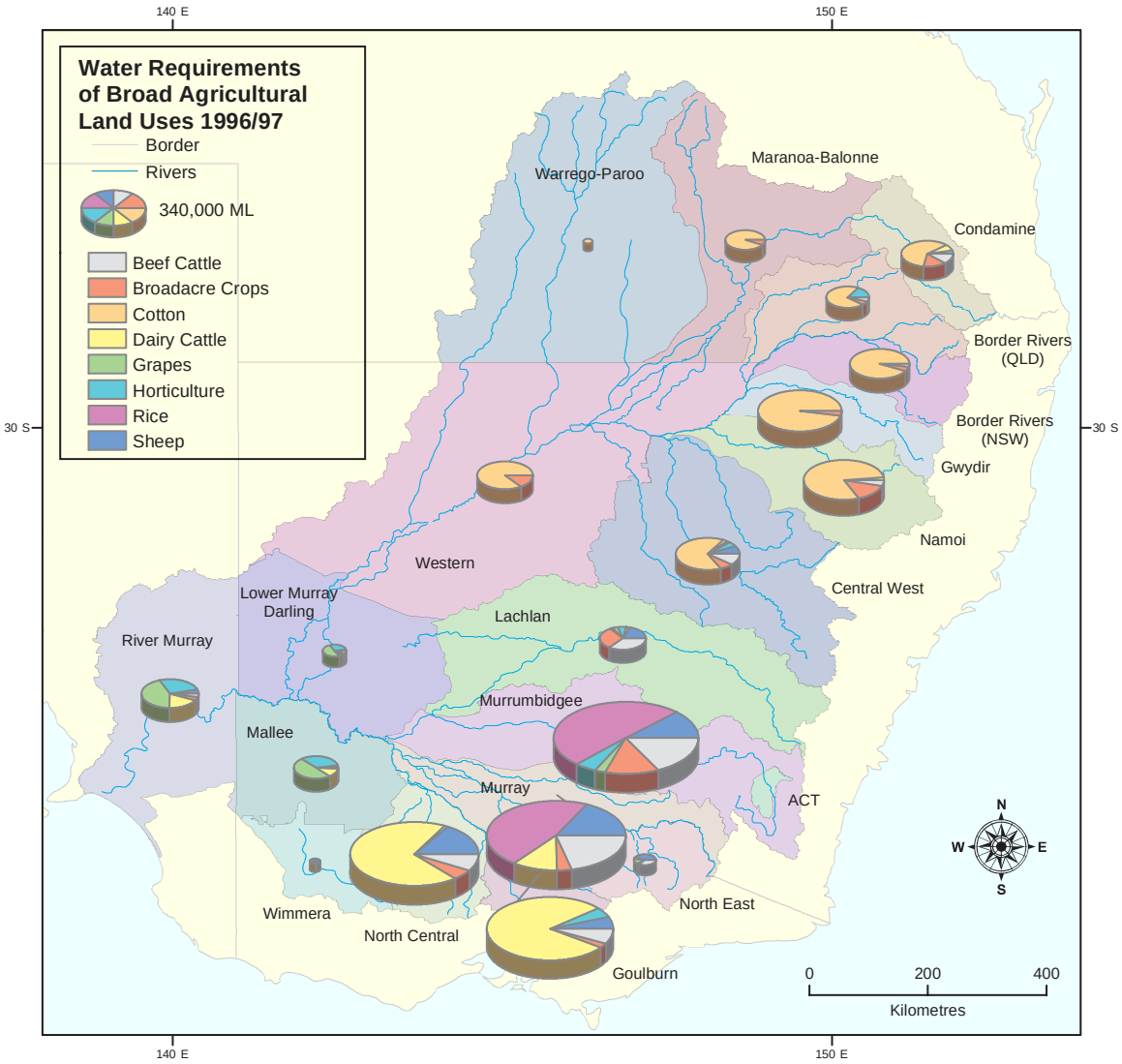


Figure 24 – Estimated amounts and proportions of water requirements of irrigated areas of broad agricultural land use by Catchment Management Region in the Murray-Darling Basin 1996/97.

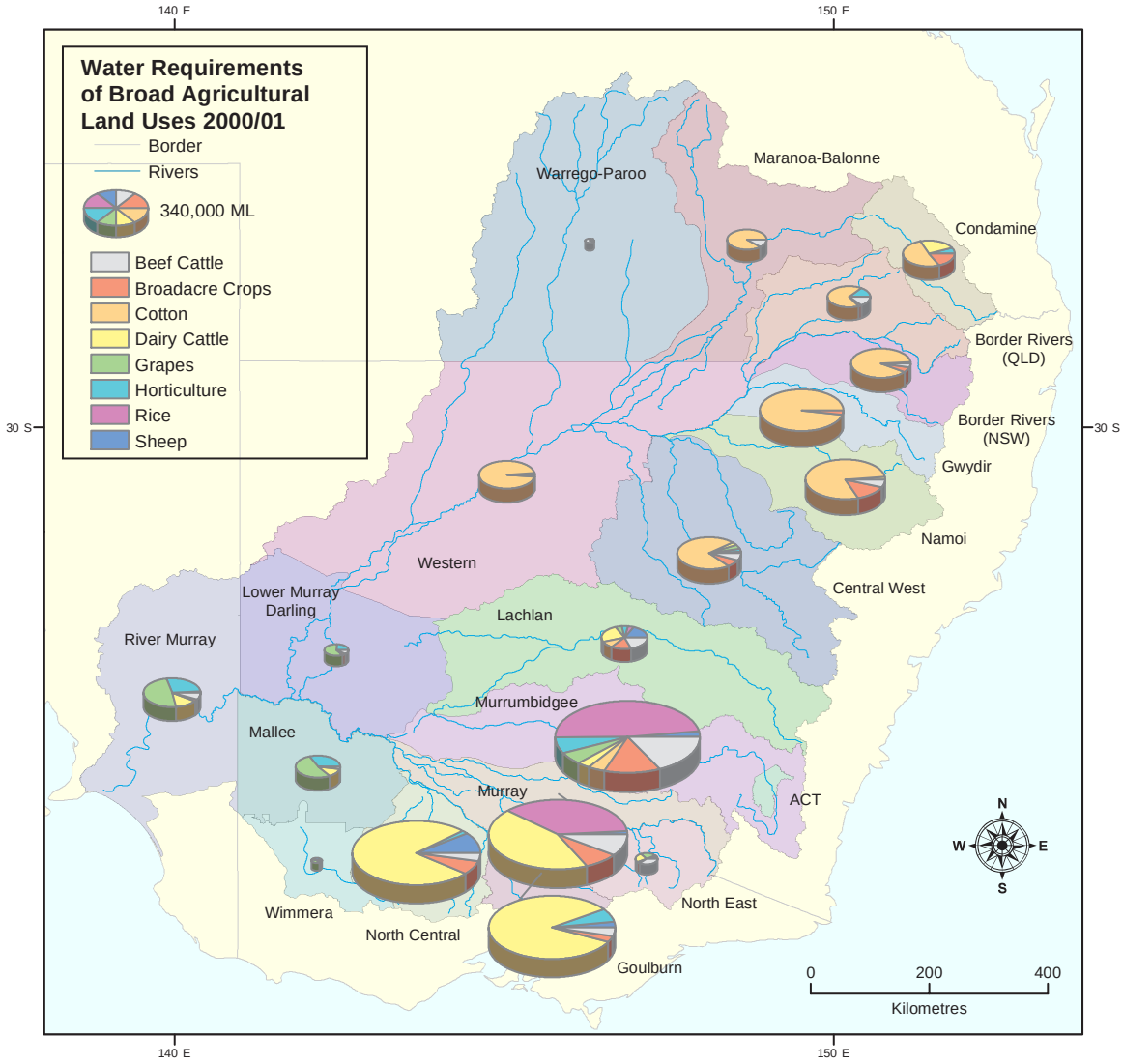


Figure 25 – Estimated amounts and proportions of water requirements of irrigated areas of broad agricultural land use by Catchment Management Region in the Murray-Darling Basin 2000/01.

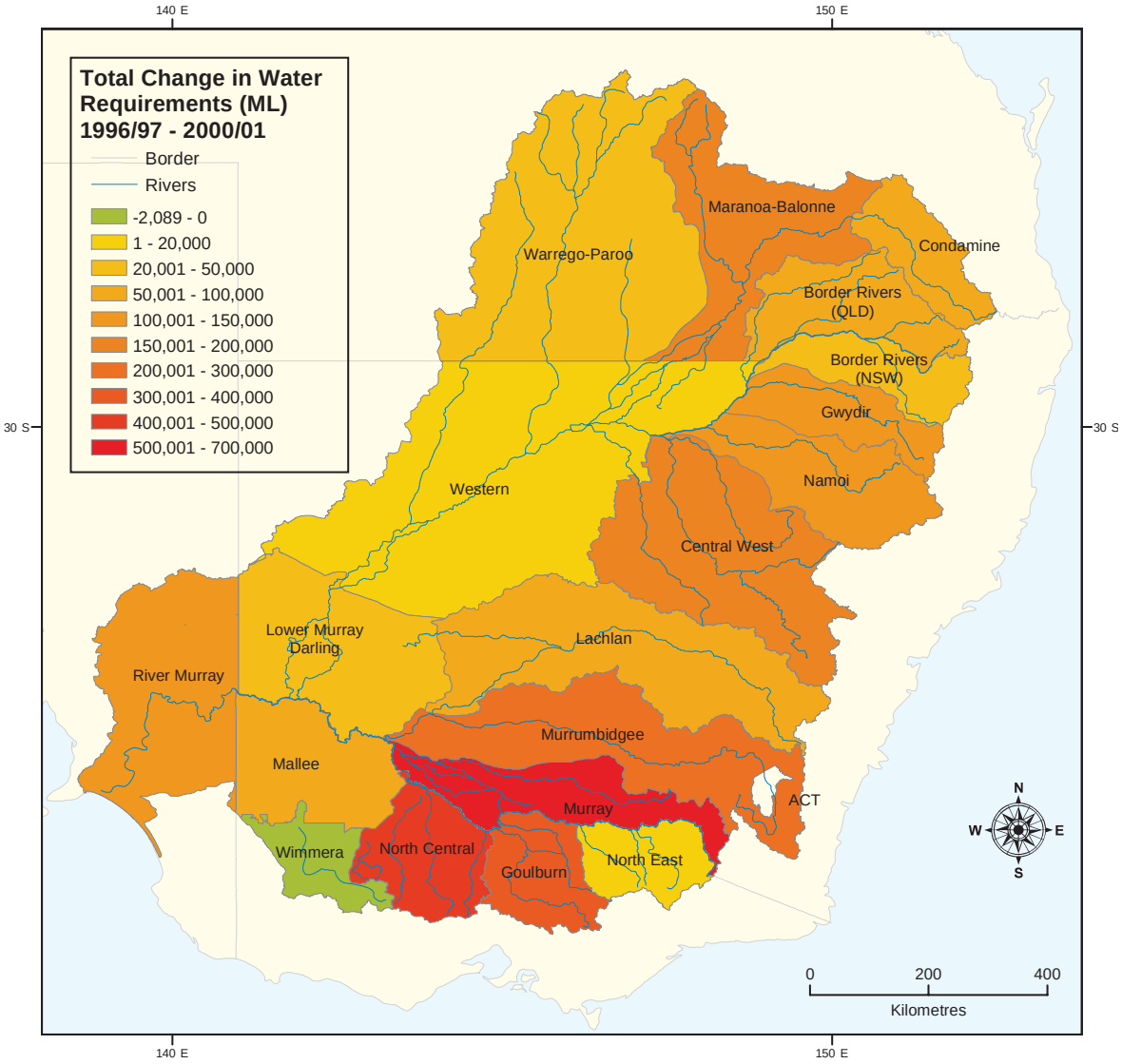


Figure 26 – Estimated total change in agricultural water requirements as a result of agricultural land use change by Catchment Management Region in the Murray-Darling Basin 2000/01. Green areas indicate a decrease in total water requirements, yellows to reds indicates an increase.

3.3 Returns to Agriculture

Assessment of the average profit function parameters over the MDB reveals some interesting changes from 1996/97 to 2000/01 (Table 13). Cost parameters change relatively little because of the use of the simple inflation factor of 1.1 in deriving the 2000/01 costs from those developed for 1996/97. Note that the average 2000/01 cost parameters are roughly equal to the 1996/97 values multiplied by 1.1 (see Section 2.3.4.4 but there is some variation due to the averaging of Commodities in the 16-class summary for Table 13.

Important differences occur in the price (P_1 and P_2) of Agricultural Land Uses and in the yields (Q_1 and Q_2). Variation in price and yield from year to year affects the gross revenue from different land uses and hence, the PFE and NER. The price of Beef increased substantially from 1996/97 to 2000/01 which resulted in a large increase in gross revenue to Beef grazing despite the decrease in yield. As Beef Cattle covers such a large area, this increase has a large effect on total economic returns to agriculture in the MDB. Other major livestock land uses also experienced increases in price per unit of production. The price of Sheep and wool both increased as did production which resulted in an increase in gross revenue from Sheep grazing. The price of Dairy Cattle per DSE increased substantially from 1996/97 to 2000/01 whilst the price of milk and yield per DSE has remained relatively constant. Together with an expansion in area, this has driven an increase in economic returns to Dairy. The price and yield of Cotton both decreased significantly resulting in dramatic decreases in gross revenue. The price of Grapes also increased markedly whilst yields remained constant. The price of Rice dropped although yields increased (Table 13). Price and yield statistics are important drivers of economic returns to agriculture and variation in either or both price and yield markedly affects economic returns.

Another variable parameter is the level of government assistance to each agricultural industry. This can vary widely from year to year depending on the status of the industry at the time and the attitude of the government towards each industry. Wide variations are seen in government support to Agricultural Land Uses such as Other (this reflects the change in support to the Tobacco industry following deregulation), Tree Nuts and Fruit. The impact of the above changes is discussed in terms of their effect on gross revenue, profit at full equity and net economic returns to Agricultural Land Uses below.

Land Use	Year	P1	Q1	TRN	P2	Q2	AC	QC	WP	WR	FOC	FDC	FLC	REV	Var. Cost	Fixed Cost	Water Cost	PFE	Gov.Asst.	NER
	Units	$/(t,DSE)	(t,DSE)/ha		$/(kg,l)	DSE/ha	$/ha	$/(t,DSE)	$/ML	ML/ha	$/ha	$/ha	$/ha	$/ha	$/ha	$/ha	$/ha	$/ha	$/ha	$/ha
Beef Cattle	**1996/97**	44.83	2.83	0.25			9.02	2.00	24.11	0.03	9.86	3.17	4.45	35.27	14.67	17.48	0.81	2.31	2.39	-0.08
	2000/01	68.30	2.68	0.32			9.68	2.20	34.19	0.03	10.18	3.29	4.58	60.59	15.57	18.05	0.94	26.03	0.45	25.58
Cereals	**1996/97**	204.65	2.27	1.00			162.69	0.00	24.07	0.06	71.45	16.65	36.61	465.32	162.69	124.71	1.40	176.52	15.70	160.82
	2000/01	203.58	2.06	1.00			185.78	0.00	33.27	0.09	79.68	18.95	41.10	419.23	185.78	139.73	2.91	90.81	4.82	85.99
Coarse Grains	**1996/97**	188.24	3.34	1.00			188.96	0.00	20.51	0.17	111.81	17.56	48.27	629.40	188.96	177.64	3.44	259.36	9.57	249.79
	2000/01	156.15	2.73	1.00			180.28	0.00	27.92	0.15	110.36	18.53	49.57	426.29	180.28	178.47	4.13	63.41	9.32	54.09
Cotton	**1996/97**	2,395.30	1.49	1.00			725.96	525.00	24.96	5.98	51.43	25.72	77.14	3,559.66	1,506.17	154.28	149.21	1,750.00	0.00	1,750.00
	2000/01	1,959.56	1.25	1.00			803.09	577.50	32.10	5.82	56.57	28.28	84.86	2,447.11	1,524.28	169.72	186.99	566.13	68.46	497.67
Dairy Cattle	**1996/97**	48.76	9.10	0.27	0.28	325.48	286.10	10.50	35.22	1.78	91.36	52.32	38.06	942.24	381.63	181.73	62.55	316.34	14.27	302.07
	2000/01	71.88	8.90	0.31	0.31	326.79	314.35	11.55	42.11	2.54	100.46	57.74	41.79	1,082.39	417.11	199.99	106.82	358.47	10.30	348.17
Fruit	**1996/97**	717.36	23.83	1.00			3,247.82	177.04	36.88	6.09	1,090.17	654.10	1,308.20	17,092.44	7,466.04	3,052.47	224.49	6,349.45	704.96	5,644.49
	2000/01	699.04	19.83	1.00			3,564.84	189.02	47.87	6.38	1,083.77	650.26	1,300.52	13,860.03	7,312.52	3,034.56	305.56	3,207.39	236.51	2,970.88
Grapes	**1996/97**	728.87	13.10	1.00			2,343.00	50.00	47.03	5.62	1,571.24	1,122.32	1,346.78	9,547.49	2,997.95	4,040.34	264.14	2,245.06	891.18	1,353.88
	2000/01	906.97	12.71	1.00			2,577.30	55.00	60.09	6.05	1,764.54	1,260.39	1,512.47	11,526.37	3,276.27	4,537.40	363.59	3,349.11	773.62	2,575.49
Hay	**1996/97**	114.86	1.69	1.00			51.81	14.63	25.47	0.29	34.93	7.65	17.67	194.54	76.59	60.25	7.43	50.27	4.51	45.76
	2000/01	112.78	3.88	1.00			60.42	16.06	37.40	0.50	33.93	9.21	18.84	437.45	122.70	61.97	18.70	234.07	4.71	229.36
Legumes	**1996/97**	282.62	1.27	1.00			120.18	0.00	18.68	0.10	42.59	14.09	24.89	358.22	120.18	81.57	1.95	154.52	7.69	146.83
	2000/01	323.30	1.08	1.00			170.43	0.00	34.17	0.05	55.26	16.31	30.99	348.82	170.43	102.56	1.60	74.22	8.81	65.41
Oilseeds	**1996/97**	373.12	1.58	1.00			199.29	0.00	23.59	0.22	64.30	13.61	30.75	590.30	199.29	108.65	5.21	277.15	10.38	266.78
	2000/01	305.86	1.51	1.00			233.82	0.00	30.67	0.03	69.19	15.22	33.87	460.80	233.82	118.28	1.07	107.63	11.17	96.47
Other	**1996/97**	2,619.40	5.35	1.00			14,982.47	277.72	55.08	1.10	6,641.77	1,237.39	2,958.53	44,180.18	15,286.23	10,837.69	60.64	17,995.63	3,054.29	14,941.33
	2000/01	1,492.60	9.18	1.00			16,786.22	156.82	75.99	2.37	4,399.69	1,422.91	2,656.04	32,753.71	17,443.62	8,478.64	180.17	6,651.27	68.20	6,583.08
Peanuts	**1996/97**	751.52	1.73	1.00			557.39	80.50	25.29	0.25	98.23	14.79	41.56	1,300.12	696.65	154.59	6.20	442.68	19.28	423.41
	2000/01	705.65	1.87	1.00			573.29	88.55	-	0.00	115.57	16.21	47.08	1,318.13	738.69	178.86	0.00	400.58	15.47	385.10
Rice	**1996/97**	247.19	8.25	1.00			900.00	0.00	17.33	10.80	150.00	25.00	50.00	2,038.31	900.00	225.00	187.21	726.09	168.69	557.41
	2000/01	213.14	9.32	1.00			990.00	0.00	31.46	10.80	165.00	27.50	55.00	1,986.62	990.00	247.50	339.71	409.41	101.21	308.20
Sheep	**1996/97**	15.75	2.23	0.23	4.91	2.34	2.37	4.00	23.17	0.02	7.66	3.15	4.75	34.75	11.31	15.57	0.36	7.51	6.51	1.00
	2000/01	18.58	2.41	0.26	5.11	2.23	2.61	4.40	33.46	0.01	8.74	3.67	5.48	40.84	13.22	17.89	0.22	9.51	6.81	2.70
Tree Nuts	**1996/97**	6,845.68	1.65	1.00			2,011.48	177.34	48.55	6.42	534.75	320.85	641.70	9,387.69	2,254.67	1,497.29	311.85	5,323.87	1,062.33	4,261.55
	2000/01	4,329.67	1.59	1.00			2,248.13	836.08	68.97	6.38	597.96	358.78	717.55	6,544.85	2,528.24	1,674.29	440.24	1,902.09	300.20	1,601.88
Vegetables	**1996/97**	420.10	27.32	1.00			3,382.90	10.50	31.55	4.11	1,649.46	989.67	1,979.35	11,478.73	3,669.76	4,618.48	129.52	3,060.97	0.00	3,060.97
	2000/01	418.62	31.76	1.00			3,729.31	220.00	43.90	4.33	1,819.70	1,091.82	2,183.64	13,293.45	4,062.97	5,095.16	190.24	3,945.08	89.91	3,855.17

Table 13 – Area-weighted average profit function parameters of Agricultural Land Uses for 1996/97 and 2000/01. Averages for gross revenue, costs, PFE and NER are also included.

3.3.1 Gross Revenue

In 1996/97 the gross revenue from agriculture was $11.7 billion. This increased by 16% to $13.6 billion in 2000/01 (Table 6; Figure 27; Table 14; Appendix 7). Inter-annual variations in agricultural revenue result from variations in the area farmed, in the yield per hectare of crops which is determined by factors such as rainfall and water allocations, and in the price per unit of production which varies with regional and global markets (see Table 13).

Different Agricultural Land Uses return very different rates of gross revenue per unit area (Table 6; Figure 27; Table 16). The “Other” Agricultural Land Use class which includes a diverse range of high value crops such as Hops, Nurseries/Flowers, Turf, Peppermint and Tobacco has the highest rate of gross revenue per hectare ($44,000/ha) in 1996/97, decreasing to $33,000/ha in 2000/01. The next highest value crops per unit area in the MDB are Fruit, Vegetables, Grapes and Tree Nuts. Fruit decreased from $17,000/ha in 1996/97 to around $14,000/ha in 2000/01, Vegetables increased from $12,000/ha - $14,000/ha, Grapes increased from $10,000/ha - $12,000/ha, and Tree Nuts decreased from $9,000/ha - $7,000/ha. Cotton and Rice return only moderate rates of gross revenue per hectare ($2-3,000/ha) and both experienced relative declines in gross revenue per hectare due to decreases in the price per tonne and yield per hectare. Peanuts and Dairy return only around $1,300/ha in gross revenue. The gross revenue per hectare of Dairy increased 59% from 1996/97 mainly due to an increase in cattle prices and possibly also due to the movement of less productive enterprises out of the industry. Other more extensive forms of agriculture such as Cereals, Beef and Sheep return very low rates of gross revenue per hectare.

Despite low rates of gross revenue per unit area, the Agricultural Land Uses contributing most to gross agricultural revenue in the MDB are Cereals, and livestock grazing. Cereals contributed $3.47 billion (30%) to gross revenue in 1996/97 but decreased to $3.28B (25%) in 2000/01. Sheep contributed $1.69B (14%) in gross revenue in the MDB in 1996/97 increasing to 1.84B in 2000/01. Dairy contributed $1.3 billion (11%) in gross agricultural revenue in 1996/97 and this increased nearly $0.5 billion to $1.79B (13%) in 2000/01. Beef accounted for 9% ($1 billion) of gross revenue in 1996/97 which increased to 15% ($2 billion) in 2000/01. Sheep and Cotton are the next largest revenue generators in the MDB at around 10% ($1 billion). Gross revenue from Sheep increased 9% whilst Cotton decreased 5% despite a 38% expansion in the area of Cotton farmed. Grapes and Fruit each account for around 5% (around $0.5 billion) share of the gross MDB revenue in 1996/97. The gross revenue of Grapes however almost doubled from 1996/97 – 2000/01 whereas Fruit remained relatively constant. Vegetables, Rice, Oilseeds, Legumes and Coarse Grains each account for around 2% ($0.2 billion) of the gross revenue in 1996/97. Oilseeds nearly doubled their revenue by 2000/01 and Vegetables, Rice and Legumes also displayed significant increases. Gross revenue from Coarse Grains was fairly constant. Other Agricultural Land Uses have a relatively minor contribution to the gross revenue of the MDB (Table 6).

The proportion of gross revenue generated by different Agricultural Land Uses varies by CMR (Table 15; Figure 28; Figure 29) and analysis of this gives an impression of the

agricultural character of each region. The River Murray (SA) generates a large proportion of agricultural revenue from Grapes, Fruit, Cereals and Dairy and the Mallee (Vic) is similar with less Dairy. Wimmera (Vic) generates revenue largely from Cereals and Sheep. The North Central (Vic), North East (Vic), Goulburn (Vic) and Murray (NSW) generate most income from Dairy, Cereals, Fruit, Beef and Sheep, and in the Murray (NSW) Rice is a significant revenue earner. The Murrumbidgee (NSW) generates the largest gross revenue from agriculture in the MDB and does so from a diverse set of Agricultural Land Uses including Cereals, Beef, Sheep, Rice, Grapes and Fruit. The central and north-eastern CMRs including the Central West (NSW), Namoi (NSW), Border Rivers (Qld and NSW), Gwydir (NSW), Condamine (Qld) and Maranoa-Balonne (Qld) generate most of their agricultural gross revenue from a mix of Cotton, Cereals, Beef and Sheep. The more marginal Warrego-Paroo (Qld), Western (NSW) and Lower Murray-Darling (NSW) CMRs have low gross revenues generated mainly from Beef and Sheep grazing although significant new streams of revenue are coming from irrigated crops such as Cotton and Grapes.

Gross revenue from agriculture is concentrated in the irrigated areas along the Goulburn, Murray and Murrumbidgee rivers in the south-east and the Cotton growing areas in the north-east of the MDB (Table 15; Figure 30; Figure 31). More than half of the gross revenue from agriculture comes from NSW, in particular, the Central West, Gwydir and Lachlan CMRs. Victoria accounts for just over a quarter of the gross agricultural revenue which occurs mainly in the Goulburn, North Central and Mallee CMRs. Queensland accounts for 13% of the gross revenue with the Maranoa-Balonne the dominant source. SA accounts for nearly 7% of gross revenue and the ACT contribution is negligible. Significant changes occurred in the gross revenue from agriculture between 1996/97 and 2000/01. Gross revenue tended to increase in the southern CMRs whereas in the central eastern CMRs significant decreases were experienced (Figure 32) mainly due to drop in Cotton revenue.

The spatial distribution of high valued Agricultural Land Uses in terms of gross revenue/ha is characterised by a crescentic band of higher value land uses from the South Australian part of the MDB around the southern and eastern parts of the MDB (Figure 30; Figure 31). This pattern of returns to agriculture essentially follows the distribution of water. Rates of gross revenue/ha are especially high in irrigated areas near major rivers, especially where high value crops such as Fruit and Vegetables are grown. In dryland agriculture, rates of return are related to rainfall.

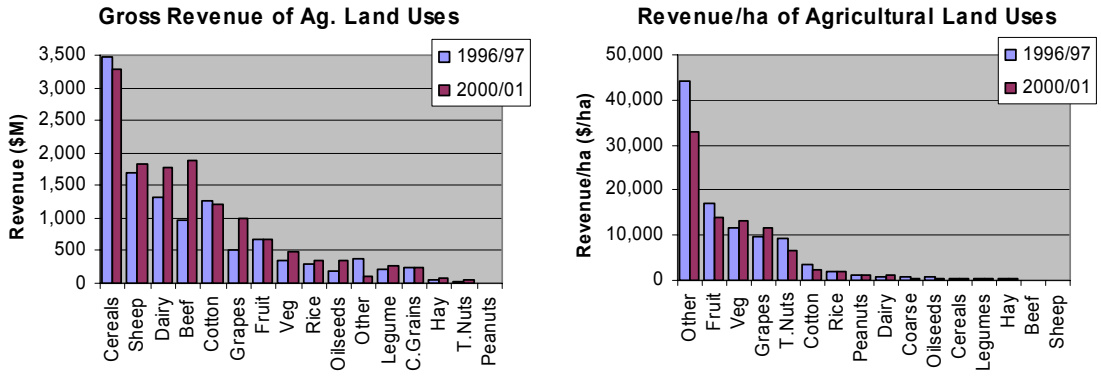


Figure 27 – Gross revenue and revenue/ha of Agricultural Land Uses in the Murray-Darling Basin 1996/97 and 2000/01.

Agricultural Land Use	Gross Revenue ($'000)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	Grand Total
Beef	1996/97	1,406	46,159	83,117	106,433	96,259	57,380	50,140	65,090	3,791	5,587	82,322	54,398	85,921	86,886	29,645	57,213	13,085	35,708	11,341	4,178	**976,059**
	2000/01	2,057	72,055	170,104	199,676	185,328	93,189	85,578	153,961	7,439	6,673	192,301	83,791	155,121	138,876	76,526	84,341	23,592	107,705	26,360	8,603	**1,873,276**
	% Change	46.3	56.1	104.7	87.6	92.5	62.4	70.7	136.5	96.2	19.4	133.6	54.0	80.5	59.8	158.1	47.4	80.3	201.6	132.4	105.9	**91.9**
Cereals	1996/97	0	198,558	160,281	465,832	122,520	42,176	211,519	437,257	14,482	290,442	102,992	207,920	374,397	250,726	179,388	5,273	169,176	4,482	33,342	197,976	**3,468,739**
	2000/01	359	74,009	59,820	262,086	42,804	71,337	91,682	468,176	37,594	467,806	50,932	274,086	436,707	117,900	262,118	7,096	277,520	1,788	36,591	240,505	**3,280,917**
	% Change	-	-62.7	-62.7	-43.7	-65.1	69.1	-56.7	7.1	159.6	61.1	-50.5	31.8	16.6	-53.0	46.1	34.6	64.0	-60.1	9.7	21.5	**-5.4**
Coarse Grains	1996/97		17,675	13,223	4,374	92,613	570	10,846	10,996	910	327	10,475	1,219	26,017	49,259	1,719	69		242	561	347	**241,443**
	2000/01		27,385	14,414	5,468	69,112	639	24,692	5,465	376	403	7,911	1,912	16,909	56,083	821	0		364	2,265	79	**234,298**
	% Change		54.9	9.0	25.0	-25.4	12.1	127.7	-50.3	-58.7	23.2	-24.5	56.9	-35.0	13.9	-52.2	-100.0		50.3	303.8	-77.3	**-3.0**
Cotton	1996/97		160,794	75,155	138,154	167,027		320,745	0	574		88,099		994	232,368				4,867	77,624		**1,266,400**
	2000/01		125,889	72,588	157,546	113,887		294,372	4,518	0		123,280		52,280	201,638				1,700	52,079		**1,199,778**
	% Change		-21.7	-3.4	14.0	-31.8		-8.2	-	-100.0		39.9		5,159.8	-13.2				-65.1	-32.9		**-5.3**
Dairy	1996/97	33	3,167	808	15,685	66,166	556,946	1,541	9,147		9,412	640	72,022	16,439	8,179	347,918	101,106	95,859	511	1	1,817	**1,307,395**
	2000/01	0	2,750	903	27,084	89,407	741,541	1,622	27,759		16,165	1,314	124,732	22,417	14,950	459,081	129,924	125,883	521	98	3,479	**1,789,630**
	% Change	-100	-13.2	11.9	72.7	35.1	33.1	5.3	203.5		71.7	105.3	73.2	36.4	82.8	32.0	28.5	31.3	2.0	8,206.2	91.5	**36.9**
Fruit	1996/97		316	36,043	46,003	584	187,694	0	18,277	30,111	65,506		6,539	138,810		11,929	5,094	134,999		0	429	**682,333**
	2000/01		16	35,500	20,437	237	206,192	250	28,862	28,405	68,902		3,936	117,889		21,121	2,942	138,695		232	483	**674,098**
	% Change		-94.8	-1.5	-55.6	-59.5	9.9	-	57.9	-5.7	5.2		-39.8	-15.1		77.1	-42.2	2.7		-	12.5	**-1.2**
Grapes	1996/97			2,078	4,448		2,087		3,930	43,640	195,774	3,898	5,319	74,038		5,687	4,179	167,265	0	4,993	520	**517,855**
	2000/01			1,648	10,995		11,147		15,990	70,171	304,825	0	9,297	113,342		7,973	16,381	419,732	6,367	8,141	1,624	**997,631**
	% Change			-20.7	147.2		434.1		306.9	60.8	55.7	-100.0	74.8	53.1		40.2	292.0	150.9	-	63.0	212.5	**92.6**
Hay	1996/97		664	211	6,593	2,586	6,393	759	5,608	78	1,670	567	4,421	4,868	1,497	7,115	669	10,417	37	238	1,220	**55,612**
	2000/01		5,024	2,048	1,567	8,129	10,038	2,459	3,986	1,522	1,855	2,748	4,677	5,707	1,116	12,976	367	11,785	399	1,267	2,823	**80,492**
	% Change		656.5	869.2	-76.2	214.4	57.0	223.7	-28.9	1,838.7	11.1	384.3	5.8	17.2	-25.5	82.4	-45.2	13.1	973.1	433.3	131.4	**44.7**
Legumes	1996/97		10,452	2,745	3,428	12,018	4,396	7,445	6,088	26	29,066	1,579	10,826	14,340	3,604	31,378	168	7,919	0	1,376	72,660	**219,516**
	2000/01		13,406	10,030	10,737	10,311	2,332	16,635	11,344	20	28,410	4,656	7,834	24,311	10,346	33,461	244	11,180	586	7,181	70,808	**273,832**
	% Change		28.3	265.4	213.2	-14.2	-47.0	123.4	86.3	-23.3	-2.3	194.9	-27.6	69.5	187.1	6.6	45.3	41.2	-	421.9	-2.5	**24.7**
Oilseeds	1996/97	0	1,920	147	8,371	6,422	3,087	3,372	46,086	1,914	3,049	137	22,128	51,867	7,712	12,500	198	610	0	647	20,148	**190,315**
	2000/01	273	1,845	203	25,563	2,010	13,066	2,152	80,279	460	11,455	119	60,647	78,030	9,585	32,559	751	7,096	0	1,598	30,001	**357,691**
	% Change	-	-3.9	38.2	205.4	-68.7	323.3	-36.2	74.2	-76.0	275.6	-13.6	174.1	50.4	24.3	160.5	278.8	1,064.1	-	146.9	48.9	**87.9**
Other	1996/97		36,520	1,182	10,390	35,460	36,166	39,856	15,567	441	6,474	34,803	1,231	24,715	15,930	30,990	24,497	1,984	49,516		12,021	**377,746**
	2000/01		8	313	10,631	17,286	23,856	64	822	0	5,518	22	1,124	8,551	949	534	23,025	6,748	124		20,951	**120,525**
	% Change		-100.0	-73.5	2.3	-51.3	-34.0	-99.8	-94.7	-100.0	-14.8	-99.9	-8.7	-65.4	-94.0	-98.3	-6.0	240.1	-99.7		74.3	**-68.1**
Peanuts	1996/97		0	799		849		166				784			455				0	208		**3,261**
	2000/01		299	180		759		0				88			176				745	216		**2,464**
	% Change		-	-77.5		-10.6		-100.0				-88.7			-61.2				-	3.8		**-24.4**
Rice	1996/97						2,217		1,110				140,358	165,868		0	0					**309,553**
	2000/01						2,587		2,371				163,078	179,727		912	191					**348,866**
	% Change						16.7		113.6				16.2	8.4		-	-					**12.7**
Sheep	1996/97	1,445	38,089	27,737	209,993	6,694	84,544	40,522	273,775	36,690	52,376	23,733	100,943	242,657	55,496	143,978	20,626	83,541	60,642	102,834	81,127	**1,687,440**
	2000/01	2,522	34,959	23,557	243,108	6,123	97,623	40,139	314,890	38,548	58,598	17,963	112,336	252,840	57,330	173,410	20,294	85,438	60,256	107,203	95,814	**1,842,950**
	% Change	74.6	-8.2	-15.1	15.8	-8.5	15.5	-0.9	15.0	5.1	11.9	-24.3	11.3	4.2	3.3	20.4	-1.6	2.3	-0.6	4.2	18.1	**9.2**
Tree Nuts	1996/97		0					0	0		24,721			4,099				8,871				**37,692**
	2000/01		986					822	2,705		21,330			501				15,528				**41,872**
	% Change		-					-	-		-13.7			-87.8				75.0				**11.1**
Vegetables	1996/97		698	27,590	8,464	18,894	29,623		15,015	4,555	49,257	92	17,257	54,469	0	26,504		89,046			0	**341,464**
	2000/01		2,273	38,969	5,830	24,789	67,834		7,244	1,416	63,198	0	21,316	89,647	21	43,073		113,707			1,561	**480,877**
	% Change		225.5	41.2	-31.1	31.2	129.0		-51.8	-68.9	28.3	-100.0	23.5	64.6	-	62.5		27.7			-	**40.8**
Gross 1996/97 Revenue ($'000)		**2,884**	**515,013**	**431,115**	**1,028,166**	**628,093**	**1,013,281**	**686,911**	**907,945**	**137,211**	**733,664**	**350,121**	**644,581**	**1,279,500**	**712,111**	**828,751**	**219,092**	**782,771**	**156,006**	**233,165**	**392,442**	**11,682,823**
Gross 2000/01 Revenue ($'000)		**5,211**	**360,904**	**430,280**	**980,727**	**570,183**	**1,341,382**	**560,465**	**1,128,371**	**185,949**	**1,055,138**	**401,333**	**868,766**	**1,553,978**	**608,968**	**1,124,566**	**285,555**	**1,236,904**	**180,556**	**243,229**	**476,730**	**13,599,197**
Total % Change		**80.7**	**-29.9**	**-0.2**	**-4.6**	**-9.2**	**32.4**	**-18.4**	**24.3**	**35.5**	**43.8**	**14.6**	**34.8**	**21.5**	**-14.5**	**35.7**	**30.3**	**58.0**	**15.7**	**4.3**	**21.5**	**16.4**

Table 14 – Gross revenue ($'000) of agricultural land uses by Catchment Management Region 1996/97 and 2000/01 including % change.

		1996/97									2000/01								
State	Catchment Management Region	Gross Revenue ($'000)	% of MDB Revenue	PFE ($'000)	% of MDB PFE	Gov't Support ($'000)	Support as % of PFE	% of Total Support	Net Economic Return ($'000)	% of MDB NER	Gross Revenue ($'000)	% of MDB Revenue	PFE ($'000)	% of MDB PFE	Gov't Support ($'000)	Support as % of PFE	% of Total Support	Net Economic Return ($'000)	% of MDB NER
ACT		2,884	0.0	-436	0.0	527	-	0.1	-963	0.0	5,211	0.0	834	0.0	614	73.6	0.1	220	0.0
ACT Total		**2,884**	**0.0**	**-436**	**0.0**	**527**	**-**	**0.1**	**-963**	**0.0**	**5,211**	**0.0**	**834**	**0.0**	**614**	**73.6**	**0.1**	**220**	**0.0**
NSW	Border Rivers (NSW)	515,013	4.4	187,348	4.9	20,064	10.7	3.0	167,283	5.2	360,904	2.7	27,532	0.7	14,780	53.7	2.8	12,751	0.4
NSW	Central West (NSW)	1,028,166	8.8	297,051	7.7	72,521	24.4	10.9	224,530	7.0	980,727	7.2	82,574	2.2	58,557	70.9	11.0	24,018	0.8
NSW	Gwydir (NSW)	686,911	5.9	280,265	7.3	20,084	7.2	3.0	260,181	8.2	560,465	4.1	60,573	1.6	19,638	32.4	3.7	40,935	1.3
NSW	Lachlan (NSW)	907,945	7.8	290,625	7.5	73,775	25.4	11.1	216,851	6.8	1,128,371	8.3	299,359	8.0	62,110	20.7	11.7	237,248	7.4
NSW	Lower Murray Darling (NSW)	137,211	1.2	29,487	0.8	10,206	34.6	1.5	19,282	0.6	185,949	1.4	40,015	1.1	11,573	28.9	2.2	28,443	0.9
NSW	Murray (NSW)	644,581	5.5	156,831	4.1	40,005	25.5	6.0	116,826	3.7	868,766	6.4	139,709	3.7	32,710	23.4	6.1	106,999	3.3
NSW	Murrumbidgee (NSW)	1,279,500	11.0	351,544	9.1	91,295	26.0	13.7	260,249	8.2	1,553,978	11.4	319,506	8.6	77,072	24.1	14.5	242,433	7.6
NSW	Namoi (NSW)	712,111	6.1	270,726	7.0	24,543	9.1	3.7	246,183	7.7	608,968	4.5	102,374	2.7	20,075	19.6	3.8	82,299	2.6
NSW	Western (NSW)	233,165	2.0	26,365	0.7	21,860	82.9	3.3	4,505	0.1	243,229	1.8	-29,117	-0.8	20,849	-	3.9	-49,966	-1.6
NSW Total		**6,144,603**	**52.6**	**1,890,241**	**49.0**	**374,352**	**19.8**	**56.3**	**1,515,889**	**47.5**	**6,491,359**	**47.7**	**1,042,525**	**27.9**	**317,365**	**30.4**	**59.6**	**725,160**	**22.7**
QLD	Border Rivers (QLD)	431,115	3.7	183,425	4.8	20,825	11.4	3.1	162,600	5.1	430,280	3.2	140,683	3.8	10,239	7.3	1.9	130,444	4.1
QLD	Condamine (QLD)	628,093	5.4	186,535	4.8	18,178	9.7	2.7	168,356	5.3	570,183	4.2	125,924	3.4	10,945	8.7	2.1	114,979	3.6
QLD	Maranoa-Balonne (QLD)	350,121	3.0	96,256	2.5	17,214	17.9	2.6	79,042	2.5	401,333	3.0	107,245	2.9	9,198	8.6	1.7	98,047	3.1
QLD	Warrego-Paroo (QLD)	156,006	1.3	-11,496	-0.3	15,546	-	2.3	-27,042	-0.8	180,556	1.3	16,071	0.4	11,225	69.8	2.1	4,846	0.2
QLD Total		**1,565,335**	**13.4**	**454,720**	**11.8**	**71,763**	**15.8**	**10.8**	**382,957**	**12.0**	**1,582,352**	**11.6**	**389,922**	**10.4**	**41,607**	**10.7**	**7.8**	**348,316**	**10.9**
SA	River Murray (SA)	782,771	6.7	190,254	4.9	52,895	27.8	8.0	137,359	4.3	1,236,904	9.1	430,411	11.5	51,475	12.0	9.7	378,936	11.8
SA Total		**782,771**	**6.7**	**190,254**	**4.9**	**52,895**	**27.8**	**8.0**	**137,359**	**4.3**	**1,236,904**	**9.1**	**430,411**	**11.5**	**51,475**	**12.0**	**9.7**	**378,936**	**11.8**
VIC	Goulburn (VIC)	1,013,281	8.7	518,181	13.4	26,449	5.1	4.0	491,732	15.4	1,341,382	9.9	686,085	18.4	21,929	3.2	4.1	664,156	20.8
VIC	Mallee (VIC)	733,664	6.3	259,368	6.7	45,763	17.6	6.9	213,605	6.7	1,055,138	7.8	452,375	12.1	40,166	8.9	7.5	412,209	12.9
VIC	North Central (VIC)	828,751	7.1	313,271	8.1	35,126	11.2	5.3	278,145	8.7	1,124,566	8.3	452,541	12.1	34,488	7.6	6.5	418,053	13.1
VIC	North East (VIC)	219,092	1.9	36,487	0.9	39,150	107.3	5.9	-2,663	-0.1	285,555	2.1	64,109	1.7	8,678	13.5	1.6	55,431	1.7
VIC	Wimmera (VIC)	392,442	3.4	194,557	5.0	18,521	9.5	2.8	176,036	5.5	476,730	3.5	213,600	5.7	16,213	7.6	3.0	197,386	6.2
VIC Total		**3,187,230**	**27.3**	**1,321,864**	**34.3**	**165,009**	**12.5**	**24.8**	**1,156,855**	**36.2**	**4,283,371**	**31.5**	**1,868,710**	**50.1**	**121,475**	**6.5**	**22.8**	**1,747,235**	**54.6**
Grand Total		**11,682,823**	**100.0**	**3,856,643**	**100.0**	**664,546**	**17.2**	**100.0**	**3,192,097**	**100.0**	**13,599,197**	**100.0**	**3,732,403**	**100.0**	**532,536**	**14.3**	**100.0**	**3,199,867**	**100.0**

Table 15 – Summary of gross revenue, profit at full equity, level of government support and net economic returns by Catchment Management Region and State 1996/97 and 2000/01 including proportional information.

Agricultural Land Use	Average Gross Revenue per Hectare ($/ha)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	MDB Average
Beef	1996/97	62	48	43	47	69	152	41	45	4	28	19	68	56	54	117	95	20	7	5	94	**35**
	2000/01	106	75	78	81	131	244	76	77	10	46	41	112	108	80	279	155	44	17	8	187	**61**
	% Change	70.1	57.2	81.5	71.3	88.9	60.9	83.9	72.2	172.0	63.5	116.9	64.4	93.1	47.7	138.0	63.2	119.1	129.4	61.9	99.5	**71.8**
Cereals	1996/97	0	566	461	484	485	432	572	488	262	386	399	516	519	537	439	406	266	370	332	567	**465**
	2000/01	653	256	214	280	229	629	241	465	443	570	226	537	559	300	542	527	375	133	215	603	**419**
	% Change	-	-54.7	-53.6	-42.1	-52.8	45.5	-58.0	-4.8	69.2	47.9	-43.2	4.0	7.8	-44.1	23.5	29.6	41.2	-64.2	-35.4	6.4	**-9.9**
Coarse Grains	1996/97		525	351	820	564	868	488	1,638	1,820	737	293	1,203	1,785	871	917	963		355	702	499	**629**
	2000/01		404	230	408	433	2,162	358	1,305	869	375	173	1,334	1,677	560	894	0		189	204	436	**426**
	% Change		-23.1	-34.3	-50.2	-23.1	149.0	-26.6	-20.3	-52.2	-49.1	-40.9	10.9	-6.0	-35.7	-2.5	-100.0		-46.9	-70.9	-12.6	**-32.3**
Cotton	1996/97		3,661	3,403	4,168	2,765		3,809	0	2,731		3,779		3,737	3,345				4,051	4,432		**3,560**
	2000/01		2,254	2,252	2,762	1,909		2,561	1,815	0		2,576		3,510	2,392				5,797	2,513		**2,447**
	% Change		-38.4	-33.8	-33.7	-31.0		-32.8	-	-100.0		-31.8		-6.1	-28.5				43.1	-43.3		**-31.3**
Dairy	1996/97	54	478	109	563	418	1,900	455	518		306	86	483	645	523	1,180	794	462	43	20	700	**942**
	2000/01	0	471	172	494	549	2,186	480	690		364	80	565	801	703	1,479	911	534	35	28	836	**1,082**
	% Change	-100.0	-1.4	58.0	-12.2	31.4	15.0	5.5	33.2		19.0	-6.5	17.1	24.1	34.3	25.3	14.7	15.7	-19.7	41.4	19.5	**14.9**
Fruit	1996/97		5,901	14,271	38,325	13,175	23,550	0	9,243	15,298	12,748		26,398	13,732		24,711	29,079	17,079		0	3,473	**17,092**
	2000/01		904	10,169	15,853	203	18,661	1,742	11,516	14,577	13,275		12,623	11,454		11,888	17,822	15,544		955	3,924	**13,860**
	% Change		-84.7	-28.7	-58.6	-98.5	-20.8	-	24.6	-4.7	4.1		-52.2	-16.6		-51.9	-38.7	-9.0		-	13.0	**-18.9**
Grapes	1996/97			6,584	4,164		2,454		3,488	10,995	10,207	23,427	8,021	9,171		6,870	3,569	10,373	0	10,929	2,125	**9,547**
	2000/01			3,085	4,738		5,320		6,212	11,187	12,652	0	8,439	7,495		5,177	5,775	15,848	22,246	12,001	2,651	**11,526**
	% Change			-53.1	13.8		116.8		78.1	1.8	24.0	-100.0	5.2	-18.3		-24.6	61.8	52.8	-	9.8	24.7	**20.7**
Hay	1996/97		55	15	193	70	438	68	231	30	200	38	346	265	89	380	353	287	15	209	285	**195**
	2000/01		1,282	266	368	328	557	871	397	769	298	195	485	493	377	477	533	406	221	1,148	457	**437**
	% Change		2,214.1	1,719.4	90.3	366.9	27.4	1,173.6	71.6	2,443.6	48.8	406.2	40.4	86.2	324.6	25.5	50.7	41.6	1,377.1	448.0	60.4	**124.9**
Legumes	1996/97		477	392	350	466	510	466	351	144	232	298	366	388	400	331	255	283	0	264	424	**358**
	2000/01		359	305	235	293	414	265	332	240	316	247	394	443	292	368	280	301	146	257	468	**349**
	% Change		-24.7	-22.3	-33.0	-37.2	-18.7	-43.2	-5.5	66.1	36.3	-17.2	7.6	14.2	-27.0	11.0	9.6	6.3	-	-2.6	10.5	**-2.6**
Oilseeds	1996/97	0	344	231	748	445	670	339	742	442	431	208	670	701	383	420	508	450	0	319	491	**590**
	2000/01	546	375	169	413	336	521	382	493	289	409	104	466	516	474	432	542	358	0	273	409	**461**
	% Change	-	8.8	-26.6	-44.7	-24.3	-22.1	12.7	-33.5	-34.7	-5.1	-50.1	-30.4	-26.3	23.9	2.9	6.7	-20.5	-	-14.4	-16.7	**-21.9**
Other	1996/97		48,316	24,321	61,762	55,397	56,249	74,456	74,461	81,206	65,179	39,541	45,046	69,594	72,010	39,037	14,021	22,146	55,410		27,505	**44,180**
	2000/01		68,667	32,673	82,158	59,299	70,008	86,768	25,909	0	101,866	18,008	65,469	78,985	72,121	100,199	13,700	22,762	93,233		30,006	**32,754**
	% Change		42.1	34.3	33.0	7.0	24.5	16.5	-65.2	-100.0	56.3	-54.5	45.3	13.5	0.2	156.7	-2.3	2.8	68.3		9.1	**-25.9**
Peanuts	1996/97		0	1,938		802		3,680				1,913			3,370				0	466		**1,300**
	2000/01		1,633	1,344		1,000		0				1,320			873				1,979	1,457		**1,318**
	% Change		-	-30.6		24.8		-100.0				-31.0			-74.1				-	212.8		**1.4**
Rice	1996/97						3,465		2,028				2,019	2,044		0	0					**2,038**
	2000/01						2,055		2,149				1,969	1,999		2,310	1,812					**1,987**
	% Change						-40.7		6.0				-2.5	-2.2		-	-					**-2.5**
Sheep	1996/97	70	51	25	57	31	189	60	65	8	43	15	88	78	57	162	104	20	8	9	126	**35**
	2000/01	86	62	31	68	40	206	75	76	8	47	19	92	82	65	178	124	23	10	9	146	**41**
	% Change	22.8	20.6	25.9	19.8	28.7	8.6	24.3	16.5	-2.0	10.3	25.1	4.6	4.8	14.1	9.8	19.9	16.4	26.5	5.6	15.6	**17.5**
Tree Nuts	1996/97		0					0	0		16,655			30,744				5,181				**9,388**
	2000/01		2,832					2,360	15,911		6,619			3,223				7,211				**6,545**
	% Change		-					-	-		-60.3			-89.5				39.2				**-30.3**
Vegetables	1996/97		4,586	15,903	4,777	12,459	13,309		6,726	16,964	18,767	651	8,436	7,110	0	11,168		17,809			0	**11,479**
	2000/01		11,050	17,288	9,290	11,437	18,368		6,432	6,490	19,453	0	12,468	8,610	202	10,822		17,970			15,500	**13,293**
	% Change		141.0	8.7	94.5	-8.2	38.0		-4.4	-61.7	3.7	-100.0	47.8	21.1	-	-3.1		0.9			-	**15.8**
Avg 1996/97 Revenue/Ha ($/Ha)		**66**	**235**	**123**	**146**	**271**	**807**	**286**	**136**	**25**	**309**	**56**	**243**	**227**	**220**	**415**	**231**	**134**	**13**	**17**	**312**	**134**
Avg 2000/01 Revenue/Ha ($/Ha)		**105**	**181**	**128**	**136**	**258**	**975**	**243**	**152**	**34**	**438**	**67**	**294**	**273**	**185**	**501**	**328**	**230**	**15**	**17**	**356**	**153**
% Change		**59.0**	**-23.0**	**3.6**	**-7.0**	**-4.6**	**20.8**	**-14.8**	**12.1**	**33.9**	**41.7**	**19.6**	**21.1**	**20.1**	**-15.6**	**20.5**	**41.8**	**71.7**	**16.7**	**-2.1**	**14.2**	**14.6**

Table 16 – Average gross revenue per hectare ($/ha) of agricultural land uses by Catchment Management Region 1996/97 and 2000/01 including % change.

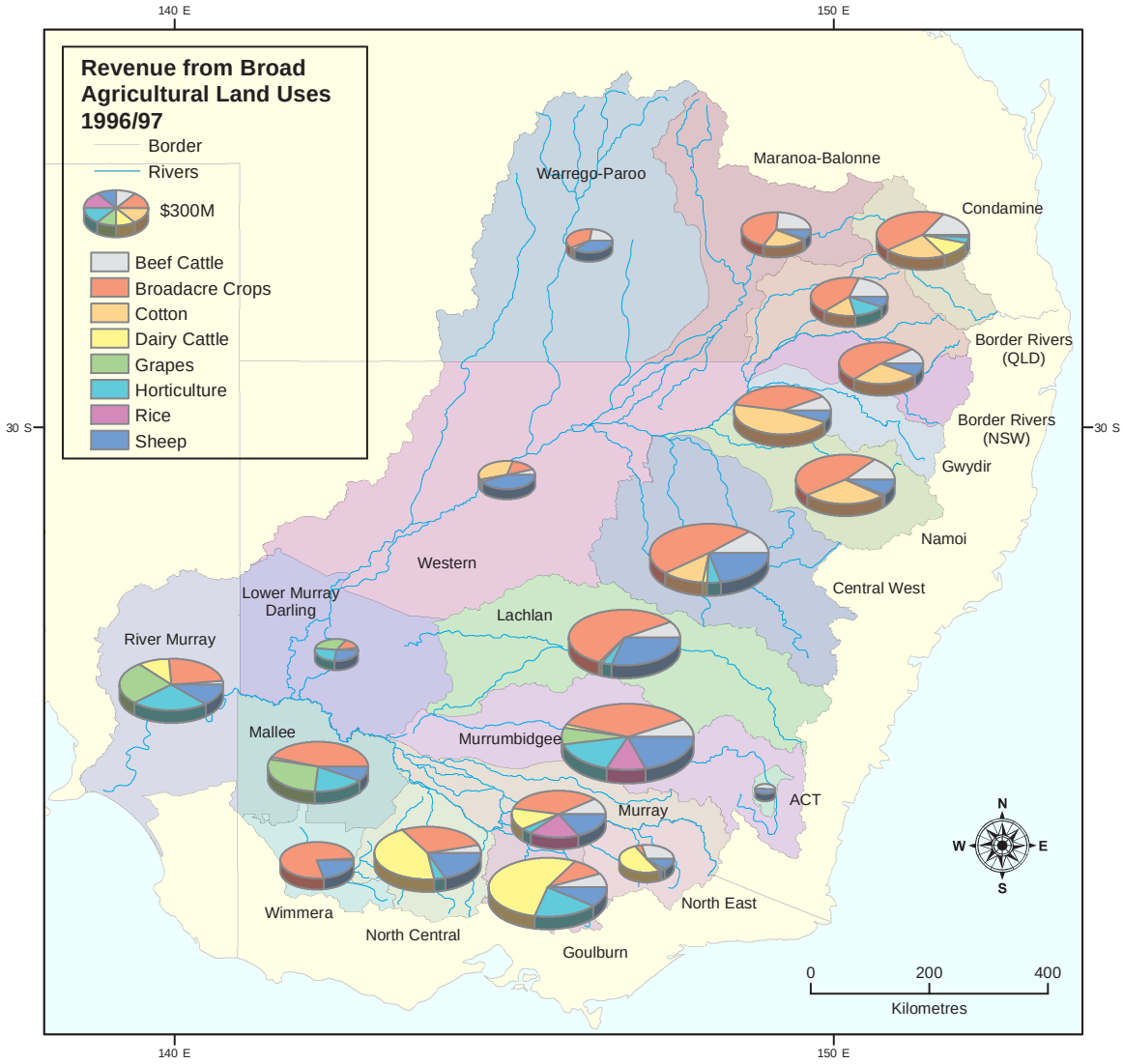


Figure 28 – Amount and proportions of gross revenue from broad agricultural land uses by Catchment Management Region in the Murray-Darling Basin 1996/97. Note that the gross revenue for the ACT is exaggerated 10 times.

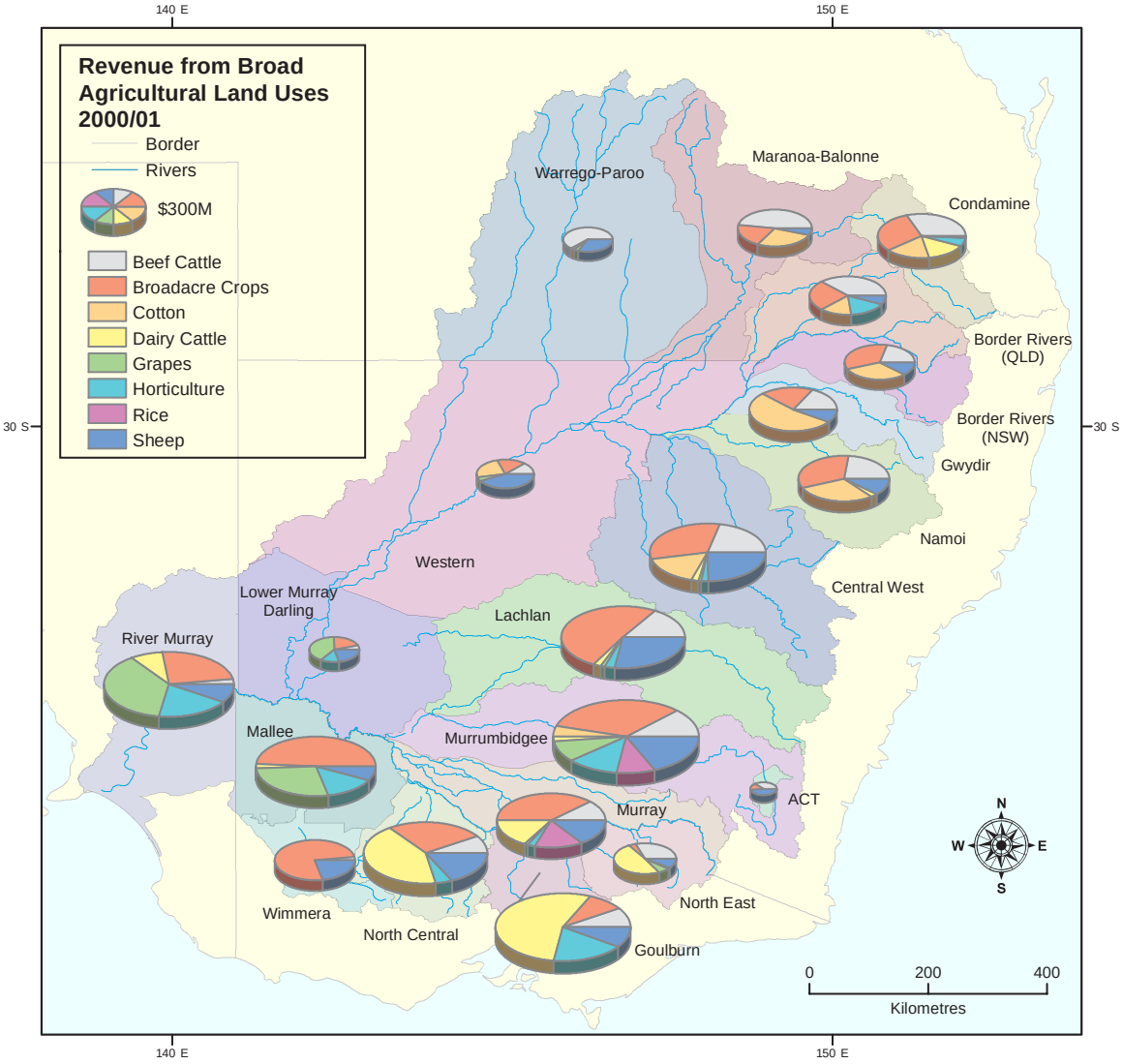


Figure 29 – Amount and proportions of gross revenue from broad agricultural land uses by Catchment Management Region in the Murray-Darling Basin 2000/01. Note that the gross revenue for the ACT is exaggerated 10 times.

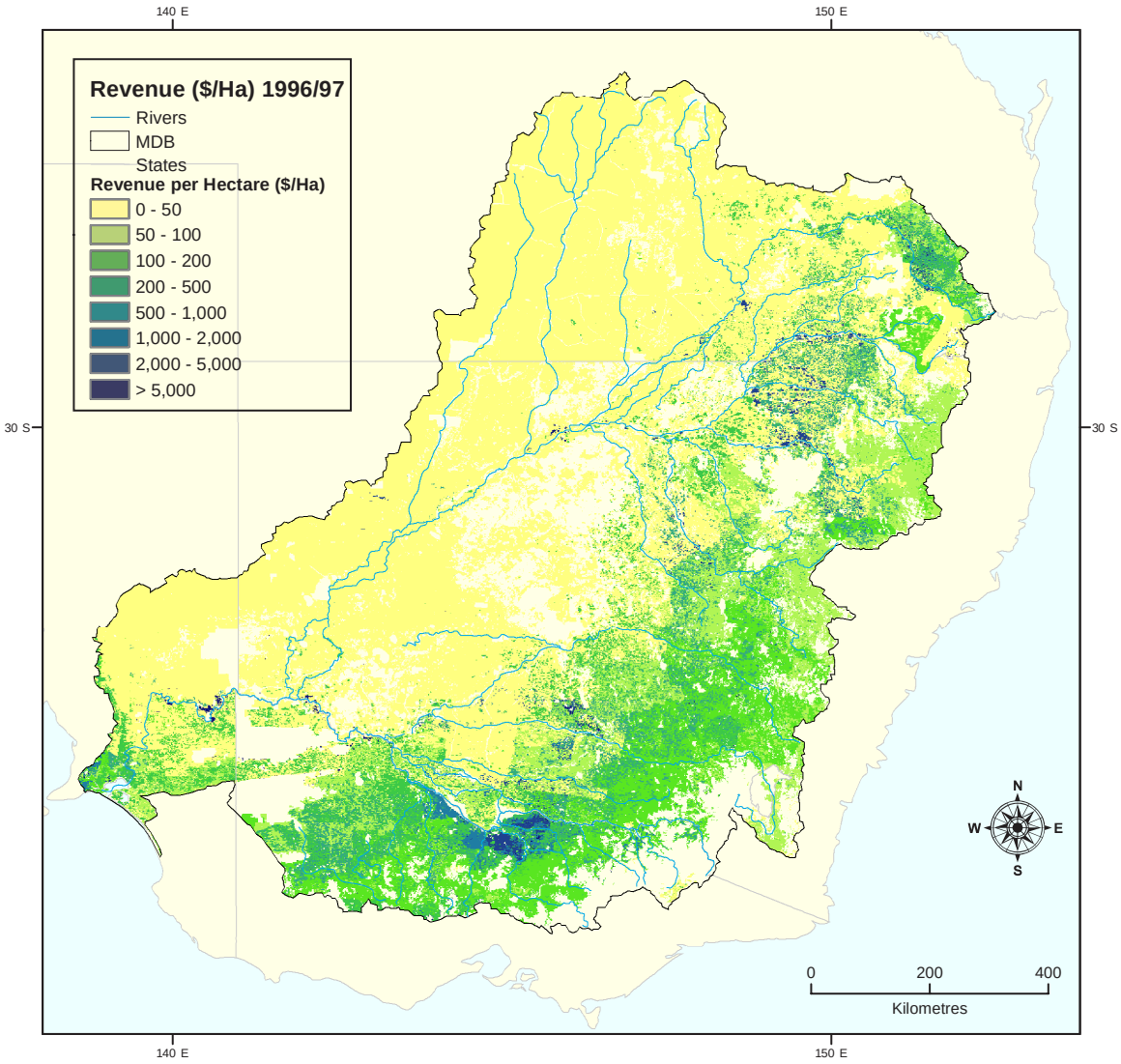


Figure 30 – Agricultural gross revenue per hectare ($/ha) in the Murray-Darling Basin 1996/97.

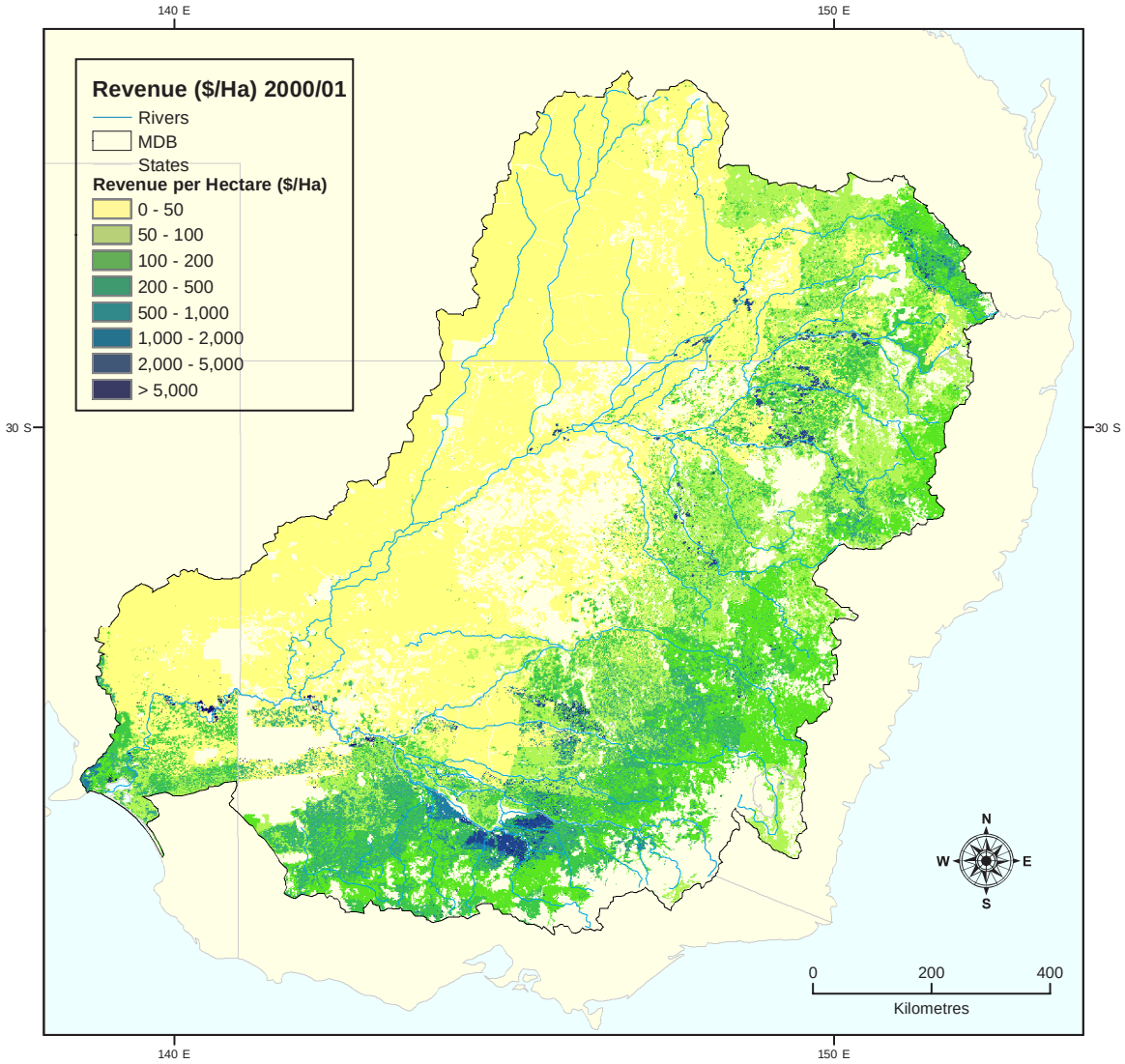


Figure 31 – Agricultural gross revenue per hectare ($/ha) in the Murray-Darling Basin 2000/01.

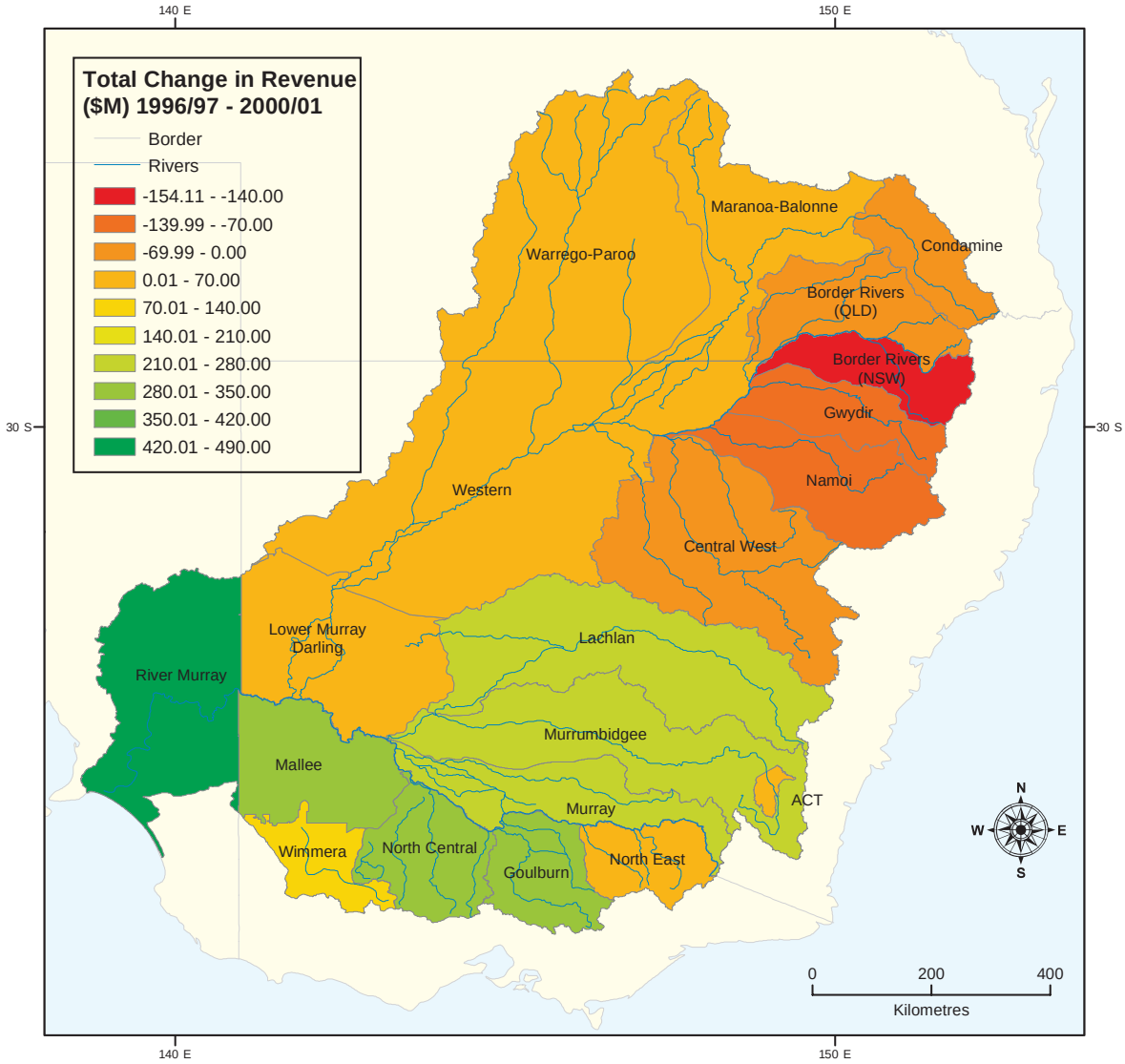


Figure 32 – Total change in gross revenue from agriculture by Catchment Management Region in the Murray-Darling Basin 2000/01. Green areas indicate an increase in gross revenue, red indicates a decrease in $Millions.

3.3.2 Profit at Full Equity

Profit at full equity is a much more variable indicator of economic returns to agriculture. To illustrate the temporal, spatial and land use variability inherent in PFE, we can say that farmers have good years and bad years. However, good years for beef farmers may not be good years for citrus orchard growers, and good years for sheep farmers in Goulburn may not be good years for sheep farmers in the Condamine. Profit varies from year to year and large inter-annual variation occurs in profit to individual agricultural land uses and the total profit to regions. PFE varies with variations in gross revenue and costs of production. However, variation in PFE is emphasised by the fact that for most of the MDB, agricultural enterprises are fairly marginal and small changes in gross revenue or costs can significantly affect PFE measures.

Total profit at full equity from agriculture in the MDB in 1996/97 was estimated at $3.86B which decreased slightly to $3.73B in 2000/01 (Table 6; Figure 33; Table 17; Appendix 8). Cereals accounted for $1.32B (34%) in PFE for the MDB in 1996/97 which was reduced to $711M (19%) in 2000/01. Dairy accounted for $438M (11%) in PFE in 1996/97 and increased to $592M (16%) in 2000/01. Cotton yielded $623M (16%) in PFE in 1996/97 and decreased with drops in both price and yield to $278M (7.4%). Beef also varied from $64M (2%) in PFE in 1996/97 to $805M (21.5%) in 2000/01 following the recovery of prices for beef cattle. Profit to Sheep grazing increased from $364M (9%) in 1996/97 to $429M (11%) in 2000/01. Significant profits (around $200M) come from Fruit, Grapes, and Rice. Profits to Grapes more than doubled from 1996/97 – 2000/01.

Large geographic variations in total PFE occurred in the MDB between 1996/97 and 2000/01 (Table 15; Figure 34). In 1996/97, NSW accounted for 49% of the total PFE in the MDB with the largest contributors being the Murrumbidgee, Central West, Lachlan and Murray CMRs. This had declined to 28% by 2000/01 led largely by decreases in the Central West, Namoi and Gwydir CMRs. Conversely, in 1996/97, Victoria accounted for 34% of the total PFE with the Goulburn, Mallee, North Central and Wimmera CMRs dominating profit generation. This increased to 50% in 2000/01 owing largely to increases in the Goulburn, Mallee and North Central CMRs. Profit in Queensland accounted for just less than 12% of the total PFE in the MDB in 1996/97 with the largest contribution from the Condamine and the Border Rivers. This share declined only slightly in 2000/01. South Australia more than doubled its share of the total PFE contribution in the MDB from 5% in 1996/97 to 11.5% in 2000/01 due to the expansion in high value Grape and Fruit production.

The most profitable agricultural CMRs are located in the south of the MDB and include Goulburn (Vic) and the Murrumbidgee (NSW). Many of these southern CMRs derive significant proportions of their agricultural PFE from Cereals but most also derive substantial PFE from their characteristic irrigated crops (Figure 35; Figure 36). The River Murray (SA) derives PFE from Grapes, Fruit and Dairy, Goulburn (Vic) from Dairy and Fruit, the Murray (NSW) and Murrumbidgee (NSW) from Rice, Fruit and Sheep. The Lachlan (NSW) and the Central West (NSW) derive PFE from Cereals and Sheep. The north-eastern CMRs derive profit from Beef, Cotton and Cereals.

Profit at full equity per hectare provides a measure of the value of Agricultural Land Uses on a per unit area basis (Table 6; Figure 33; Table 18). The PFE/ha of different Agricultural Land Uses displays a similar pattern to gross revenue. There are a few land uses such as Other, Fruit, Tree Nuts, Vegetables and Grapes that have high rates of return in terms of PFE per hectare (over $2,000/ha). Cotton, Rice, Peanuts, Dairy and Oilseeds have rates of return in PFE/ha of between $300 and $1,500/ha. Other extensive Agricultural Land Uses have much lower rates of return of PFE/ha. However, due to their large areas, these low value land uses such as Cereals, Beef and Sheep grazing account for a very large proportion of the total PFE of the MDB.

PFE per hectare is also highly variable over the MDB. PFE/ha is negative or very low in the semi-arid interior of the MDB where extensive grazing of Beef and Sheep are the dominant land uses (Figure 37; Figure 38). Only relatively small areas of the MDB

experience very high returns per hectare and these are confined largely to the irrigated southern regions and the north-eastern parts. PFE/ha follows similar patterns to gross revenue/ha. However, large differences in PFE/ha tend to occur over very short distances. This occurs in areas where there is a diversity of land uses. Such as the southern parts of the MDB, along the river corridor into South Australia, and in the north-eastern parts of the MDB. In these areas it is common for irrigated and/or high value Agricultural Land Uses to be located adjacent to low value land uses.

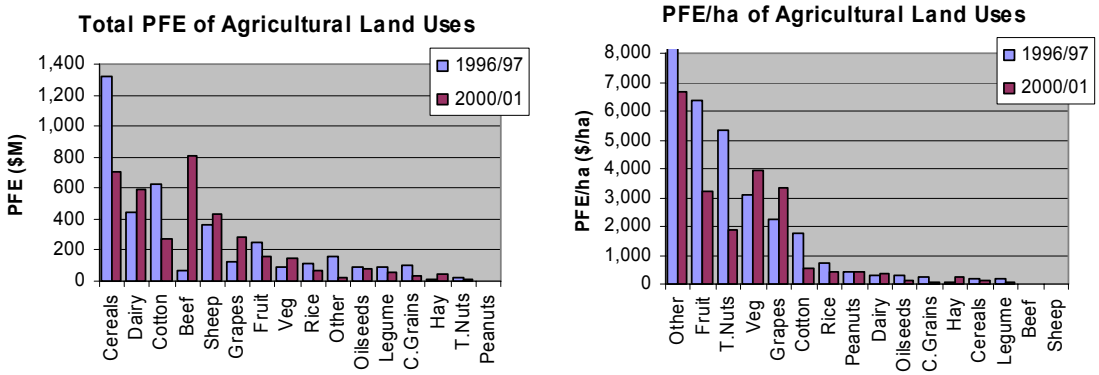


Figure 33 – Total profit at full equity (PFE) and PFE/ha of Agricultural Land Uses in the Murray-Darling Basin 1996/97 and 2000/01. Note the PFE/ha of "Other" in 1996/97 is $18,000/ha.

Agricultural Land Use	Profit at Full Equity ($'000)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	Grand Total
Beef	1996/97	262	635	21,141	529	39,363	22,304	-6,008	13,269	-3,761	-2,146	-27,226	8,312	7,912	9,710	5,823	8,542	-7,572	-21,969	-6,912	1,735	**63,945**
	2000/01	979	22,478	94,966	72,552	122,911	54,713	27,639	80,363	992	-9	62,021	36,244	67,214	46,853	51,491	34,969	908	24,266	-2,721	5,905	**804,734**
	% Change	273.6	3,440.4	349.2	13,606.9	212.2	145.3	-	505.6	-	-	-	336.1	749.5	382.5	784.3	309.4	-	-	-	240.3	**1,158.5**
Cereals	1996/97	0	82,404	95,749	162,781	41,562	21,585	90,057	144,309	-2,390	123,860	58,058	56,005	103,913	95,286	87,028	2,686	36,643	2,203	-1,178	115,308	**1,315,871**
	2000/01	121	-31,600	3,416	-73,786	-24,792	42,570	-46,802	87,110	8,711	266,342	8,024	48,737	94,768	-27,551	137,080	3,904	102,599	-1,501	-24,047	137,413	**710,717**
	% Change	-	-138.3	-96.4	-145.3	-159.7	97.2	-152.0	-39.6	-	115.0	-86.2	-13.0	-8.8	-128.9	57.5	45.3	180.0	-168.1	-	19.2	**-46.0**
Coarse Grains	1996/97		7,601	4,216	2,602	21,852	274	4,399	7,251	629	166	4,091	713	12,773	31,699	729	49		122	279	49	**99,493**
	2000/01		5,162	682	912	-4,365	316	2,934	2,737	108	-133	-927	1,151	5,415	21,906	194	0		-83	-1,146	-11	**34,853**
	% Change		-32.1	-83.8	-64.9	-120.0	15.6	-33.3	-62.3	-82.8	-179.9	-122.7	61.5	-57.6	-30.9	-73.4	-100.0		-168.2	-510.9	-123.1	**-65.0**
Cotton	1996/97		81,553	38,125	69,718	77,958		164,696	0	61		47,129		506	111,937				2,582	28,323		**622,587**
	2000/01		27,631	18,456	34,751	22,820		77,302	-891	0		37,763		18,750	46,019				880	-5,918		**277,564**
	% Change		-66.1	-51.6	-50.2	-70.7		-53.1	-	-100.0		-19.9		3,606.6	-58.9				-65.9	-120.9		**-55.4**
Dairy	1996/97	-313	-79	-2,470	946	-10,549	326,447	0	-92		-6,579	-2,652	-15,562	1,635	766	120,366	28,350	3,092	-4,623	-22	274	**438,935**
	2000/01	0	-576	-1,697	-2,988	1,050	438,918	-97	4,367		-9,309	-6,560	-42,779	2,663	3,776	163,572	39,437	10,069	-6,596	-1,621	1,067	**592,692**
	% Change	-	-	-	-415.9	-	34.5	-34,713.8	-		-	-	-	62.9	393.0	35.9	39.1	225.7	-	-	288.9	**35.0**
Fruit	1996/97		98	9,818	22,657	292	75,146	0	5,551	10,821	19,329		2,851	45,465		3,584	2,229	55,730		0	-100	**253,471**
	2000/01		-73	1,280	1,949	-4,752	53,497	-470	8,960	7,254	20,937		503	16,268		4,899	403	47,611		-2,148	-121	**155,995**
	% Change		-174.7	-87.0	-91.4	-1,727.8	-28.8	-	61.4	-33.0	8.3		-82.4	-64.2		36.7	-81.9	-14.6		-	-	**-38.5**
Grapes	1996/97			-285	-3,657		-3,372		-4,701	14,892	58,883	2,614	550	9,140		-151	-4,545	51,741	0	1,905	-1,242	**121,772**
	2000/01			-2,751	-8,680		-4,523		-5,872	19,812	114,613	0	-255	-19,163		-3,208	-7,766	204,064	3,937	2,876	-3,212	**289,872**
	% Change			-	-		-		-	33.0	94.6	-100.0	-146.4	-309.7		-	-	294.4	-	51.0	-	**138.0**
Hay	1996/97		-814	-1,344	1,865	-3,046	3,764	-612	1,973	-267	537	-847	2,201	1,874	-685	3,669	377	5,343	-220	24	579	**14,370**
	2000/01		3,831	897	805	3,080	5,948	1,729	1,948	1,085	785	972	2,092	3,206	587	6,150	233	7,009	142	963	1,608	**43,070**
	% Change		-	-	-56.8	-	58.0	-	-1.2	-	46.0	-	-4.9	71.0	-	67.6	-38.4	31.2	-	3,906.1	177.8	**199.7**
Legumes	1996/97		4,201	1,147	903	5,393	2,204	3,003	1,880	-6	8,537	489	2,923	3,826	1,067	14,444	53	3,656	0	-71	41,040	**94,688**
	2000/01		1,899	3,396	-2,070	1,134	792	-2,813	2,355	-1	6,218	765	1,951	8,315	-908	9,920	107	4,451	-436	-1,387	24,577	**58,267**
	% Change		-54.8	196.1	-329.4	-79.0	-64.1	-193.7	25.3	-	-27.2	56.4	-33.3	117.3	-185.1	-31.3	103.5	21.8	-	-	-40.1	**-38.5**
Oilseeds	1996/97	0	461	27	4,669	2,297	1,745	769	23,858	1,265	1,305	-11	9,646	25,286	2,489	4,880	88	330	0	-142	10,393	**89,355**
	2000/01	81	321	-67	1,852	247	5,221	369	16,532	101	3,392	-154	10,460	20,508	2,473	10,013	328	2,100	-59	188	9,642	**83,550**
	% Change	-	-30.4	-346.2	-60.3	-89.2	199.2	-52.0	-30.7	-92.1	160.0	-	8.4	-18.9	-0.6	105.2	271.6	536.6	-	-	-7.2	**-6.5**
Other	1996/97		15,682	-256	4,156	4,260	20,239	25,098	9,803	337	4,521	10,537	-285	13,399	9,831	11,314	-3,267	83	24,879		3,533	**153,865**
	2000/01		1	-73	4,526	3,660	14,410	42	-348	0	4,143	-15	76	1,981	550	349	-10,988	64	63		6,034	**24,475**
	% Change		-100.0	-	8.9	-14.1	-28.8	-99.8	-103.5	-100.0	-8.4	-100.1	-	-85.2	-94.4	-96.9	-	-23.3	-99.7		70.8	**-84.1**
Peanuts	1996/97		0	334		4		116				443			310				0	-97		**1,110**
	2000/01		116	65		67		0				31			-7				390	85		**749**
	% Change		-	-80.4		1,685.8		-100.0				-92.9			-102.2				-	-		**-32.6**
Rice	1996/97						1,321		393				49,239	59,318		0	0					**110,270**
	2000/01						594		640				32,511	37,978		210	-38					**71,895**
	% Change						-55.1		63.1				-34.0	-36.0		-	-					**-34.8**
Sheep	1996/97	-385	-3,181	5,118	36,707	202	35,992	329	91,901	5,800	7,161	4,797	38,174	72,976	8,315	54,978	1,925	-9,104	-14,469	4,256	22,987	**364,479**
	2000/01	-346	-1,827	5,219	52,767	509	41,481	1,100	103,030	2,731	8,606	5,324	41,936	68,533	9,609	66,626	3,520	-10,565	-4,934	5,759	30,014	**429,091**
	% Change	-	-	2.0	43.8	152.6	15.2	234.3	12.1	-52.9	20.2	11.0	9.9	-6.1	15.6	21.2	82.9	-	-	35.3	30.6	**17.7**
Tree Nuts	1996/97		-633					-1,582	0		17,960			3,617				2,013				**21,376**
	2000/01		-272					-360	2,202		5,391			-196				5,404				**12,169**
	% Change		-					-	-		-70.0			-105.4				168.4				**-43.1**
Vegetables	1996/97		-579	12,104	-6,824	6,945	10,532		-4,771	2,108	25,832	-1,165	2,065	-10,096	0	6,607		48,299			0	**91,056**
	2000/01		441	16,893	-16	4,355	32,149		-3,775	-778	31,399	0	7,083	-6,735	-933	5,245		56,698			684	**142,709**
	% Change		-	39.6	-	-37.3	205.3		-	-136.9	21.6	-	243.0	-	-	-20.6		17.4			-	**56.7**
Total 1996/97 PFE ($'000)		**-436**	**187,348**	**183,425**	**297,051**	**186,535**	**518,181**	**280,265**	**290,625**	**29,487**	**259,368**	**96,256**	**156,831**	**351,544**	**270,726**	**313,271**	**36,487**	**190,254**	**-11,496**	**26,365**	**194,557**	**3,856,643**
Total 2000/01 PFE ($'000)		**834**	**27,532**	**140,683**	**82,574**	**125,924**	**686,085**	**60,573**	**299,359**	**40,015**	**452,375**	**107,245**	**139,709**	**319,506**	**102,374**	**452,541**	**64,109**	**430,411**	**16,071**	**-29,117**	**213,600**	**3,732,403**
Total % Change		**-**	**-85.3**	**-23.3**	**-72.2**	**-32.5**	**32.4**	**-78.4**	**3.0**	**35.7**	**74.4**	**11.4**	**-10.9**	**-9.1**	**-62.2**	**44.5**	**75.7**	**126.2**	**-**	**-210.4**	**9.8**	**-3.2**

Table 17 – Total profit at full equity ($'000) of agricultural land uses by Catchment Management Region 1996/97 and 2000/01 including % change.

Agricultural Land Use	Average PFE per Hectare ($/ha)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	MDB Average
Beef	1996/97	12	1	11	0	28	59	-5	9	-4	-11	-6	10	5	6	23	14	-12	-5	-3	39	**2**
	2000/01	51	23	43	29	87	143	25	40	1	0	13	48	47	27	188	64	2	4	-1	128	**26**
	% Change	334.4	3,466.3	298.4	12,417.9	206.4	143.0	-	341.0	-	-	-	365.6	808.4	345.7	715.3	353.1	-	-	-	229.6	**1,026.5**
Cereals	1996/97	0	235	275	169	164	221	244	161	-43	164	225	139	144	204	213	207	58	182	-12	330	**177**
	2000/01	219	-110	12	-79	-133	376	-123	86	103	325	36	95	121	-70	283	290	139	-111	-141	345	**91**
	% Change	-	-146.6	-95.6	-146.6	-180.6	69.7	-150.4	-46.3	-	97.4	-84.1	-31.3	-15.7	-134.4	33.1	40.0	141.0	-161.2	-	4.4	**-48.6**
Coarse Grains	1996/97		226	112	488	133	416	198	1,080	1,258	374	114	703	876	561	389	688		179	349	70	**259**
	2000/01		76	11	68	-27	1,069	43	654	250	-124	-20	803	537	219	211	0		-43	-103	-62	**63**
	% Change		-66.3	-90.3	-86.0	-120.6	156.8	-78.5	-39.5	-80.1	-133.0	-117.7	14.2	-38.7	-61.0	-45.7	-100.0		-124.1	-129.6	-188.8	**-75.6**
Cotton	1996/97		1,857	1,726	2,103	1,291		1,956	0	289		2,021		1,902	1,611				2,149	1,617		**1,750**
	2000/01		495	573	609	383		672	-358	0		789		1,259	546				3,000	-286		**566**
	% Change		-73.4	-66.8	-71.0	-70.4		-65.6	-	-100.0		-61.0		-33.8	-66.1				39.6	-117.7		**-67.6**
Dairy	1996/97	-511	-12	-333	34	-67	1,114	0	-5		-214	-356	-104	64	49	408	223	15	-390	-380	106	**316**
	2000/01	0	-99	-324	-55	6	1,294	-29	109		-210	-401	-194	95	178	527	277	43	-438	-470	257	**358**
	% Change	-	-	-	-260.6	-	16.2	-34,796.4	-		-	-	-	48.3	262.2	29.1	24.1	187.0	-	-	142.7	**13.3**
Fruit	1996/97		1,826	3,887	18,876	6,590	9,428	0	2,807	5,498	3,762		11,511	4,498		7,424	12,721	7,051		0	-809	**6,349**
	2000/01		-4,056	367	1,512	-4,078	4,842	-3,275	3,575	3,723	4,034		1,612	1,581		2,757	2,441	5,336		-8,856	-986	**3,207**
	% Change		-322.1	-90.6	-92.0	-161.9	-48.6	-	27.3	-32.3	7.2		-86.0	-64.9		-62.9	-80.8	-24.3		-	-	**-49.5**
Grapes	1996/97			-904	-3,423		-3,964		-4,172	3,752	3,070	15,710	829	1,132		-182	-3,882	3,209	0	4,171	-5,082	**2,245**
	2000/01			-5,149	-3,741		-2,159		-2,281	3,159	4,757	0	-232	-1,267		-2,083	-2,738	7,705	13,756	4,240	-5,244	**3,349**
	% Change			-	-		-		-	-15.8	55.0	-100.0	-127.9	-211.9		-	-	140.1	-	1.7	-	**49.2**
Hay	1996/97		-68	-93	55	-83	258	-55	81	-103	64	-57	172	102	-41	196	200	147	-89	21	135	**50**
	2000/01		977	116	189	124	330	613	194	548	126	69	217	277	198	226	338	242	79	873	260	**234**
	% Change		-	-	245.7	-	28.2	-	138.4	-	95.6	-	26.2	171.7	-	15.3	69.3	64.2	-	4,017.1	92.5	**365.6**
Legumes	1996/97		192	164	92	209	256	188	109	-33	68	92	99	103	119	153	80	131	0	-14	239	**155**
	2000/01		51	103	-45	32	141	-45	69	-16	69	41	98	151	-26	109	123	120	-108	-50	163	**74**
	% Change		-73.5	-37.1	-149.1	-84.6	-45.0	-123.8	-36.5	-	1.6	-56.1	-0.8	46.4	-121.6	-28.5	53.6	-8.4	-	-	-32.1	**-52.0**
Oilseeds	1996/97	0	83	43	417	159	379	77	384	292	185	-17	292	342	124	164	226	244	0	-70	253	**277**
	2000/01	162	65	-56	30	41	208	65	102	63	121	-134	80	136	122	133	237	106	-243	32	131	**108**
	% Change	-	-21.3	-230.7	-92.8	-74.0	-45.0	-15.3	-73.6	-78.4	-34.3	-	-72.5	-60.3	-1.0	-18.9	4.7	-56.5	-	-	-48.1	**-61.2**
Other	1996/97		20,747	-5,260	24,705	6,655	31,477	46,886	46,891	61,959	45,516	11,972	-10,430	37,729	44,441	14,252	-1,870	927	27,840		8,083	**17,996**
	2000/01		7,588	-7,581	34,982	12,554	42,289	56,442	-10,968	0	76,478	-12,318	4,412	18,299	41,795	65,432	-6,538	215	47,550		8,642	**6,651**
	% Change		-63.4	-	41.6	88.6	34.4	20.4	-123.4	-100.0	68.0	-202.9	-	-51.5	-6.0	359.1	-	-76.8	70.8		6.9	**-63.0**
Peanuts	1996/97		0	811		4		2,574				1,082			2,296				0	-217		**443**
	2000/01		631	489		89		0				468			-34				1,037	576		**401**
	% Change		-	-39.7		2,393.3		-100.0				-56.8			-101.5				-	-		**-9.5**
Rice	1996/97						2,064		717				708	731		0	0					**726**
	2000/01						471		580				393	422		532	-358					**409**
	% Change						-77.2		-19.1				-44.6	-42.2		-	-					**-43.6**
Sheep	1996/97	-19	-4	5	10	1	87	1	22	1	6	3	33	24	9	71	17	-2	-2	0	36	**8**
	2000/01	-12	-3	7	15	3	91	2	25	1	7	6	34	22	11	76	22	-3	-1	1	46	**10**
	% Change	-	-	51.1	47.3	255.5	5.1	264.0	14.1	-56.9	14.1	83.4	3.1	-5.6	25.8	6.5	32.0	-	-	37.1	26.9	**26.7**
Tree Nuts	1996/97		-3,234					-3,234	0		12,100			27,127				1,176				**5,324**
	2000/01		-780					-1,035	12,952		1,673			-1,262				2,509				**1,902**
	% Change		-					-	-		-86.2			-104.7				113.4				**-64.3**
Vegetables	1996/97		-3,800	6,977	-3,852	4,580	4,732		-2,137	7,850	9,842	-8,275	1,010	-1,318	0	2,784		9,660			0	**3,061**
	2000/01		2,143	7,494	-26	2,009	8,705		-3,352	-3,565	9,665	0	4,143	-647	-9,081	1,318		8,960			6,793	**3,945**
	% Change		-	7.4	-	-56.1	84.0		-	-145.4	-1.8	-	310.4	-	-	-52.7		-7.2			-	**28.9**
Avg 1996/97 PFE/Ha ($/Ha)		**-10**	**86**	**52**	**42**	**80**	**413**	**116**	**43**	**5**	**109**	**15**	**59**	**62**	**84**	**157**	**39**	**33**	**-1**	**2**	**155**	**44**
Avg 2000/01 PFE/Ha ($/Ha)		**17**	**14**	**42**	**11**	**57**	**498**	**26**	**40**	**7**	**188**	**18**	**47**	**56**	**31**	**201**	**74**	**80**	**1**	**-2**	**160**	**42**
% Change		**-**	**-83.9**	**-20.4**	**-72.9**	**-29.1**	**20.8**	**-77.4**	**-7.1**	**34.1**	**71.8**	**16.3**	**-20.0**	**-10.1**	**-62.7**	**28.3**	**91.1**	**145.9**	**-**	**-203.6**	**3.2**	**-4.7**

Table 18 – Average profit at full equity per hectare ($/Ha) of agricultural land uses by Catchment Management Region 1996/97 and 2000/01 including % change.

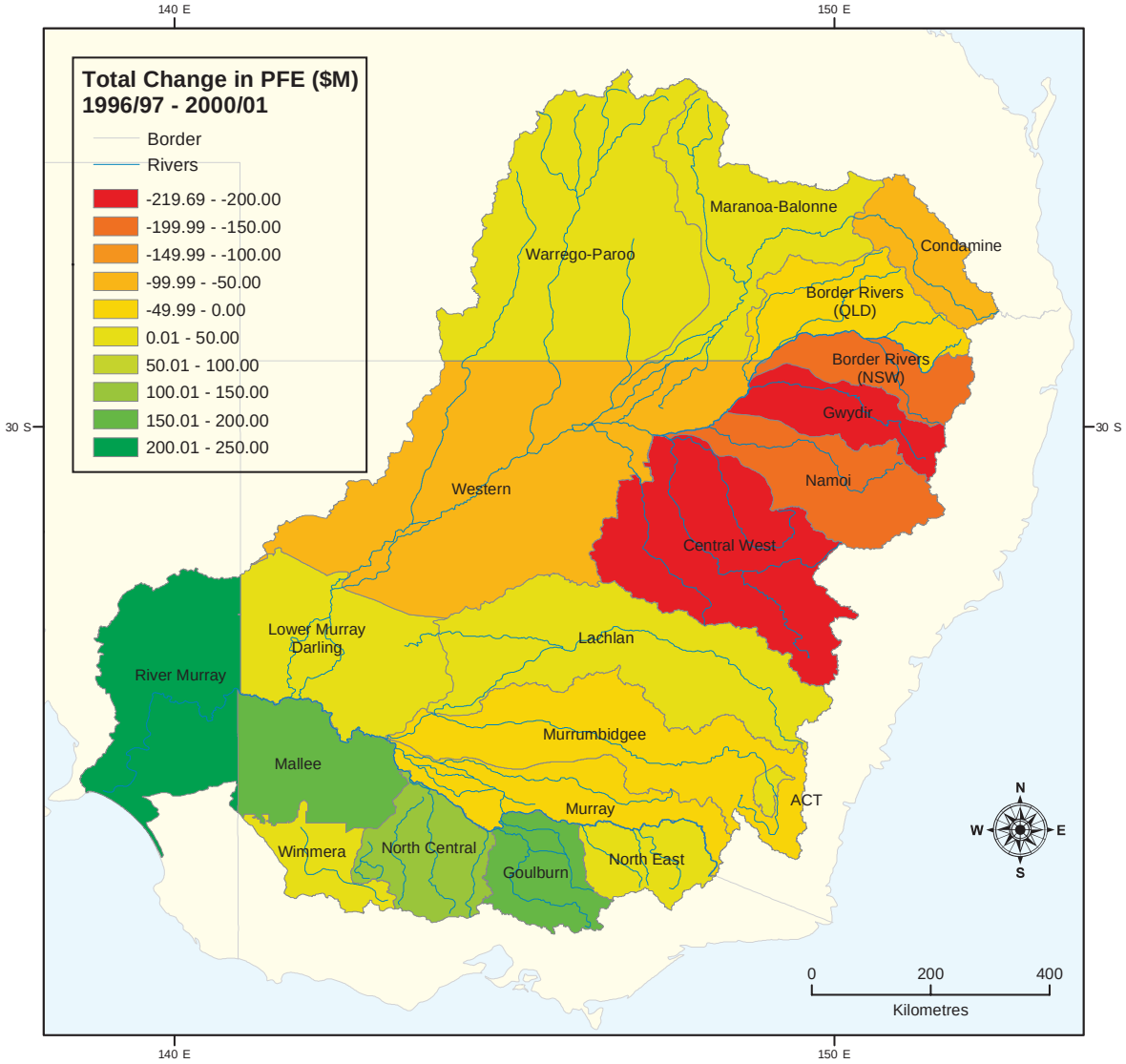


Figure 34 – Total change in profit at full equity from agricultural land use by Catchment Management Region in the Murray-Darling Basin 2000/01. Green areas indicate an increase in PFE, red indicates a decrease in $ Millions.

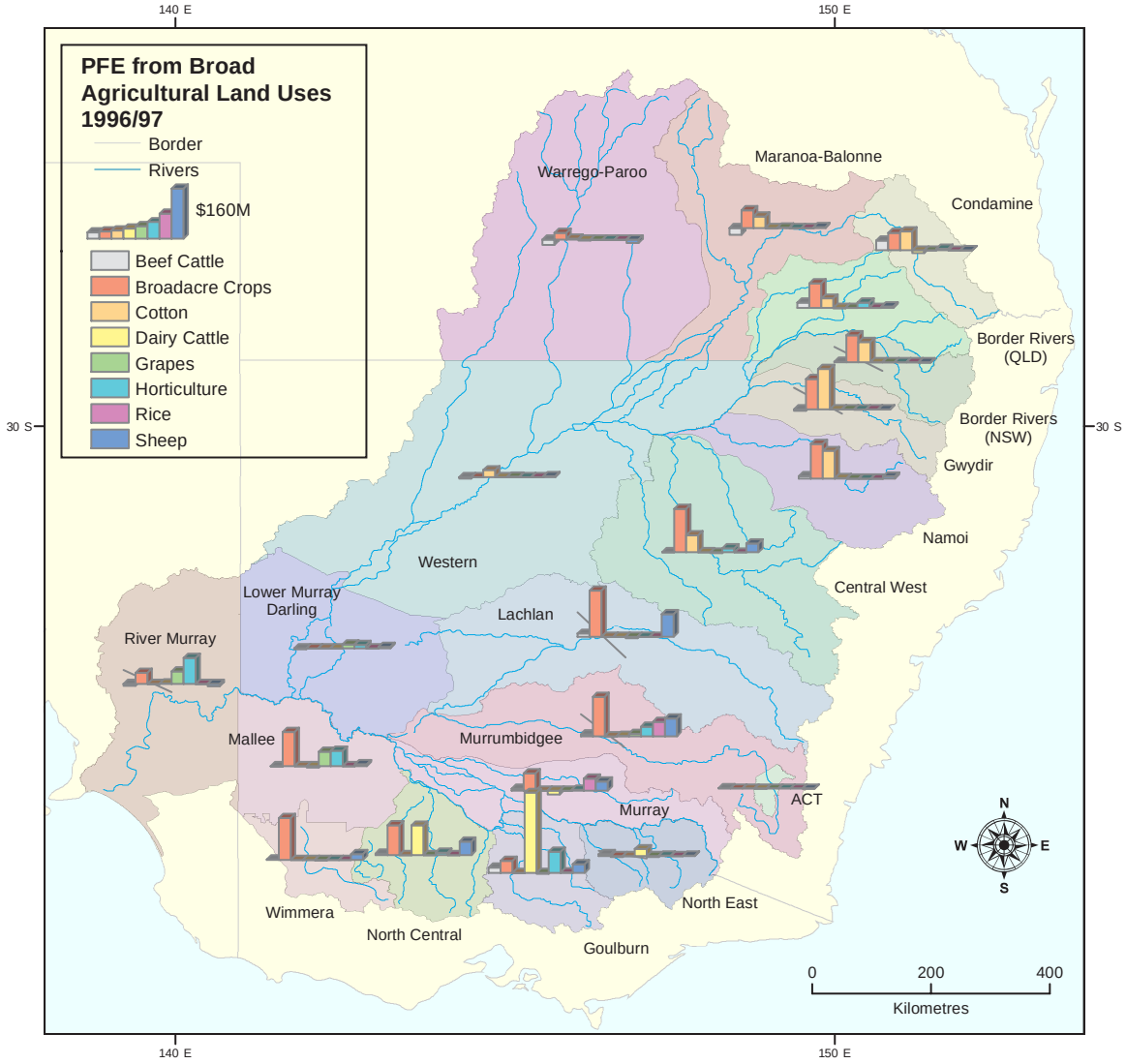


Figure 35 – Profit at full equity from broad agricultural land uses by Catchment Management Region in the Murray-Darling Basin 1996/97.

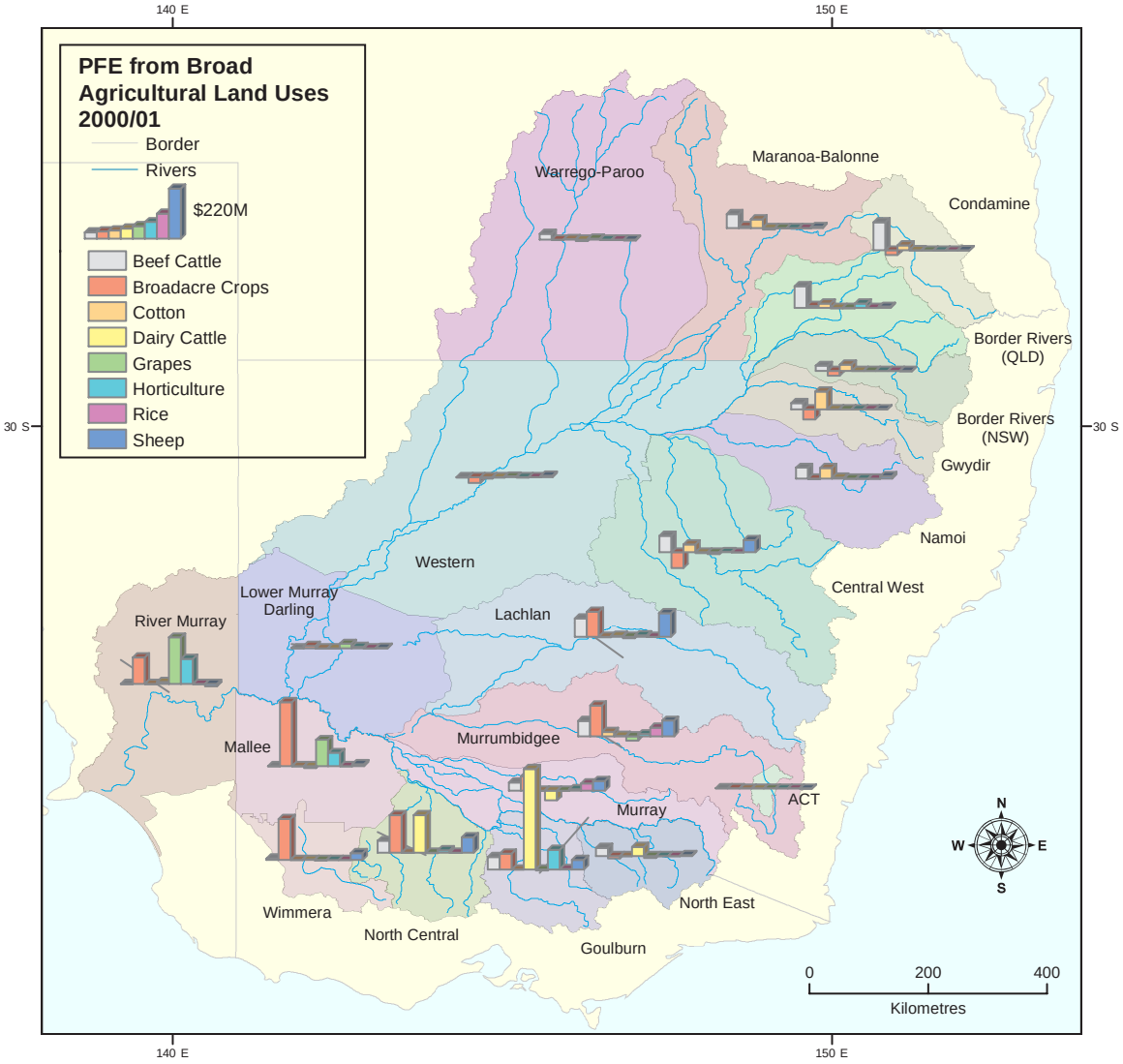


Figure 36 – Profit at full equity from broad agricultural land uses by Catchment Management Region in the Murray-Darling Basin 2000/01.

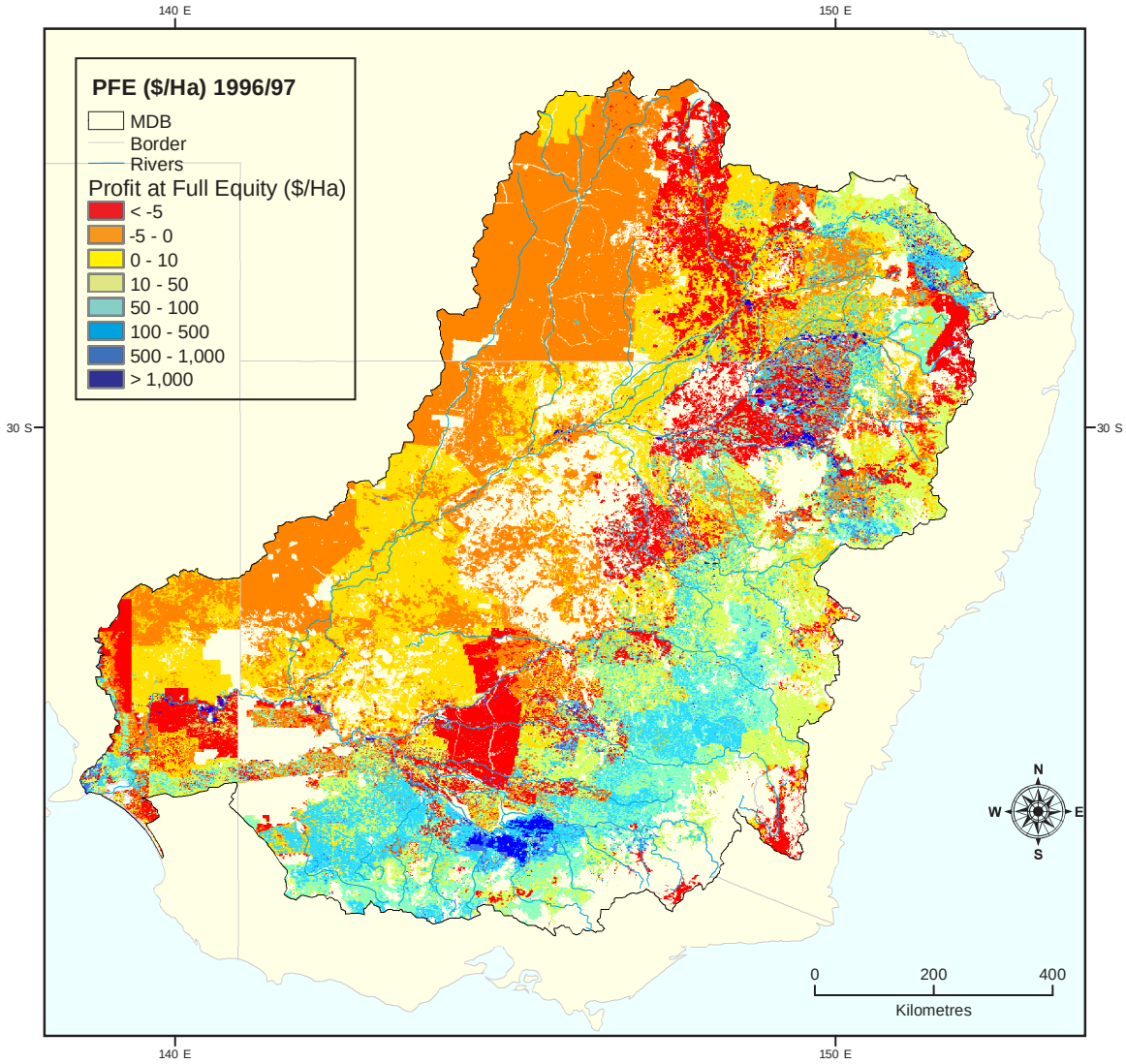


Figure 37 – Agricultural profit at full equity ($/Ha) in the Murray-Darling Basin 1996/97. Note that abrupt linear changes in the spatial distribution of PFE have resulted from differences in yield and price data assembled by SLA.

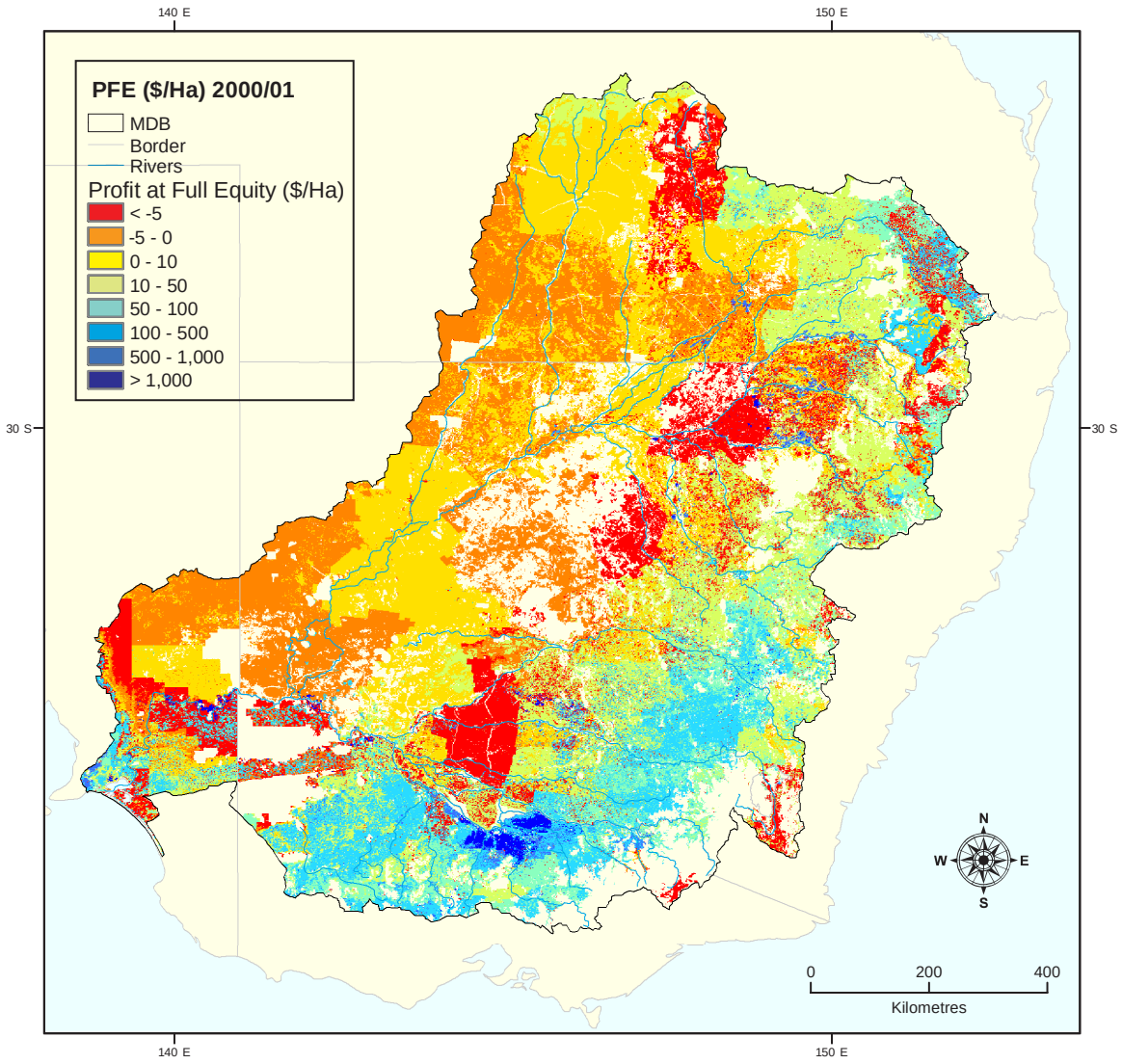


Figure 38 – Agricultural profit at full equity ($/Ha) in the Murray-Darling Basin 2000/01. Note that abrupt linear changes in the spatial distribution of PFE have resulted from differences in yield and price data assembled by SLA.

The distribution of profit at full equity in the MDB is such that very few pixels have very high PFE per hectare, many pixels have low to moderate PFE/ha and a few pixels have negative PFE/ha (Figure 39). Hence, a large proportion of the PFE in the MDB is generated from a relatively small area. Figure 39 shows that around 50% of the total PFE occurs in around 1% of the agricultural area and 80% of the total PFE occurs in around 5.5% of the area. The highest value areas are concentrated in the irrigated areas located in the crescent-shaped band in the south, east and north-east of the MDB (Figure 40; Figure 41). In 1996/97 some 25% of the agricultural area of the MDB did not make a profit and in 2000/01 some 15% of the agricultural area failed to make a profit. That is to say that in these areas insufficient money was returned from agriculture to pay the manager a wage, cover production costs and put aside sufficient money to replace depreciating assets.

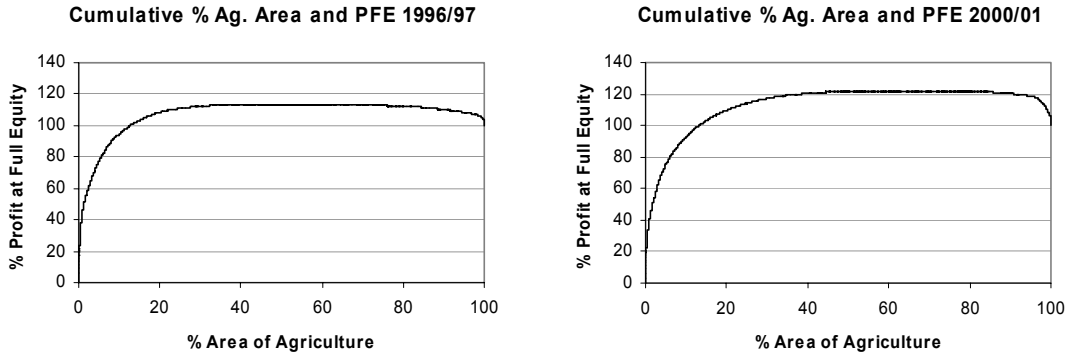


Figure 39 – Cumulative percentage of agricultural profit at full equity graphed against cumulative percentage of agricultural area for all agricultural pixels ranked in order of highest to lowest PFE for both 1996/97 and 2000/01.

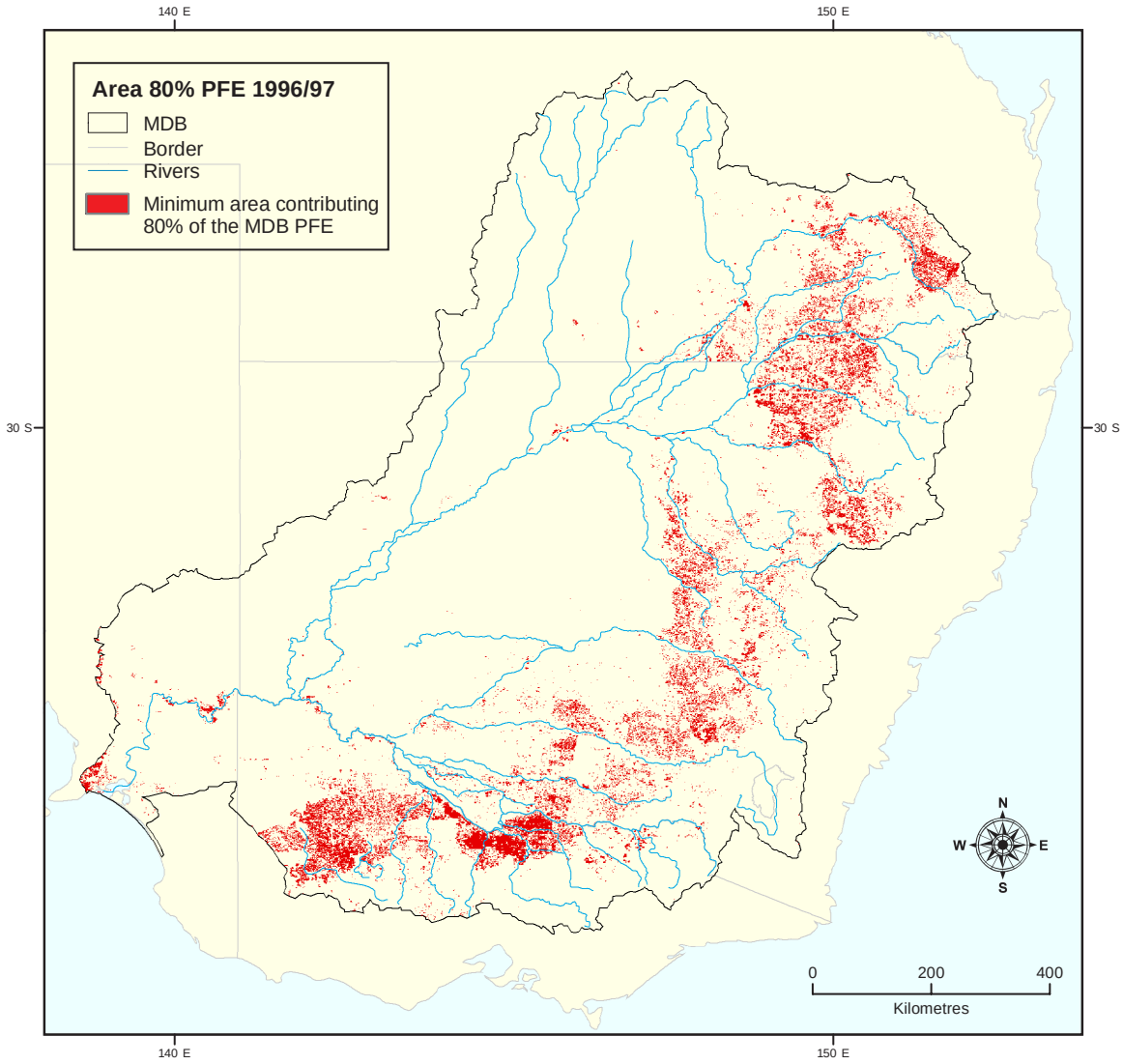


Figure 40 – Highest PFE pixels accounting for 80% of the total profit at full equity from agriculture in the Murray-Darling Basin 1996/97.

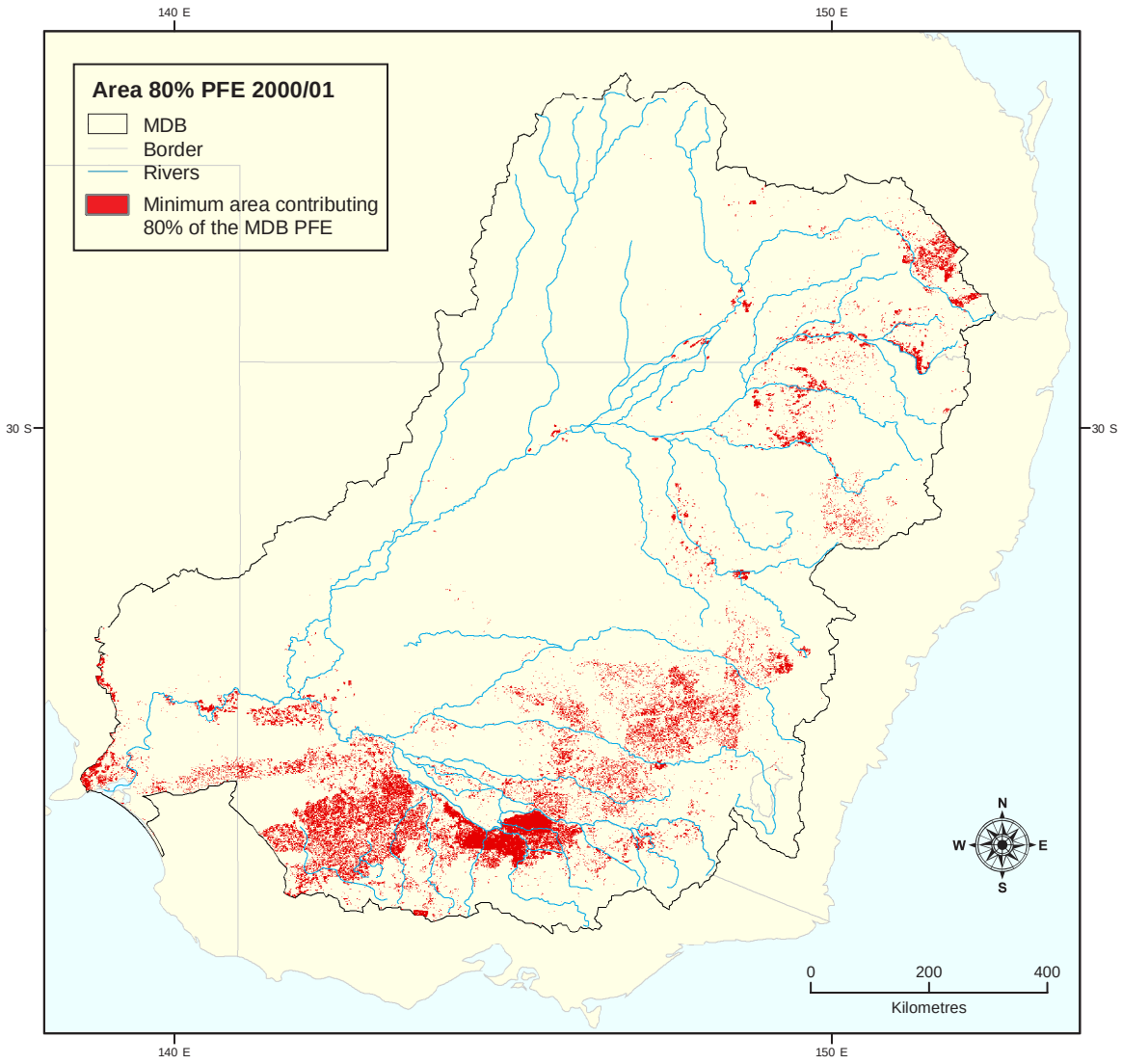


Figure 41 - Highest PFE pixels accounting for 80% of the total profit at full equity from agriculture in the Murray-Darling Basin 2000/01.

3.3.3 Net Economic Returns

The total value of government support to agriculture, using the internationally agreed measure of support was estimated at $665M in 1996/97 or 17% of profit at full equity. In 2000/01 the total government support to agriculture was $533M, or 14% of the total PFE (Table 15). The Agricultural Land Uses of Sheep, Cereals, Grapes and Beef receive the largest total amounts of government support in the MDB. On a per hectare basis, the highest rates of support are directed towards Other (largely Tobacco), Grapes, Tree Nuts and Fruit (Table 6; Figure 42). Significant variation in support occurred between 1996/97 and 2000/01. The reduction in government support to the land use class “Other“ reflects the cessation of a tobacco subsidy.

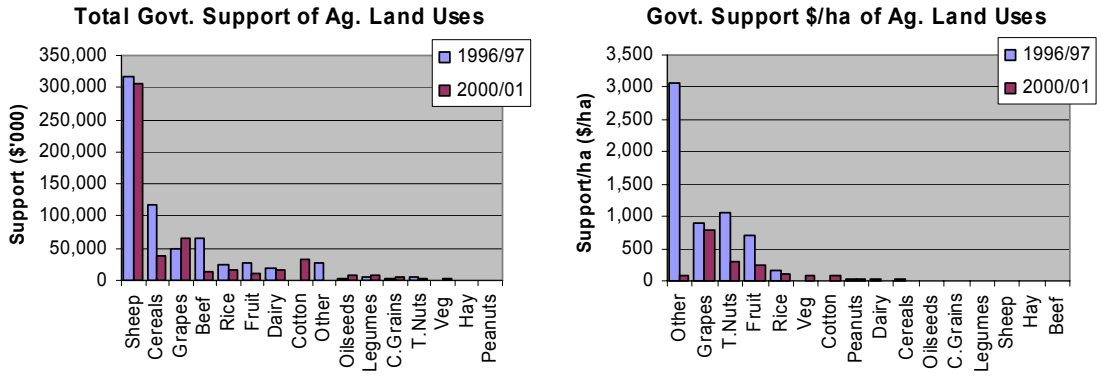


Figure 42 – Total government support and government support per hectare of Agricultural Land Uses in the Murray-Darling Basin 1996/97 and 2000/01.

NSW accounted for more than half of the total government support with the Murrumbidgee, Lachlan, Central West CMRs the largest contributors and Victoria accounting for less than a third. The River Murray (SA) CMR has around 8% of total government support in the MDB (Table 15; Figure 43; Figure 44). Although there was an overall decrease in the level of government support to agriculture, there is not much geographic variation in the level of government support over the five year period. The percentage of total support given to each CMR and state was relatively invariant from 1996/97 to 2000/01 (Table 15).

Several CMRs also have a very high level of support relative to their total profit at full equity although this measure is highly variable on a year to year basis. In NSW in 1996/97, government support was 20% of total PFE which increased to 30% in 2000/01 with high proportions occurring in the Murray, Lachlan and Murrumbidgee CMRs. Support to Victoria in 1996/97 was 12% of total PFE and only 7% in 2000/01.

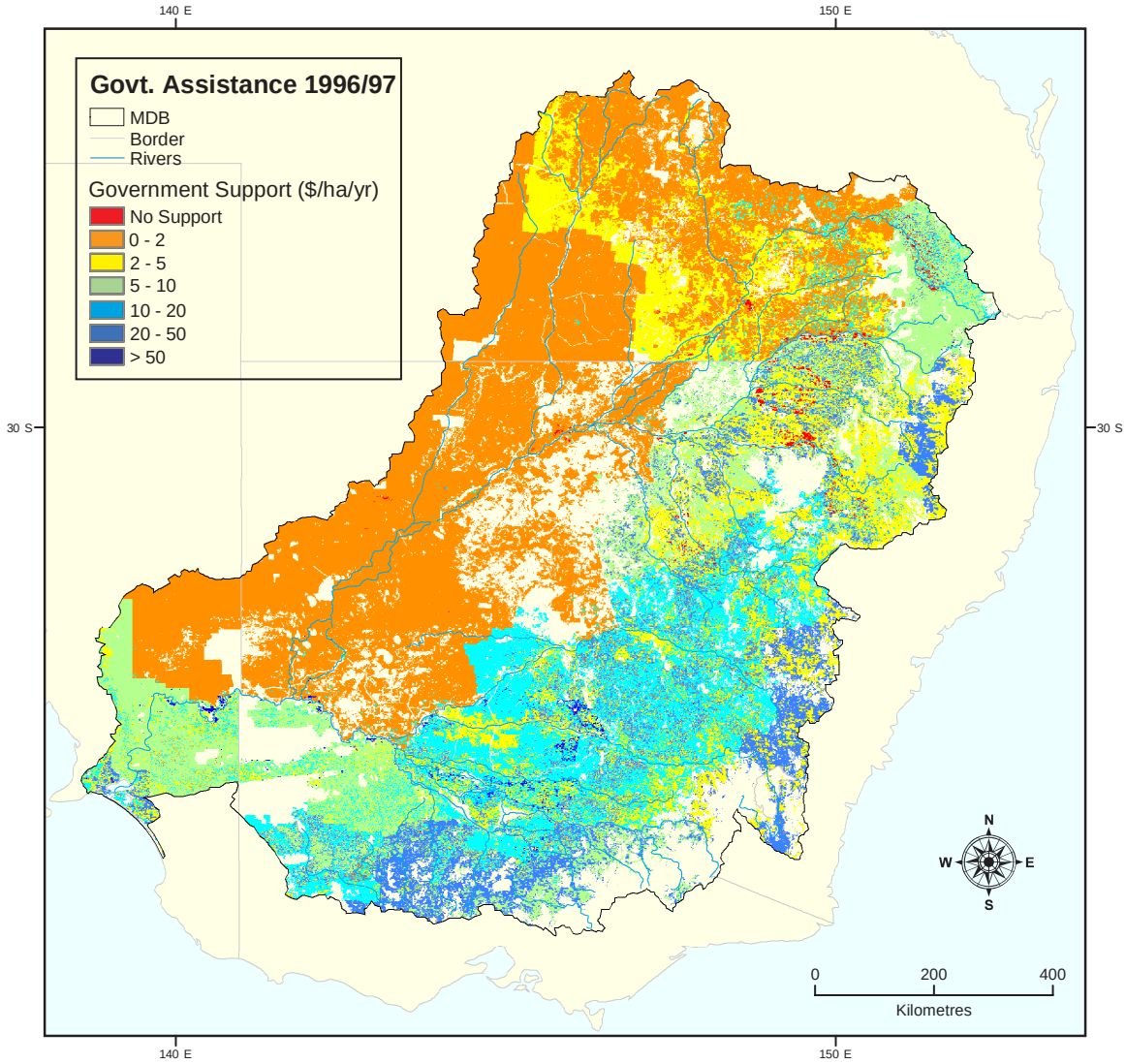


Figure 43 - Level of government support to agriculture within the Murray-Darling Basin 1996/97 ($/ha). Note that this does not include NHT and NAPSWQ funds.

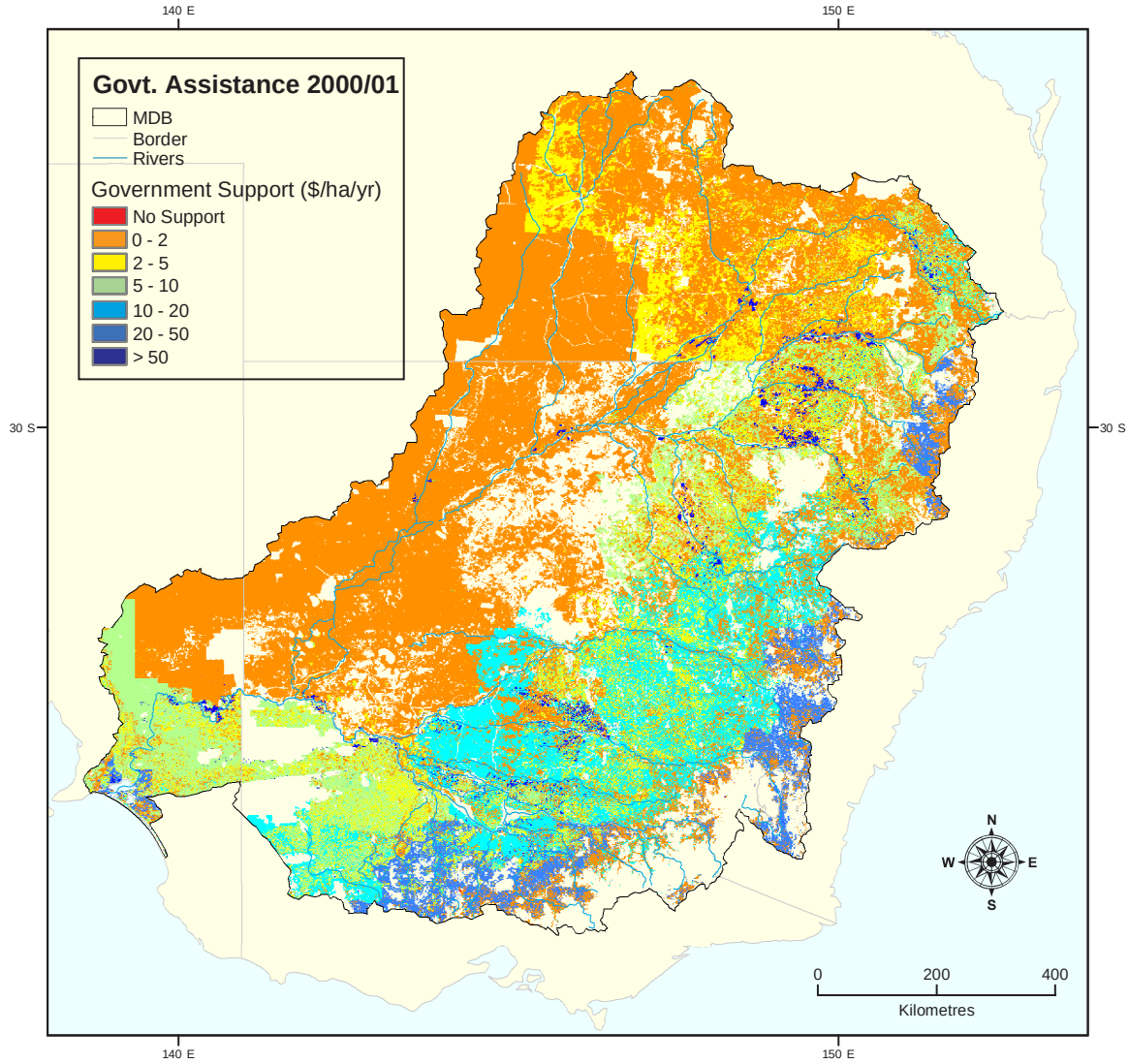


Figure 44 - Level of Government support to agriculture within the Murray-Darling Basin 2000/01 ($/ha/yr). Note that this does not include NHT and NAPSWQ funds.

Total net economic returns to agriculture in the MDB in 1996/97 was $3.192B. This increased slightly to $3.199B in 2000/01. The increase in NER compared to the decrease in PFE resulted from a lower level of government support in 2000/01. Despite variations in the levels of government support to different types of Agricultural Land Use and across different regions in the MDB, the net economic returns follow similar patterns to profit at full equity. A couple of notable exceptions include Sheep and Grapes (Table 6; compare Figure 33 and Figure 45; Table 19). The NER from Sheep is much lower than the PFE due to the high level of government support for the Sheep industry. Grapes also have a significantly lower NER resulting from the higher level of government support.

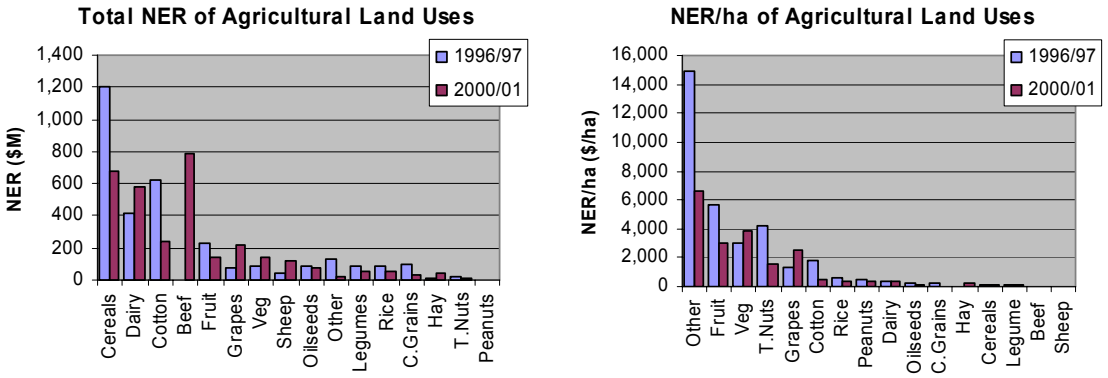


Figure 45 – Total net economic returns and NER/ha of Agricultural Land Uses in the Murray-Darling Basin 1996/97 and 2000/01.

There is a large amount of variation in net economic returns between 1996/97 and 2000/01 due to the high level of variation in PFE from year to year (Table 15; Table 19). In 1996/97, NSW accounted for around 48% of NER. This declined to 23% in 2000/01 due to the dramatic decrease in PFE in NSW. The largest influence on this change was the Central West, Gwydir and Border Rivers CMRs. Queensland's share of net economic returns remained fairly constant at around 12%. Victoria increased its share of NER from 36% in 1996/97 to 55% in 2000/01 largely due to increases in the North Central, Goulburn and Mallee CMRs. South Australia's River Murray CMR increased its share of NER from 6.2% in 1996/97 to 13.3% in 2000/01.

Agricultural Land Use	Net Economic Returns ($'000)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	Grand Total
Beef	1996/97	153	-2,728	13,891	-6,380	30,242	20,015	-9,508	9,977	-4,001	-2,582	-34,116	5,749	2,886	5,144	4,514	4,445	-8,659	-25,278	-7,572	1,577	**-2,232**
	2000/01	960	21,825	93,473	71,050	121,107	54,248	26,982	79,505	956	-72	60,528	35,763	66,266	45,866	51,213	34,233	698	23,396	-2,921	5,873	**790,949**
	% Change	525.8	-	572.9	-	300.5	171.0	-	696.9	-	-	-	522.0	2,196.0	791.7	1,034.5	670.2	-	-	-	272.4	**-**
Cereals	1996/97	0	76,138	90,388	145,636	37,991	20,368	83,289	129,531	-2,943	114,522	54,036	49,387	91,912	86,803	81,539	2,522	28,967	2,019	-2,792	109,495	**1,198,808**
	2000/01	118	-33,036	2,437	-78,060	-25,793	41,935	-48,572	82,290	8,482	262,450	7,267	45,981	90,765	-29,395	134,450	3,828	99,261	-1,540	-24,712	134,808	**672,965**
	% Change	-	-143.4	-97.3	-153.6	-167.9	105.9	-158.3	-36.5	-	129.2	-86.6	-6.9	-1.2	-133.9	64.9	51.8	242.7	-176.3	-	23.1	**-43.9**
Coarse Grains	1996/97		7,259	3,969	2,541	20,331	264	4,173	7,148	621	163	3,886	699	12,473	31,121	696	49		118	269	41	**95,822**
	2000/01		4,466	303	766	-5,821	305	2,242	2,671	101	-146	-1,188	1,133	5,196	20,892	177	0		-95	-1,259	-13	**29,730**
	% Change		-38.5	-92.4	-69.9	-128.6	15.6	-46.3	-62.6	-83.7	-189.5	-130.6	62.1	-58.3	-32.9	-74.5	-100.0		-180.1	-567.3	-132.4	**-69.0**
Cotton	1996/97		81,553	38,125	69,718	77,958		164,696	0	61		47,129		506	111,937				2,582	28,323		**622,587**
	2000/01		23,772	16,455	30,440	19,888		69,075	-1,084	0		34,757		17,607	39,949				861	-7,719		**244,000**
	% Change		-70.9	-56.8	-56.3	-74.5		-58.1	-	-100.0		-26.3		3,380.8	-64.3				-66.7	-127.3		**-60.8**
Dairy	1996/97	-319	-149	-2,530	647	-12,657	321,096	-36	-276		-6,788	-2,707	-17,312	1,344	596	116,067	25,395	1,186	-4,651	-22	250	**419,136**
	2000/01	0	-620	-1,735	-3,429	-543	434,282	-125	4,108		-9,533	-6,649	-44,538	2,433	3,603	160,062	36,983	8,557	-6,604	-1,622	1,037	**575,668**
	% Change	-	-	-	-629.7	-	35.2	-	-		-	-	-	81.0	504.8	37.9	45.6	621.8	-	-	314.5	**37.3**
Fruit	1996/97		25	7,085	21,614	232	70,380	0	-95	10,511	16,052		2,794	39,094		3,439	2,148	52,263		0	-212	**225,329**
	2000/01		-80	316	1,564	-5,205	51,826	-526	7,184	7,027	19,567		488	14,115		4,347	383	45,813		-2,174	-153	**144,492**
	% Change		-421.7	-95.5	-92.8	-2,347.0	-26.4	-	-	-33.1	21.9		-82.5	-63.9		26.4	-82.1	-12.3		-	-	**-35.9**
Grapes	1996/97			-494	-4,094		-3,708		-5,114	10,965	41,100	2,292	27	1,881		-748	-4,869	36,063	0	1,439	-1,306	**73,434**
	2000/01			-3,159	-9,467		-5,206		-6,984	14,301	94,744	0	-1,099	-31,400		-4,007	-8,400	181,241	3,438	2,285	-3,375	**222,914**
	% Change			-	-		-		-	30.4	130.5	-100.0	-4,187.8	-1,769.1		-	-	402.6	-	58.8	-	**203.6**
Hay	1996/97		-867	-1,408	1,714	-3,213	3,695	-661	1,867	-278	498	-912	2,141	1,793	-759	3,576	368	5,184	-231	19	555	**13,081**
	2000/01		3,814	863	786	2,956	5,862	1,717	1,904	1,076	753	911	2,046	3,154	574	6,011	229	6,882	134	959	1,574	**42,203**
	% Change		-	-	-54.2	-	58.6	-	2.0	-	51.2	-	-4.5	75.9	-	68.1	-37.7	32.8	-	4,993.2	183.3	**222.6**
Legumes	1996/97		4,025	1,087	848	5,131	2,127	2,873	1,789	-6	7,574	442	2,746	3,588	997	13,721	49	3,486	0	-105	39,605	**89,978**
	2000/01		1,612	3,174	-2,324	781	743	-3,277	2,176	-2	5,239	626	1,829	7,990	-1,169	8,974	102	4,216	-461	-1,566	22,685	**51,347**
	% Change		-60.0	192.2	-374.0	-84.8	-65.1	-214.0	21.6	-	-30.8	41.7	-33.4	122.7	-217.2	-34.6	107.5	20.9	-	-	-42.7	**-42.9**
Oilseeds	1996/97	0	423	24	4,539	2,178	1,698	709	23,076	1,253	1,250	-15	9,241	24,415	2,352	4,603	84	318	0	-151	10,012	**86,009**
	2000/01	75	293	-78	1,170	201	4,969	337	14,475	88	3,158	-165	8,855	18,674	2,317	9,286	314	1,890	-61	142	8,942	**74,881**
	% Change	-	-30.9	-427.0	-74.2	-90.8	192.6	-52.5	-37.3	-92.9	152.7	-	-4.2	-23.5	-1.5	101.7	272.4	494.5	-	-	-10.7	**-12.9**
Other	1996/97		15,670	-256	4,153	4,249	20,232	25,089	9,800	337	4,520	10,523	-286	13,393	9,828	11,306	-29,285	82	24,865		3,530	**127,750**
	2000/01		1	-73	4,524	3,655	14,407	42	-348	0	4,142	-15	75	1,979	550	349	-11,218	62	63		6,029	**24,224**
	% Change		-100.0	-	8.9	-14.0	-28.8	-99.8	-103.6	-100.0	-8.4	-100.1	-	-85.2	-94.4	-96.9	-	-25.1	-99.7		70.8	**-81.0**
Peanuts	1996/97		0	320		-11		115				433			308				0	-102		**1,062**
	2000/01		113	62		57		0				30			-9				384	84		**720**
	% Change		-	-80.6		-		-100.0				-93.2			-103.0				-	-		**-32.2**
Rice	1996/97						1,214		300				37,510	45,627		0	0					**84,652**
	2000/01						468		529				24,127	28,877		170	-48					**54,123**
	% Change						-61.5		76.1				-35.7	-36.7		-	-					**-36.1**
Sheep	1996/97	-798	-12,641	297	-9,584	-1,020	23,818	-8,446	43,619	656	-4,895	-784	22,064	27,962	-2,144	32,826	-3,568	-30,068	-26,466	-14,800	12,487	**48,515**
	2000/01	-932	-9,450	1,781	7,074	-411	28,541	-6,513	52,493	-2,784	-3,605	1,946	25,415	24,463	64	42,151	-976	-30,484	-14,668	-11,462	19,305	**121,946**
	% Change	-	-	500.6	-	-	19.8	-	20.3	-524.5	-	-	15.2	-12.5	-	28.4	-	-	-	-	54.6	**151.4**
Tree Nuts	1996/97		-845					-2,113	0		16,359			3,472				238				**17,110**
	2000/01		-380					-446	2,182		4,336			-207				4,764				**10,248**
	% Change		-					-	-		-73.5			-106.0				1,904.7				**-40.1**
Vegetables	1996/97		-579	12,104	-6,824	6,945	10,532		-4,771	2,108	25,832	-1,165	2,065	-10,096	0	6,607		48,299			0	**91,056**
	2000/01		421	16,624	-74	4,108	31,778		-3,853	-803	31,174	0	6,923	-7,479	-943	4,870		56,037			674	**139,457**
	% Change		-	37.3	-	-40.9	201.7		-	-138.1	20.7	-	235.2	-	-	-26.3		16.0			-	**53.2**
Total 1996/97 NER ($'000)		**-963**	**167,283**	**162,600**	**224,530**	**168,356**	**491,732**	**260,181**	**216,851**	**19,282**	**213,605**	**79,042**	**116,826**	**260,249**	**246,183**	**278,145**	**-2,663**	**137,359**	**-27,042**	**4,505**	**176,036**	**3,192,097**
Total 2000/01 NER ($'000)		**220**	**12,751**	**130,444**	**24,018**	**114,979**	**664,156**	**40,935**	**237,248**	**28,443**	**412,209**	**98,047**	**106,999**	**242,433**	**82,299**	**418,053**	**55,431**	**378,936**	**4,846**	**-49,966**	**197,386**	**3,199,867**
Total % Change		**-**	**-92.4**	**-19.8**	**-89.3**	**-31.7**	**35.1**	**-84.3**	**9.4**	**47.5**	**93.0**	**24.0**	**-8.4**	**-6.8**	**-66.6**	**50.3**	**-**	**175.9**	**-**	**-1,209.1**	**12.1**	**0.2**

Table 19 – Total net economic returns ($'000) of agricultural land uses by Catchment Management Region 1996/97 and 2000/01 including % change.

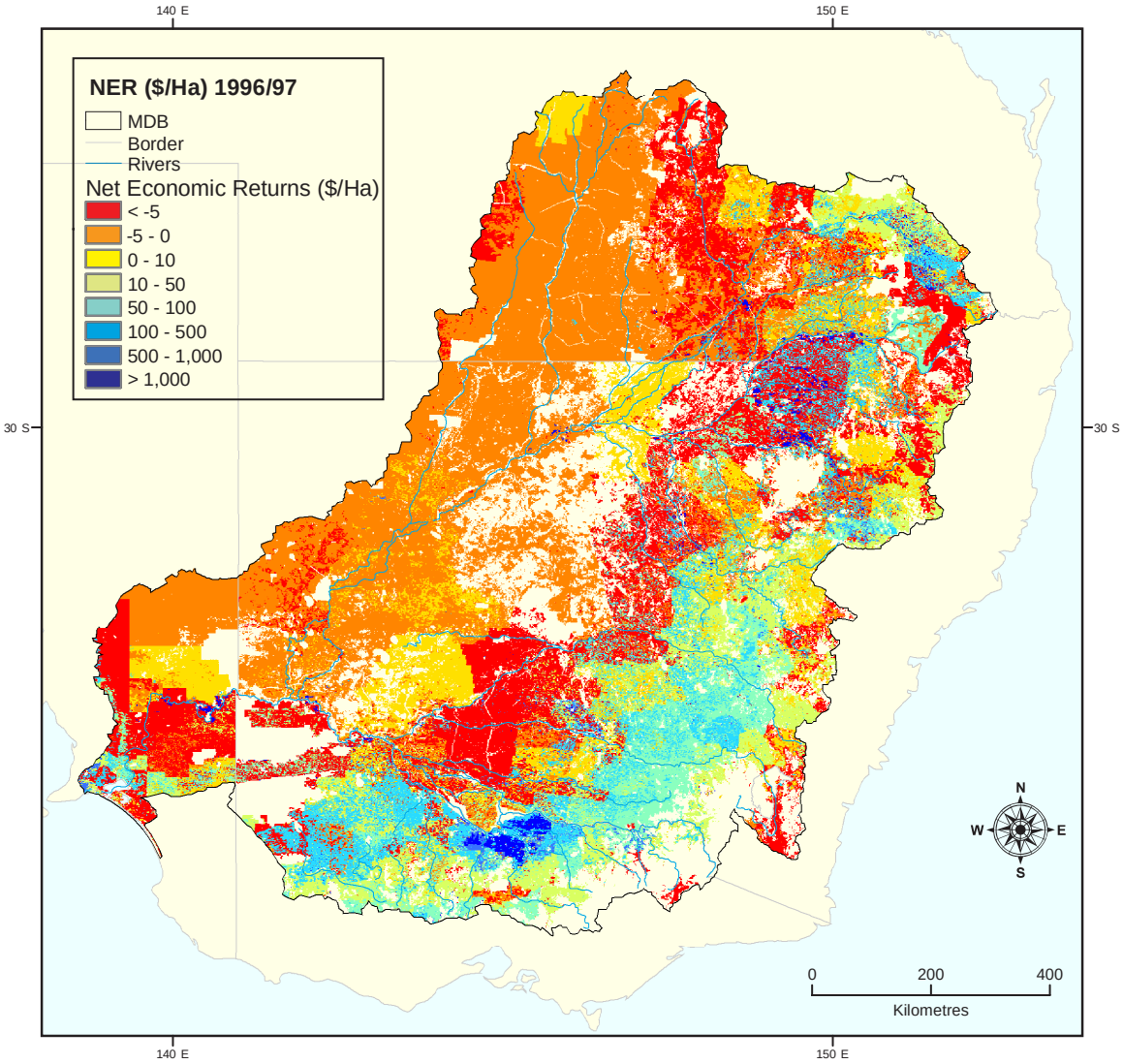


Figure 46 - Net economic returns to agriculture for 1996/97 in the Murray-Darling Basin ($/ha).

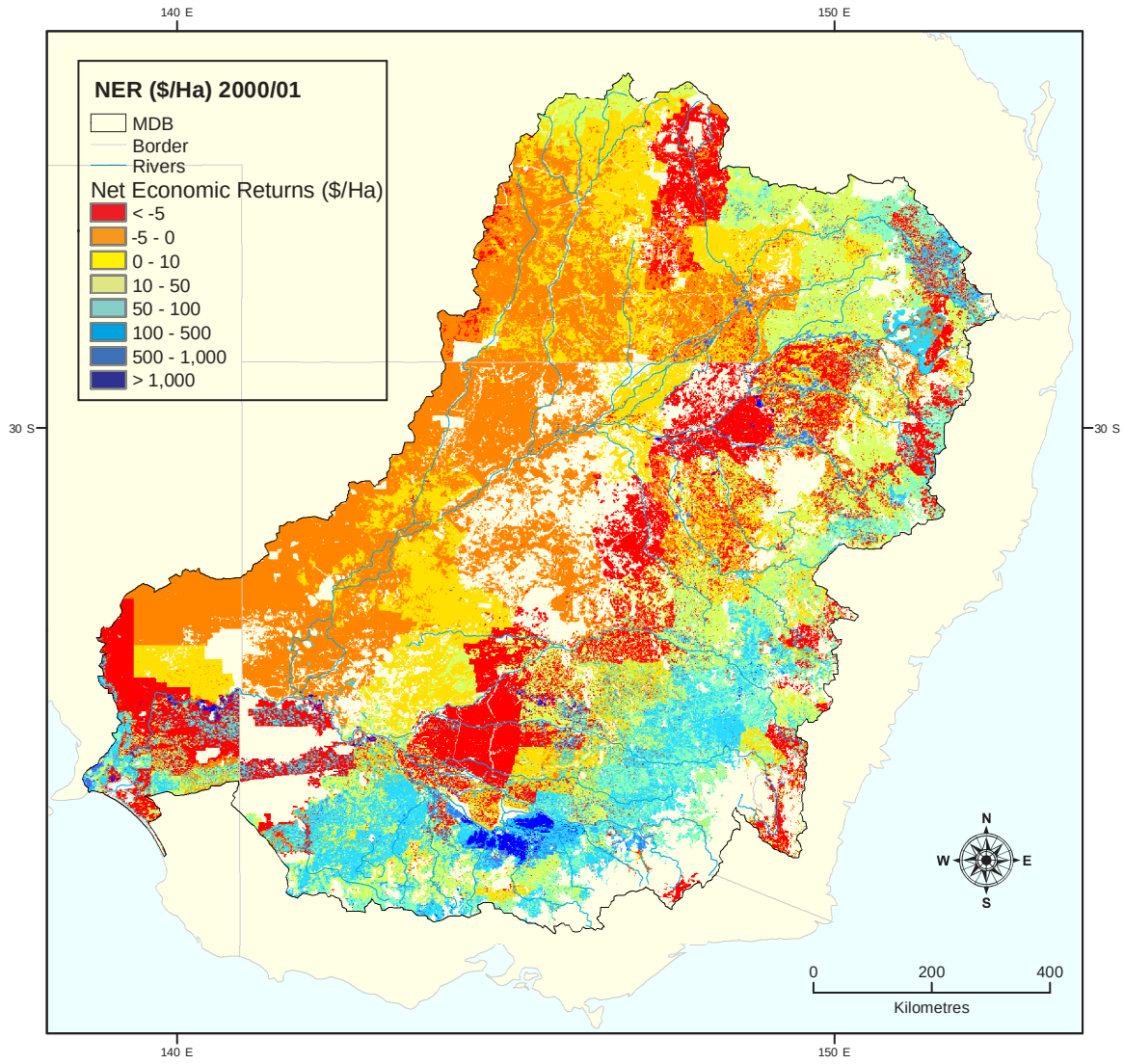


Figure 47 - Net economic returns to agriculture for 2000/01 in the Murray-Darling Basin ($/ha).

3.4 Returns to Water Resources

Returns to water resources from irrigated agriculture provides information about one aspect of the benefits to water use in the Murray-Darling Basin. This information may be used to assess trade-offs for the public costs such as reduced environmental flows and salinity resulting from irrigation water use. Table 20 shows that in 1996/97, although irrigated agriculture covers only about 1.4% of the total land area of the MDB, around 36% of the total profits generated from agriculture come from irrigated land uses. In 2000/01 irrigated land uses expanded to 1.7% of the MDB and the profit share decreased to 33%.

	1996/97				2000/01			
Agriculture Type	**Area ('000 Ha)**	**% of MDB Area**	**PFE ($'000)**	**% of MDB PFE**	**Area ('000 Ha)**	**% of MDB Area**	**PFE ($'000)**	**% of MDB PFE**
Dryland	85,841	81.1	2,470,045	64.4	86,844	82.0	2,506,865	67.2
Irrigated	1,485	1.4	1,386,598	35.6	1,818	1.7	1,225,537	32.8
TOTAL	**87,326**	**82.5**	**3,856,643**	**100.0**	**88,662**	**50.3**	**3,732,403**	**100.0**

Table 20 – Summary of areas and total profit at full equity generated from dryland and irrigated agriculture.

Total returns to irrigated Agricultural Land Uses for 1996/97 and 2000/01 in terms of gross revenue and profit at full equity are presented in Figure 48, Table 8, Table 21 and Table 22. Cotton delivers the highest returns both in terms of gross revenue and PFE although both have decreased from 1996/97 to 2000/01. Dairy has the next highest returns of irrigated land uses and has increased over the five year period. Fruit, Grapes, Vegetables and Rice also have high returns. Returns from Grapes have doubled over the period from 1996/97 to 2000/01. Gross revenue from Fruit has remained constant but PFE has dropped, returns from Vegetables have increased and Rice has remained fairly stable (gross revenue increased slightly, PFE dropped slightly). Other Agricultural Land Uses have relatively minor contributions to the total returns.

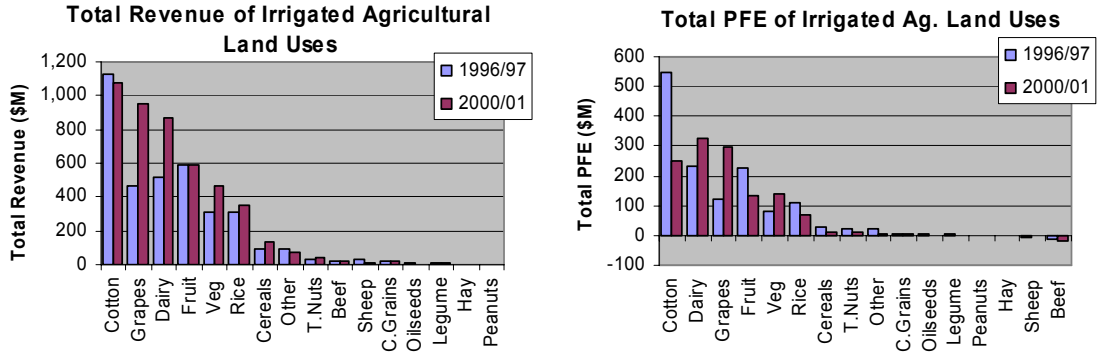


Figure 48 – Gross revenue and total PFE of irrigated Agricultural Land Uses in the Murray-Darling Basin 1996/97 and 2000/01.

Estimates of average gross revenue and profit at full equity in dollars per megalitre of water used in irrigation for each Agricultural Land Use for 1996/97 and 2000/01 are presented in Figure 49, Table 8, Table 23 and Table 24. The land uses that have the highest total returns are not those that have the highest relative returns per megalitre of irrigation water used. The *Other* Agricultural Land Use has the highest returns per megalitre. This is largely influenced by the very high returns and low water requirements of Cut Flowers (Appendix 4, Appendix 7, Appendix 8). Cut Flowers however, only have a minor contribution to total returns from irrigated agriculture.

Some Agricultural Land Uses like Oilseeds, Cereals, Legumes and Beef Cattle have low water requirements in megalitres per hectare (Table 8; Appendix 4). However, the irrigated versions of these land uses produce moderate returns per hectare. Hence, the returns per megalitre are high. In contrast, some Agricultural Land Uses such as Cotton, Rice and Dairy have high water requirements but only moderate returns per hectare. Hence, they tend to have lower rates of return per megalitre of water used. Land Uses such as Grapes, Fruit and Vegetables tend to have moderate to high water requirements per hectare and also moderate to high returns per hectare. Hence, these land uses have moderate returns per megalitre (Figure 49; Table 23; Table 24).

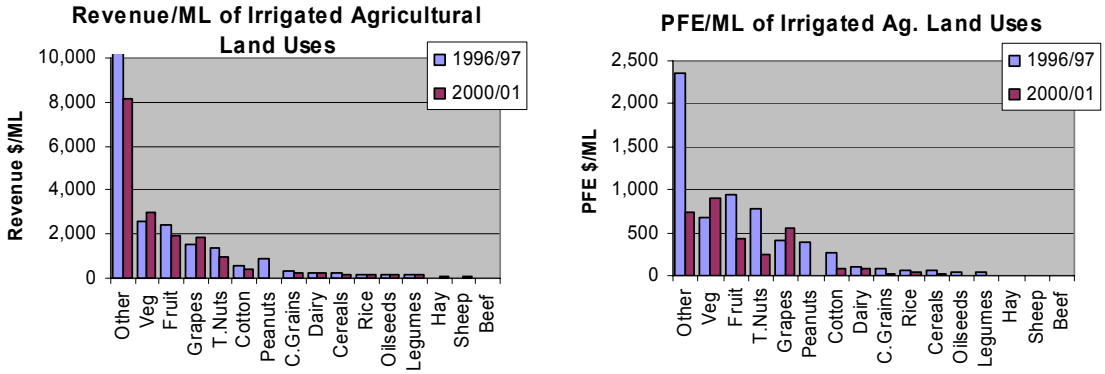


Figure 49 – Gross revenue per megalitre and PFE per megalitre of irrigated Agricultural Land Uses in the Murray-Darling Basin 1996/97 and 2000/01.

Agricultural Land Use	Irrigation Gross Revenue ($'000)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	Grand Total
Beef	1996/97		88	161	428	416	5,587	18	985	3	4	3	4,818	3,182	322	3,374	675	140	0	4	42	**20,250**
	2000/01		250	620	816	42	5,239	183	1,331	12	40	182	3,869	7,319	898	2,413	1,286	743	165	10	37	**25,454**
	% Change		184.4	284.2	90.8	-90.0	-6.2	935.8	35.1	282.4	829.9	6,264.3	-19.7	130.0	178.8	-28.5	90.5	432.1	-	178.2	-11.2	**25.7**
Cereals	1996/97		1,075	510	3,680	3,948	1,362	3,119	5,898	90	212	1,630	8,089	40,222	11,310	6,758		73		4,149	145	**92,270**
	2000/01		1,077	261	3,901	2,054	4,404	989	5,770	487	305	208	32,264	64,133	5,484	11,255		345		30	62	**133,027**
	% Change		0.1	-48.9	6.0	-48.0	223.4	-68.3	-2.2	442.3	43.9	-87.2	298.9	59.4	-51.5	66.6		371.3		-99.3	-57.3	**44.2**
Coarse Grains	1996/97		379	85	0	3,925	44	47	0			57	24	11,492	2,081	135						**18,269**
	2000/01		273	103	152	2,980	0	299	502			0	131	11,099	3,389	168						**19,096**
	% Change		-28.1	21.1	-	-24.1	-100.0	535.7	-			-99.5	435.4	-3.4	62.9	24.9						**4.5**
Cotton	1996/97		143,906	69,186	136,691	96,399		300,013	0	574		83,344		994	212,411				4,867	77,624		**1,126,010**
	2000/01		101,006	68,395	156,465	79,367		256,642	4,518	0		120,904		52,280	181,010				1,700	49,979		**1,072,267**
	% Change		-29.8	-1.1	14.5	-17.7		-14.5	-	-100.0		45.1		5,159.8	-14.8				-65.1	-35.6		**-4.8**
Dairy	1996/97			0	1,102	1,105	328,327	0	292		760		16,060	352	841	167,907	0	4,926		0	205	**521,878**
	2000/01			52	1,017	6,748	475,544	62	2,319		1,266		79,027	3,011	1,979	285,449	3,821	6,634		7	0	**866,938**
	% Change			-	-7.7	510.7	44.8	-	693.3		66.7		392.1	755.8	135.2	70.0	-	34.7		-	-100.0	**66.1**
Fruit	1996/97		0	31,843	42,911	584	169,425	0	9,473	24,855	60,521		4,898	112,756		11,929	4,224	114,875		0		**588,294**
	2000/01		16	29,194	18,713	121	191,416	250	17,645	26,529	61,172		3,057	98,672		19,485	2,942	124,560		117		**593,892**
	% Change		-	-8.3	-56.4	-79.2	13.0	-	86.3	6.7	1.1		-37.6	-12.5		63.3	-30.3	8.4		-		**1.0**
Grapes	1996/97			714	3,608		1,961		3,930	39,986	175,391	3,898	3,040	70,113		5,687	3,485	152,176	0	3,984	138	**468,111**
	2000/01			1,648	10,995		9,942		13,868	67,961	298,154	0	7,878	107,027		6,198	14,828	397,105	6,367	8,141	1,501	**951,613**
	% Change			130.8	204.7		407.1		252.9	70.0	70.0	-100.0	159.2	52.6		9.0	325.5	161.0	-	104.3	987.7	**103.3**
Hay	1996/97		9	9	22	50	609	0	243	1		3	484	461	91	623		148		10		**2,760**
	2000/01		25	69	0	396	793	35	224	0		69	1,232	539	0	1,652		92		0		**5,126**
	% Change		199.5	671.1	-100.0	690.3	30.2	-	-7.8	-100.0		2,120.7	154.6	16.9	-100.0	165.3		-37.8		-100.0		**85.7**
Legumes	1996/97		108	366	155	85	1,089	0	518				2,730	4,722	0	81		99				**9,954**
	2000/01		43	86	89	190	445	26	210				916	2,650	338	187		32				**5,213**
	% Change		-60.7	-76.6	-42.4	124.3	-59.1	-	-59.4				-66.5	-43.9	-	131.9		-67.4				**-47.6**
Oilseeds	1996/97		58		188	0	120	0	877			24	4,001	6,825	129	830		0		363		**13,415**
	2000/01		131		175	237	0	86	588			0	585	1,328	1,130	229		31		0		**4,520**
	% Change		127.4		-6.8	-	-100.0	-	-33.0			-100.0	-85.4	-80.5	774.5	-72.4		-		-100.0		**-66.3**
Other	1996/97		0	305	2,201	29,431	26,995		0		998		1,231	2,342		11,973	19,350	1,984	0		0	**96,810**
	2000/01		8	55	5,826	11,471	11,330		396		5,518		1,124	8,445		521	22,727	3,892	68		6	**71,388**
	% Change		-	-81.8	164.6	-61.0	-58.0		-		453.2		-8.7	260.6		-95.6	17.4	96.1	-		-	**-26.3**
Peanuts	1996/97			553																		**553**
	2000/01			0																		**0**
	% Change			-100.0																		**-100.0**
Rice	1996/97						2,217		1,110				140,358	165,868		0	0					**309,553**
	2000/01						2,587		2,371				163,078	179,727		912	191					**348,866**
	% Change						16.7		113.6				16.2	8.4		-	-					**12.7**
Sheep	1996/97		15		474		4,339	39	1,103	4	29		6,182	3,648	126	8,750	947	268			219	**26,142**
	2000/01		0		199		2,657	0	1,456	0	10		746	707	0	7,152	98	135			149	**13,310**
	% Change		-100.0		-58.0		-38.8	-100.0	32.0	-100.0	-65.6		-87.9	-80.6	-100.0	-18.3	-89.6	-49.5			-31.9	**-49.1**
Tree Nuts	1996/97		0					0			22,629			4,099				8,853				**35,581**
	2000/01		986					605			20,966			501				14,968				**38,026**
	% Change		-					-			-7.4			-87.8				69.1				**6.9**
Vegetables	1996/97		698	27,590	8,464	16,498	28,170		15,015	4,555	49,257	92	14,429	53,395	0	25,221		71,837			0	**315,221**
	2000/01		2,273	38,969	5,830	23,714	67,834		7,244	1,416	63,198	0	17,579	80,459	21	39,858		112,515			1,561	**462,469**
	% Change		225.5	41.2	-31.1	43.7	140.8		-51.8	-68.9	28.3	-100.0	21.8	50.7	-	58.0		56.6			-	**46.7**
1996/97 Irrig. Revenue ($'000)		**0**	**146,336**	**131,324**	**199,925**	**152,440**	**570,245**	**303,236**	**39,445**	**70,067**	**309,799**	**89,052**	**206,344**	**480,470**	**227,312**	**243,266**	**28,681**	**355,380**	**4,867**	**86,134**	**749**	**3,645,071**
2000/01 Irrig. Revenue ($'000)		**0**	**106,089**	**139,451**	**204,178**	**127,318**	**772,192**	**259,178**	**58,442**	**96,405**	**450,629**	**121,364**	**311,487**	**617,896**	**194,250**	**375,480**	**45,894**	**661,052**	**8,301**	**58,284**	**3,316**	**4,611,205**
% Change		**0**	**-27.5**	**6.2**	**2.1**	**-16.5**	**35.4**	**-14.5**	**48.2**	**37.6**	**45.5**	**36.3**	**51.0**	**28.6**	**-14.5**	**54.3**	**60.0**	**86.0**	**70.6**	**-32.3**	**342.6**	**26.5**

Table 21 – Gross revenue from agricultural land uses (irrigated areas only) by Catchment Management Region 1996/97 and 2000/01 including % change.

Agricultural Land Use	Irrigation PFE ($'000)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	Grand Total
Beef	1996/97		-102	-71	-576	-352	1,574	-21	-1,537	-234	-27	-35	-4,687	-5,378	-203	-2,465	-704	-269	0	-175	-78	**-15,339**
	2000/01		-157	-259	-420	-21	1,944	-87	-485	-565	-526	-701	-3,927	-7,208	-330	-445	-691	-1,120	-667	-348	-28	**-16,041**
	% Change		-	-	-	-	23.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Cereals	1996/97		442	148	1,238	1,129	440	1,184	1,819	-56	-78	706	2,562	12,394	4,525	1,657		-45		-453	41	**27,652**
	2000/01		-375	-265	-871	-1,458	1,750	-616	467	-168	27	-258	2,729	9,110	-2,035	2,527		-71		-30	2	**10,466**
	% Change		-184.8	-279.4	-170.4	-229.1	298.1	-152.1	-74.3	-	-	-136.5	6.5	-26.5	-145.0	52.5		-		-	-95.4	**-62.1**
Coarse Grains	1996/97		118	-23	0	639	19	12	0			-54	3	3,229	1,033	28						**5,005**
	2000/01		-7	-186	42	-861	0	-42	21			0	59	2,141	1,069	36						**2,273**
	% Change		-105.8	-	-	-234.7	-100.0	-457.3	-			-	1,705.4	-33.7	3.5	32.5						**-54.6**
Cotton	1996/97		72,779	34,398	68,857	39,866		153,818	0	61		44,422		506	103,427				2,582	28,323		**549,038**
	2000/01		22,350	16,750	34,813	14,491		67,332	-891	0		37,610		18,750	42,493				880	-6,707		**247,871**
	% Change		-69.3	-51.3	-49.4	-63.7		-56.2	-	-100.0		-15.3		3,606.6	-58.9				-65.9	-123.7		**-54.9**
Dairy	1996/97			0	352	-57	196,488	0	-19		-1,356		-3,233	-131	200	43,759	0	-1,174		0	-86	**234,743**
	2000/01			-18	-308	265	284,385	-108	-2,376		-2,125		-31,114	-3,580	947	81,472	840	-1,142		-329	0	**326,809**
	% Change			-	-187.6	-	44.7	-	-		-		-	-	373.2	86.2	-	-		-	-	**39.2**
Fruit	1996/97		0	8,989	21,668	292	69,546	0	3,408	9,695	18,080		2,146	39,056		3,584	1,789	48,688		0		**226,941**
	2000/01		-73	-87	1,429	-2,648	50,115	-470	4,527	6,996	18,121		279	11,586		4,700	403	40,884		-1,215		**134,546**
	% Change		-	-101.0	-93.4	-1,007.0	-27.9	-	32.8	-27.8	0.2		-87.0	-70.3		31.1	-77.5	-16.0		-		**-40.7**
Grapes	1996/97			-80	-2,819		-2,935		-4,701	14,897	57,074	2,614	656	9,833		-151	-3,454	50,240	0	1,895	-278	**122,790**
	2000/01			-2,751	-8,680		-3,507		-3,399	20,010	113,646	0	54	-15,012		672	-6,846	195,712	3,937	2,876	-2,861	**293,853**
	% Change			-	-		-		-	34.3	99.1	-100.0	-91.8	-252.7		-	-	289.6	-	51.8	-	**139.3**
Hay	1996/97		-37	-74	-3	-216	125	0	-72	-71		-1	114	-70	-67	-156		-201		-51		**-779**
	2000/01		4	10	0	30	110	-9	-119	0		49	101	90	0	-573		-27		0		**-334**
	% Change		-	-	-	-	-12.6	-	-	-		-	-11.0	-	-	-		-		-		**-**
Legumes	1996/97		-76	96	36	-1	455	0	53				544	1,207	0	47		28				**2,389**
	2000/01		-66	0	-75	116	47	-49	-89				-161	416	-23	41		-10				**149**
	% Change		-	-100.5	-308.5	-	-89.6	-	-269.1				-129.5	-65.5	-	-13.0		-134.8				**-93.8**
Oilseeds	1996/97		29		31	0	38	0	195			-27	1,026	1,880	33	79		0		-196		**3,088**
	2000/01		46		-8	237	0	-32	-180			0	-160	53	116	-4		-70		0		**-4**
	% Change		58.1		-127.2	-	-100.0	-	-192.5			-	-115.6	-97.2	246.1	-105.1		-		-		**-100.1**
Other	1996/97		0	111	-971	2,502	18,153		0		747		-285	-691		6,556	-3,950	83	0		0	**22,256**
	2000/01		1	-134	1,494	1,959	6,359		-17		4,143		76	1,914		341	-9,540	-118	28		4	**6,509**
	% Change		-	-220.8	-	-21.7	-65.0		-		454.6		-	-		-94.8	-	-242.5	-		-	**-70.8**
Peanuts	1996/97			240																		**240**
	2000/01			0																		**0**
	% Change			-100.0																		**-100.0**
Rice	1996/97						1,321		393				49,239	59,318		0	0					**110,270**
	2000/01						594		640				32,511	37,978		210	-38					**71,895**
	% Change						-55.1		63.1				-34.0	-36.0		-	-					**-34.8**
Sheep	1996/97		-6		-197		714	-24	-7	-103	-281		-1,415	-1,530	-31	-1,331	-671	-336			-236	**-5,454**
	2000/01		0		-95		312	0	-332	0	-29		-426	-905	0	-1,672	-6	-295			-187	**-3,634**
	% Change		-		-		-56.3	-	-	-	-		-	-	-	-	-	-			-	**-**
Tree Nuts	1996/97		-633					-1,582			16,537			3,617				2,380				**20,319**
	2000/01		-272					-234			5,483			-196				5,400				**10,181**
	% Change		-					-			-66.8			-105.4				126.9				**-49.9**
Vegetables	1996/97		-579	12,104	-6,824	6,251	10,088		-4,771	2,108	25,832	-1,165	2,332	-9,754	0	6,171		41,647			0	**83,439**
	2000/01		441	16,893	-16	4,328	32,149		-3,775	-778	31,399	0	6,009	-6,369	-933	4,254		56,711			684	**140,997**
	% Change		-	39.6	-	-30.8	218.7		-	-136.9	21.6	-	157.7	-	-	-31.1		36.2			-	**69.0**
1996/97 Irrigation PFE ($'000)		**0**	**71,936**	**55,838**	**80,791**	**50,053**	**296,025**	**153,386**	**-5,240**	**26,297**	**116,528**	**46,460**	**49,002**	**113,488**	**108,916**	**57,778**	**-6,990**	**141,041**	**2,582**	**29,343**	**-637**	**1,386,598**
2000/01 Irrigation PFE ($'000)		**0**	**21,894**	**29,952**	**27,304**	**16,438**	**374,258**	**65,685**	**-6,006**	**25,496**	**170,139**	**36,700**	**6,032**	**48,767**	**41,304**	**91,560**	**-15,878**	**295,854**	**4,178**	**-5,752**	**-2,385**	**1,225,537**
% Change		**0**	**-69.6**	**-46.4**	**-66.2**	**-67.2**	**26.4**	**-57.2**	**-**	**-3.0**	**46.0**	**-21.0**	**-87.7**	**-57.0**	**-62.1**	**58.5**	**-**	**109.8**	**61.8**	**-119.6**	**-**	**-11.6**

Table 22 – Profit at full equity from agricultural land uses (irrigated areas only) by Catchment Management Region 1996/97 and 2000/01 including % change.

Agricultural Land Use	Irrigation Gross Revenue per Megalitre ($'000)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	MDB Average
Beef	1996/97		13	23	14	19	73	13	15	1	11	2	15	12	18	39	50	20	0	2	30	**22**
	2000/01		25	21	29	21	99	27	31	2	7	6	22	24	30	47	75	32	6	3	57	**30**
	% Change		91.3	-7.2	106.4	15.1	35.2	106.3	109.4	85.5	-39.6	156.4	48.9	98.2	65.3	21.2	51.5	61.2	-	64.5	90.7	**37.7**
Cereals	1996/97		204	233	190	249	155	200	212	108	102	260	240	237	207	155		59		158	220	**213**
	2000/01		105	89	131	113	210	89	192	151	178	72	213	229	104	175		106		72	186	**194**
	% Change		-48.8	-61.9	-30.8	-54.8	36.1	-55.5	-9.5	38.8	74.8	-72.2	-11.1	-3.7	-49.6	13.0		78.8		-54.6	-15.5	**-8.6**
Coarse Grains	1996/97		189	126	0	221	197	123	0			61	88	361	224	147						**284**
	2000/01		107	61	127	151	0	96	331			244	382	350	179	360						**235**
	% Change		-43.4	-51.6	-	-31.4	-100.0	-21.7	-			298.9	335.3	-3.1	-20.2	144.9						**-17.2**
Cotton	1996/97		521	595	572	688		534	0	213		682		644	488				675	346		**530**
	2000/01		342	396	383	522		374	240	0		460		585	353				966	197		**375**
	% Change		-34.3	-33.6	-33.0	-24.2		-30.1	-	-100.0		-32.6		-9.3	-27.6				43.1	-43.2		**-29.1**
Dairy	1996/97			0	131	76	294	0	81		45		75	66	104	164	0	91		0	93	**212**
	2000/01			59	70	86	331	31	48		54		80	50	191	195	399	119		3	0	**207**
	% Change			-	-46.8	12.3	12.7	-	-40.4		20.0		5.8	-24.4	83.4	18.8	-	31.2		-	-100.0	**-2.4**
Fruit	1996/97		0	2,608	6,769	1,882	3,684	0	1,714	1,856	1,559		3,658	1,879		3,802	4,800	2,088		0		**2,421**
	2000/01		129	1,677	2,291	30	2,844	249	1,805	1,674	1,701		2,673	1,449		1,871	2,649	1,805		116		**1,913**
	% Change		-	-35.7	-66.2	-98.4	-22.8	-	5.3	-9.8	9.1		-26.9	-22.9		-50.8	-44.8	-13.6		-		**-21.0**
Grapes	1996/97			1,940	601		516		491	1,652	2,141	6,693	1,197	1,321		1,374	785	1,346	0	1,890	424	**1,537**
	2000/01			881	667		1,111		966	1,613	2,559	0	1,232	1,086		1,708	1,180	2,050	6,356	1,690	553	**1,817**
	% Change			-54.6	11.1		115.2		96.5	-2.4	19.5	-100.0	2.9	-17.8		24.3	50.2	52.3	-	-10.6	30.4	**18.2**
Hay	1996/97		5	4	29	8	58	0	26	1		0	49	28	18	47		25		14		**33**
	2000/01		58	53	0	49	62	35	33	0		0	57	69	0	54		60		0		**56**
	% Change		1,005.5	1,134.1	-100.0	541.3	5.9	-	27.3	-100.0		-	17.7	149.7	-100.0	15.0		143.4		-100.0		**68.3**
Legumes	1996/97		93	191	139	186	169	0	123				145	164	0	203		116				**155**
	2000/01		51	106	72	348	124	44	89				126	180	109	139		81				**142**
	% Change		-45.4	-44.8	-48.1	87.1	-26.7	-	-27.1				-13.5	9.9	-	-31.5		-30.4				**-8.7**
Oilseeds	1996/97		113		91	0	197	0	228			31	262	195	100	117		0		75		**188**
	2000/01		138		205	0	0	89	164			0	188	216	127	134		39		0		**167**
	% Change		21.8		125.6	-	-100.0	-	-28.1			-100.0	-28.4	10.7	26.1	14.1		-		-100.0		**-11.3**
Other	1996/97		0	30,057	12,834	20,917	20,451		0		24,157		16,684	15,868		15,916	3,805	4,921	0		0	**10,285**
	2000/01		17,607	6,163	27,371	25,382	19,834		19,510		26,807		24,248	29,242		26,823	3,705	5,115	35,344		17,477	**8,183**
	% Change		-	-79.5	113.3	21.3	-3.0		-		11.0		45.3	84.3		68.5	-2.6	3.9	-		-	**-20.4**
Peanuts	1996/97			900																		**900**
	2000/01			0																		**-**
	% Change			-100.0																		
Rice	1996/97						321		188				187	189		0	0					**189**
	2000/01						190		199				182	185		214	168					**184**
	% Change						-40.7		6.0				-2.5	-2.2		-	-					**-2.5**
Sheep	1996/97		27		22		74	22	34	2	7		25	21	28	47	55	27			47	**34**
	2000/01		0		30		76	0	37	0	25		30	20	0	51	60	26			51	**45**
	% Change		-100.0		35.1		2.6	-100.0	10.9	-100.0	230.9		20.5	-7.4	-100.0	8.7	9.2	-5.3			7.4	**32.6**
Tree Nuts	1996/97		0					0			2,494			4,392				806				**1,380**
	2000/01		405					372			966			460				1,070				**931**
	% Change		-					-			-61.2			-89.5				32.8				**-32.5**
Vegetables	1996/97		1,176	2,892	1,140	2,528	2,697		1,571	3,770	3,753	118	2,240	1,792	0	2,232		4,666			0	**2,581**
	2000/01		2,833	3,143	2,359	2,119	3,674		1,496	1,442	3,891	0	3,186	2,163	47	2,149		4,145			3,100	**2,950**
	% Change		141.0	8.7	107.0	-16.2	36.2		-4.8	-61.7	3.7	-100.0	42.2	20.7	-	-3.8		-11.2			-	**14.3**
1996/97 Avg. Irrig. Rev/ML ($/ML)		**0**	**494**	**860**	**584**	**675**	**423**	**519**	**221**	**1,473**	**1,863**	**671**	**127**	**275**	**424**	**176**	**695**	**1,297**	**675**	**331**	**81**	**390**
2000/01 Avg. Irrig. Rev/ML ($/ML)		**0**	**328**	**578**	**394**	**431**	**462**	**362**	**249**	**1,411**	**2,028**	**409**	**137**	**308**	**305**	**210**	**931**	**1,675**	**261**	**219**	**465**	**383**
% Change		**0**	**-33.7**	**-32.7**	**-32.5**	**-36.1**	**9.2**	**-30.2**	**12.4**	**-4.2**	**8.8**	**-39.0**	**7.2**	**11.7**	**-28.0**	**19.1**	**33.9**	**29.2**	**-61.4**	**-33.9**	**472.3**	**-1.9**

Table 23 – Gross revenue per Megalitre from agricultural land uses (irrigated areas only) by Catchment Management Region 1996/97 and 2000/01 including % change.

Agricultural Land Use	Irrigation PFE per Megalitre ($/ML)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	MDB Average
Beef	1996/97		-15	-10	-19	-16	21	-16	-23	-79	-72	-28	-15	-20	-11	-28	-52	-38	0	-78	-55	**-16**
	2000/01		-16	-9	-15	-11	37	-13	-11	-93	-90	-23	-23	-24	-11	-9	-40	-49	-23	-92	-43	**-19**
	% Change		-	-	-	-	78.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Cereals	1996/97		84	67	64	71	50	76	65	-68	-38	113	76	73	83	38		-36		-17	62	**64**
	2000/01		-36	-90	-29	-80	84	-55	16	-52	16	-90	18	32	-39	39		-22		-72	6	**15**
	% Change		-143.4	-233.8	-145.9	-212.3	67.5	-173.0	-76.2	-	-	-179.7	-76.3	-55.6	-146.8	3.5		-		-	-90.8	**-76.0**
Coarse Grains	1996/97		59	-34	0	36	86	30	0			-57	12	101	111	30						**78**
	2000/01		-3	-110	35	-44	0	-13	14			109	173	67	57	78						**28**
	% Change		-104.6	-	-	-221.7	-100.0	-144.0	-			-	1,368.0	-33.5	-49.3	159.8						**-64.0**
Cotton	1996/97		263	296	288	285		274	0	23		364		328	237				358	126		**258**
	2000/01		76	97	85	95		98	-47	0		143		210	83				500	-26		**87**
	% Change		-71.3	-67.3	-70.4	-66.5		-64.2	-	-100.0		-60.6		-36.1	-65.1				39.6	-120.9		**-66.4**
Dairy	1996/97			0	42	-4	176	0	-5		-80		-15	-24	25	43	0	-22		0	-39	**95**
	2000/01			-20	-21	3	198	-54	-49		-90		-31	-59	91	56	88	-21		-139	0	**78**
	% Change			-	-150.5	-	12.6	-	-		-		-	-	269.0	30.1	-	-		-	-	**-18.2**
Fruit	1996/97		0	736	3,418	941	1,512	0	617	724	466		1,603	651		1,142	2,033	885		0		**934**
	2000/01		-579	-5	175	-649	745	-468	463	442	504		244	170		451	363	592		-1,204		**433**
	% Change		-	-100.7	-94.9	-169.0	-50.8	-	-24.9	-39.0	8.2		-84.8	-73.9		-60.5	-82.2	-33.1		-		**-53.6**
Grapes	1996/97			-218	-469		-773		-588	616	697	4,489	258	185		-36	-778	444	0	899	-856	**403**
	2000/01			-1,471	-527		-392		-237	475	975	0	8	-152		185	-545	1,010	3,930	597	-1,054	**561**
	% Change			-	-		-		-	-22.9	40.0	-100.0	-96.7	-182.2		-	-	127.4	-	-33.6	-	**39.2**
Hay	1996/97		-23	-36	-4	-33	12	0	-8	-82		0	11	-4	-13	-12		-33		-71		**-9**
	2000/01		10	8	0	4	9	-9	-17	0		0	5	12	0	-19		-17		0		**-4**
	% Change		-	-	-	-	-29.0	-	-	-		-	-58.9	-	-	-		-		-		**-**
Legumes	1996/97		-65	50	32	-1	71	0	12				29	42	0	119		32				**37**
	2000/01		-78	-1	-60	213	13	-83	-38				-22	28	-7	31		-24				**4**
	% Change		-	-101.1	-287.8	-	-81.4	-	-404.1				-176.2	-32.5	-	-74.3		-174.3				**-89.1**
Oilseeds	1996/97		57		15	0	62	0	51			-35	67	54	26	11		0		-40		**43**
	2000/01		48		-10	0	0	-33	-50			0	-51	9	13	-2		-90		0		**0**
	% Change		-15.3		-165.8	-	-100.0	-	-199.3			-	-176.3	-84.1	-50.1	-121.1		-		-		**-100.3**
Other	1996/97		0	10,918	-5,660	1,778	13,753		0		18,090		-3,863	-4,678		8,715	-777	206	0		0	**2,364**
	2000/01		1,946	-14,885	7,019	4,334	11,132		-841		20,126		1,634	6,629		17,579	-1,555	-156	14,296		11,768	**746**
	% Change		-	-236.3	-	143.8	-19.1		-		11.3		-	-		101.7	-	-175.5	-		-	**-68.4**
Peanuts	1996/97			391																		**391**
	2000/01			0																		**-**
	% Change			-100.0																		
Rice	1996/97						191		66				66	68		0	0					**67**
	2000/01						44		54				36	39		49	-33					**38**
	% Change						-77.2		-19.1				-44.6	-42.2		-	-					**-43.6**
Sheep	1996/97		-11		-9		12	-13	0	-72	-73		-6	-9	-7	-7	-39	-34			-51	**-7**
	2000/01		0		-14		9	0	-9	0	-74		-17	-25	0	-12	-3	-56			-64	**-12**
	% Change		-		-		-26.8	-	-	-	-		-	-	-	-	-	-			-	**-**
Tree Nuts	1996/97		-462					-462			1,822			3,875				217				**788**
	2000/01		-111					-144			253			-180				386				**249**
	% Change		-					-			-86.1			-104.7				78.1				**-68.4**
Vegetables	1996/97		-974	1,269	-919	958	966		-499	1,744	1,968	-1,505	362	-327	0	546		2,705			0	**683**
	2000/01		549	1,363	-7	387	1,741		-780	-792	1,933	0	1,089	-171	-2,112	229		2,089			1,359	**900**
	% Change		-	7.4	-	-59.6	80.3		-	-145.4	-1.8	-	200.9	-	-	-58.0		-22.8			-	**31.7**
Avg. 1996/97 Irrig. PFE/ML ($/ML)			**243**	**365**	**236**	**222**	**220**	**263**	**-29**	**553**	**701**	**350**	**30**	**65**	**203**	**42**	**-169**	**515**	**358**	**113**	**-69**	**148**
Avg. 2000/01 Irrig. PFE/ML ($/ML)			**68**	**124**	**53**	**56**	**224**	**92**	**-26**	**373**	**766**	**124**	**3**	**24**	**65**	**51**	**-322**	**750**	**131**	**-22**	**-334**	**102**
% Change			**-72.2**	**-66.0**	**-77.7**	**-74.9**	**2.0**	**-65.0**	**-**	**-32.5**	**9.3**	**-64.6**	**-91.3**	**-62.7**	**-68.1**	**22.3**	**-**	**45.7**	**-63.4**	**-119.1**	**-**	**-31.4**

Table 24 – Profit at full equity per megalitre from agricultural land uses (irrigated areas only) by Catchment Management Region 1996/97 and 2000/01 including % change.

4. Conclusion

There are many aspects of the distribution and dynamics of agricultural land use and the economic returns to land and water resources from agriculture in the Murray-Darling Basin assessed and discussed in this study. Each of these aspects tells a particular part of the story. It is important to integrate these individual pieces of information in considering the status of agricultural land uses in the MBD for Integrated Catchment Management. It is important to consider both the aggregate figures such as the total area, total returns (gross revenue, PFE and NER), total water requirements and total irrigated area, as well as the returns per hectare and returns per megalitre of water used.

Some agricultural land uses are more widespread than others in the MDB. The ones covering the largest area such as Beef and Sheep grazing, and Cereal cropping are the least intensive land uses. That is to say that in general terms, they have the least impact on the environment, use the least water, and also have the lowest economic returns per unit area. However, whilst they have very low returns per hectare, in a regional sense these land uses are very important as they are the dominant source of total economic returns to agriculture in the MDB.

Dairy, Cotton and Rice are intensive forms of agriculture, are generally irrigated, and cover a reasonably large area in the MDB. These land uses have a significant environmental impact as they are by far the largest water users in the MDB. Returns per hectare and per megalitre are moderate to low. However, these land uses, especially Dairy, generate a substantial proportion of the agricultural returns in the MDB. Large increases in the relative profitability of Dairy have recently been made.

Horticultural crops such as Fruit and Grapes have lower total water requirements overall and contribute substantially to the total returns to agriculture in the MDB. Fruit and Grapes have high returns per hectare and returns per megalitre. Other land uses may be locally important but at this stage, make only a minor contribution to the MDB-wide picture of agriculture. Some less common crops may become significant in the near future.

5. References

ABARE 2004. A review of the Australian dairy industry. ABARE report for the Primary Industries Standing Committee Working Group on Dairy – Annex A. Australian Bureau of Agricultural and Resource Economics. Australian Government.

ABS 1996. *Statistical Local Areas, Australian Standard Geographical Classification (ASGC) 1996 (digital map, MapInfo format)*. Australian Bureau of Statistics.

ABS 1997. *AgStats: Small Area of Agricultural Commodity Data 1996-97*. Australian Bureau of Statistics.

ABS 2001a. *AgStats: Small Area of Agricultural Commodity Data 2000-01*. Australian Bureau of Statistics.

ABS 2001b. *Statistical Local Areas, Australian Standard Geographical Classification (ASGC) 2001 (digital map, MapInfo format)*. Australian Bureau of Statistics.

Agarwal, S., Joshi, P.K., Shukla, Y. and Roy, P.S. 2003. Spot Vegetation Multi Temporal Data for Classifying Vegetation in South Central Asia. *Current Science* 84(11), 1440-1448.

Al-Bakri, J.T., Taylor, J.C., and Brewer, T.R. 2001. Monitoring Land Use Change in the Badia Transition Zone in Jordan Using Aerial Photography and Satellite Imagery. *Geographical Journal* 167, 248-262.

Alphan, H. 2003. Land-Use Change and Urbanization of Adana, Turkey. *Land Degradation & Development* 14(6), 575-586.

ANCID 2000. *Australian Irrigation Water Provider Benchmarking Report 1998/99*. Australian National Committee on Irrigation and Drainage.

ANCID 2002. *Australian Irrigation Water Provider Benchmarking Report 2000/01*. Australian National Committee on Irrigation and Drainage.

Baez-Gonzalez, A.D., Chen, P.Y., Tiscareno-Lopez, M. and Srinivasan, R. 2002. Using Satellite and Field Data With Crop Growth Modeling to Monitor and Estimate Corn Yield in Mexico. *Crop Science* 42(6), 1943-1949.

Bastiaanssena, W.G.M and Alib, S. 2003. A new crop yield forecasting model based on satellite measurements applied across the Indus Basin Pakistan. *Agriculture, Ecosystems and Environment* 94(3), 321-340.

Bastian, C.T., McLeod, D.M, Germino, M.J., Reiners, W.A. and Blasko, B.J. 2002. Environmental amenities and agricultural land values: a hedonic pricing model using geographic information systems data. *Ecological Economics* 40, 337-349.

Bateman, I.J., Ennew, C., Lovett, A.A., and Rayner, A.J. 1999. Modelling and Mapping Agricultural Output Values Using Farm Specific Details and Environmental Databases. *Journal of Agricultural Economics* 50(3), 488-511.

BRS 2003. *Forests of Australia, 2003*. Digital map, ARC/INFO grid format, 100 m cell size. National Forest Inventory, Bureau of Rural Sciences, Australian Government.

BRS 2004. *Land Use Mapping for the Murray-Darling Basin: 1993, 1996, 1998, 2000 maps*. Bureau of Rural Sciences, Australian Government. Unpublished report with digital maps prepared for the Murray-Darling Basin Commission.

Cardille, J.A. and Foley, J.A. 2003. Agricultural Land-Use Change in Brazilian Amazonia Between 1980 and 1995: Evidence From Integrated Satellite and Census Data. *Remote Sensing of Environment* 87(4), 551-562.

Cardille, J.A., Foley, J.A., and Costa, M.H. 2002. Characterizing Patterns of Agricultural Land Use in Amazonia by Merging Satellite Classifications and Census Data. *Global Biogeochemical Cycles* 16(3), 1045.

Congalton, R.G., Balogh, M., Bell, C., Green, K., Milliken, J.A., and Ottman, R. 1998. Mapping and Monitoring Agricultural Crops and Other Land Cover in the Lower Colorado River Basin. *Photogrammetric Engineering and Remote Sensing* 64(11), 1107-1113.

Dalezios, N.R., Domenikiotis, C., Loukas, A., Tzortzios, S.T., and Kalaitzidis, C. 2001. Cotton Yield Estimation Based on NOAA/AVHRR Produced NDVI. *Physics and Chemistry of the Earth Part B-Hydrology Oceans and Atmosphere* 26(3), 247-251.

De Santa Olalla, F., Calera, A., and Dominguez, A. 2003. Monitoring Irrigation Water Use by Combining Irrigation Advisory Service, and Remotely Sensed Data with a Geographic Information System. *Agricultural Water Management* 61(2), 111-124.

Domenikiotis, C., Spiliotopoulos, M., Tsiros, E., and Dalezios, N. R. 2004. Early Cotton Yield Assessment by the use of the NOAA/AVHRR Derived Vegetation Condition Index (VCI) in Greece. *International Journal of Remote Sensing* 25(14), 2807-2819.

Environment Australia, 2000, *Collaborative Australian Protected Areas Database – CAPAD - 2000* (digital map, ARC/INFO cover format).

Eva, H.D., Belward, A.S., De Miranda, E.E., Di Bella, C.M., Gond, V., Huber, O., Jones, S., Sgrenzaroli, M., and Fritz, S. 2004. A Land Cover Map of South America. *Global Change Biology* 10(5), 731-744.

Frolking, S., Qiu, J.J., Boles, S., Xiao, X.M., Liu, J.Y., Zhuang, Y.H., Li, C.S., and Qin, X.G. 2002. Combining Remote Sensing and Ground Census Data to Develop New Maps of the Distribution of Rice Agriculture in China. *Global Biogeochemical Cycles* 16(4), 1091.

Frolking, S., Xiao, X. M., Zhuang, Y. H., Salas, W., and Li, C. S. (1999). "Agricultural Land-Use in China: a Comparison of Area Estimates from Ground-Based Census and Satellite-Borne Remote Sensing. *Global Ecology and Biogeography* 8(5), 407-416.

Giri, C., Defourny, P., and Shrestha, S. 2003. Land Cover Characterization and Mapping of Continental Southeast Asia Using Multi-Resolution Satellite Sensor Data. *International Journal of Remote Sensing* 24(21), 4181-4196.

Gonzalez, O.M.R. 2001. Assessing Vegetation and Land Cover Changes in Northeastern Puerto Rico: 1978-1995. *Caribbean Journal of Science* 37(1-2), 95-106.

Goodchild, M.F., Anselin, L. and Diechmann, U. 1993. A framework for the areal interpolation of socio-economic data. *Environment and Planning A* 25(3), 383-397.

Hajkowicz, S.A. and Young, M.D. (Eds) 2002. *Value of returns to land and water and costs of degradation*. A consultancy report to the National Land and Water Resources Audit, CSIRO Land and Water, Canberra.

Hansen, M.C., Defries, R.S., Townshend, J.R.G., and Sohlberg, R. 2000. Global Land Cover Classification at 1km Spatial Resolution using a Classification Tree Approach. *International Journal of Remote Sensing* 21(6-7), 1331-1364.

Kalubarme, A.H., Potdar, M.B., Manjunath, K.R., Mahey, R.K., and Siddhu, S.S. 2003. Growth Profile Based Crop Yield Models: a Case Study of Large Area Wheat Yield Modelling and its Extendibility Using Atmospheric Corrected NOAA AVHRR Data. *International Journal of Remote Sensing* 24(10), 2037-2054.

Knudby, A. 2004. An AVHRR-Based Model of Groundnut Yields in the Peanut Basin of Senegal. *International Journal of Remote Sensing* 25(16), 3161-3175.

Labus, M.P., Nielsen, G.A., Lawrence, R.L., Engel, R., and Long, D.S. 2002. Wheat Yield Estimates Using Multi-Temporal NDVI Satellite Imagery. *International Journal of Remote Sensing* 23(20), 4169-4180.

Latifovic, R., Zhu, Z.L., Cihlar, J., Giri, C., and Olthof, I. 2004. Land Cover Mapping of North and Central America - Global Land Cover 2000. *Remote Sensing of Environment*, 89(1), 116-127.

Liew, S.C., Kam, S.P., Tuong, T.P., Chen, P., Minh, V.Q., and Lim, H. 1998. Application of Multitemporal ERS-2 Synthetic Aperture Radar in Delineating Rice Cropping Systems in the Mekong River Delta, Vietnam. *IEEE Transactions on Geoscience and Remote Sensing* 36(5), 1412-1420.

Liu, W.T. and Kogan, F. 2002. Monitoring Brazilian Soybean Production Using NOAA/AVHRR Based Vegetation Condition Indices. *International Journal of Remote Sensing* 23(6), 1161-1179.

Martin, P., Hooper, S., Blias, A., Hanna, N. and Ford, M. 2003. Farm financial performance. In *Australian Commodities* 10(1),120-133.

Maxwell, S.K., Nuckols, J.R., Ward, M.H., and Hoffer, R.M. 2004. An Automated Approach to Mapping Corn from Landsat Imagery. *Computers and Electronics in Agriculture* 43(1), 43-54.

MDBC 1998. *Water Audit Monitoring Report 1996/97*. *Report of the Murray-Darling Basin Commission on the final year of the interim Cap in the Murray-Darling Basin*. Murray-Darling Basin Commission. Commonwealth of Australia.

MDBC 2002. *Water Audit Monitoring Report 2000/01. Report of the Murray-Darling Basin Commission on the Cap on Diversions*. Murray-Darling Basin Commission. Commonwealth of Australia.

MDBMC 2001. *Integrated Catchment Management in the Murray-Darling Basin 2001 – 2010: Delivering a Sustainable Future*. Murray-Darling Basin Ministerial Council. Murray-Darling Basing Commission, Canberra.

Muller, D. and Zeller, M. 2002. Land Use Dynamics in the Central Highlands of Vietnam: a Spatial Model Combining Village Survey Data With Satellite Imagery Interpretation. *Agricultural Economics* 27(3), 333-354.

NLWRA 2002. *Australians and Natural Resource Management 2002*. Commonwealth of Australia.

Petit, C., Scudder, T., and Lambin, E. 2001. Quantifying Processes of Land-Cover Change by Remote Sensing: Resettlement and Rapid Land-Cover Changes in South-Eastern Zambia. *International Journal of Remote Sensing* 22(17), 3435-3456.

Productivity Commission 1998. *Trade & Assistance Review 1997-98*. Annual Report Series 1997-98, AusInfo, Canberra, December.

Productivity Commission 2001. *Trade & Assistance Review 2000-01*. Annual Report Series 2000-01, AusInfo, Canberra, December.

Ray, S.S. and Dadhwal, V.K. 2001. Estimation of Crop Evapotranspiration of Irrigation Command Area Using Remote Sensing and GIS. *Agricultural Water Management* 49(3), 239-249.

Reuter, D.J. 1998. Developing Indicators for Monitoring Catchment Health: the Challenges. *Australian Journal of Experimental Agriculture* 38(7), 637-648.

Samarasinghe, G.B. 2003. Growth and Yields of Sri Lanka's Major Crops Interpreted From Public Domain Satellites. *Agricultural Water Management* 58(2), 145-157.

Semwal, R.L., Nautiyal, S., Sen, K.K., Rana, U., Maikhuri, R.K., Rao, K.S., and Saxena, K.G. 2004. Patterns and Ecological Implications of Agricultural Land-Use Changes: a

Case Study From Central Himalaya, India. *Agriculture Ecosystems & Environment* 102(1), 81-92.

Senay, G.B. and Elliott, R.L. 2002. Capability of AVHRR Data in Discriminating Rangeland Cover Mixtures. International Journal of Remote Sensing 23(2), 299-312.

Sengupta, S. and Osgood, D.E. 2003. The Value of Remoteness: a Hedonic Estimation of Ranchette Prices. Ecological Economics 44(1), 91-103.

Seto, K.C., Woodcock, C.E., Song, C., Huang, X., Lu, J. and Kaufmann, R.K. 2002. Monitoring Land-Use Change in the Pearl River Delta Using Landsat TM. *International Journal of Remote Sensing* 23(10), 1985-2004.

Shanahan, J.F., Schepers, J.S., Francis, D.D., Varvel, G.E., Wilhelm, W.W., Tringe, J.M., Schlemmer, M.R., and Major, D.J. 2001. Use of Remote-Sensing Imagery to Estimate Corn Grain Yield. *Agronomy Journal* 93(3), 583-589.

Shao, Y., Fan, X.T., Liu, H., Xiao, J.H., Ross, S., Brisco, B., Brown, R., and Staples, G. 2001. Rice Monitoring and Production Estimation Using Multitemporal Radarsat. *Remote Sensing of Environment* 76(3), 310-325.

Skop, E. and Schou, J.S. 1999. Modeling the Effects of Agricultural Production. An Integrated Economic and Environmental Analysis Using Farm Account Statistics and GIS. *Ecological Economics* 29(3), 427-442.

Stewart, J.B., Smart, R.V., Barry, S.C. and Veitch S.M. 2001. *1996/97 Land Use of Australia*. Final report for project BRR5, National Land and Water Resources Audit, Bureau of Rural Sciences, Australian Government, Canberra.

Trewin, D. 2004. *Water Account, Australia 2000-01*. Australian Bureau of Statistics. Commonwealth of Australia.

Van Niel, T.G. and Mcvicar, T.R. 2004. Current and Potential Uses of Optical Remote Sensing in Rice-Based Irrigation Systems: a Review. *Australian Journal of Agricultural Research* 55(2), 155-185.

Vertessy, R. 2001. *Integrated Catchment Science*. CSIRO Land and Water Technical Report 21/01, June 2001.

Walker, J. and Reuter, D.J. 1996. *Indicators of catchment health – A technical perspective*. CSIRO Publishing, Victoria.

Walker, P. and Young, M.D. 1997. Using integrated economic and ecological information to improve government policy. *International Journal of Geographical Information Science* 7, pp. 619-632.

Walker, P.A. and Mallawaarachchi, T. 1998. Disaggregating Agricultural Statistics Using NOAA/AVHRR NDVI. *Remote Sensing of Environment* 63(2), 112-125.

Wittwer, G., McKirdy, S. and Wilson, R. 2003. *Analysing the economic impacts of a plant disease incursion using a general equilibrium approach*. Preliminary Working Paper No. OP-97. September 2003.

Young, M.D. and McColl, J.C. 2003. Robust Reform: Implementing robust institutional arrangements to achieve efficient water use in Australia. Policy and Economic Research Unit, CSIRO Land and Water. Folio No: S/03/1258.,

Young, M.D., Gillooly, J. and Marvanek, S. 2003. Quanti*fying and Valuing Land-use Change in the Murray-Darling Basin: An Interim 1996/97 Snapshot*. Stage 1 Report to the Murray-Darling Basin Commission. CSIRO Land and Water.

Zhao, B., Kreuter, U., Li, B., Ma, Z.J., Chen, J.K., and Nakagoshi, N. 2004. An Ecosystem Service Value Assessment of Land-Use Change on Chongming Island, China. *Land Use Policy* 21(2), 139-148.

6. Appendices

6.1 Commodity Classifications Used in this Study

Commodity Class	Agricultural Land Use	SPREAD Class	ABS Level 3	Broad Agricultural Land Use
Almonds	Tree Nuts	Nuts	Almonds	Horticulture
Apples	Fruit	Apples	Apples	Horticulture
Apricots	Fruit	Stone Fruit	Apricots	Horticulture
Barley	Cereals	Cereals excluding Rice	Barley	Broadacre Crops
Canola	Oilseeds	Oilseeds	Canola	Broadacre Crops
Cereals for Hay/Silage	Hay	Cereals excluding Rice	Cereals for Hay/Silage	Broadacre Crops
Cherries	Fruit	Stone Fruit	Cherries	Horticulture
Chick Peas	Legumes	Legumes	Chick Peas	Broadacre Crops
Cotton	Cotton	Cotton	Cotton	Cotton
Faba Beans	Legumes	Legumes	Faba Beans	Broadacre Crops
Field Peas	Legumes	Legumes	Field Peas	Broadacre Crops
Grain Sorghum	Coarse Grains	Cereals excluding Rice	Grain Sorghum	Broadacre Crops
Grapes	Grapes	Grapes	Grapes	Grapes
Lentils	Legumes	Legumes	Lentils	Broadacre Crops
Lupins	Legumes	Legumes	Lupins	Broadacre Crops
Maize	Coarse Grains	Cereals excluding Rice	Maize	Broadacre Crops
Millet	Coarse Grains	Cereals excluding Rice	Millet	Broadacre Crops
Mung Beans	Legumes	Legumes	Mung Beans	Broadacre Crops
Nectarines	Fruit	Stone Fruit	Nectarines	Horticulture
Non-Cereal Crops Cut for Hay	Hay	Non-Cereal Forage Crops	Non-Cereal Crops for Silage/Green Feed	Broadacre Crops
Non-Cereal Crops Cut for Hay	Hay	Non-Cereal Forage Crops	Non-Cereal Crops Cut for Hay	Broadacre Crops
Oats	Cereals	Cereals excluding Rice	Oats	Broadacre Crops
Oranges	Fruit	Citrus	Oranges	Horticulture
Other Cereal Crops	Cereals	Cereals excluding Rice	Cereal Rye	Broadacre Crops
Other Cereal Crops	Cereals	Cereals excluding Rice	Buckwheat	Broadacre Crops
Other Citrus	Fruit	Citrus	Lemon/Lime	Horticulture
Other Citrus	Fruit	Citrus	Mandarins	Horticulture
Other non-Cereal Crops	Other	Other Non-Cereal Crops	Hops	Broadacre Crops
Other non-Cereal Crops	Other	Other Non-Cereal Crops	Nurseries/Flowers	Broadacre Crops
Other non-Cereal Crops	Other	Other Non-Cereal Crops	Turf	Broadacre Crops
Other non-Cereal Crops	Other	Other Non-Cereal Crops	Peppermint	Broadacre Crops
Other Nuts	Tree Nuts	Nuts	Chestnuts	Horticulture
Other Nuts	Tree Nuts	Nuts	Pecans	Horticulture
Other Nuts	Tree Nuts	Nuts	Pistachios	Horticulture
Other Nuts	Tree Nuts	Nuts	Other Nuts	Horticulture
Other Oilseeds	Oilseeds	Oilseeds	Linseed	Broadacre Crops
Other Oilseeds	Oilseeds	Oilseeds	Sesame	Broadacre Crops
Other Stone Fruit	Fruit	Stone Fruit	Olives	Horticulture
Other Stone Fruit	Fruit	Stone Fruit	Prunes	Horticulture
Other Stone Fruit	Fruit	Stone Fruit	Other Orchard Fruit	Horticulture
Other Stone Fruit	Fruit	Stone Fruit	Avocados	Horticulture
Other Stone Fruit	Fruit	Stone Fruit	Kiwi Fruit	Horticulture
Other Vegetables	Vegetables	Other Vegetables	Other Vegetables	Horticulture
Peaches	Fruit	Stone Fruit	Peaches	Horticulture
Peanuts	Peanuts	Legumes	Peanuts	Broadacre Crops
Pears	Fruit	Pears	Pears	Horticulture
Pears	Fruit	Pears	Nashi	Horticulture
Plums	Fruit	Stone Fruit	Plums	Horticulture
Popcorn	Coarse Grains	Other Non-Cereal Crops	Popcorn	Broadacre Crops
Potatoes	Vegetables	Potatoes	Potatoes	Horticulture
Rice	Rice	Rice	Rice	Rice
Safflower	Oilseeds	Oilseeds	Safflower	Broadacre Crops
Soybeans	Legumes	Legumes	Soybeans	Broadacre Crops
Sunflower	Oilseeds	Oilseeds	Sunflower	Broadacre Crops
Tobacco	Other	Other Non-Cereal Crops	Tobacco	Other
Triticale	Cereals	Cereals excluding Rice	Triticale	Broadacre Crops
Vetches	Legumes	Legumes	Vetches	Broadacre Crops
Wheat	Cereals	Cereals excluding Rice	Wheat	Broadacre Crops
Dairy Cattle, Beef Cattle, Sheep	Dairy Cattle, Beef Cattle, Sheep	Sown Pasture	Total Area of Holdings – cropped area	Dairy, Beef, Sheep
Dairy Cattle, Beef Cattle, Sheep	Dairy Cattle, Beef Cattle, Sheep	Native Pasture	Total Area of Holdings – cropped area	Dairy, Beef, Sheep
Dairy Cattle, Beef Cattle, Sheep	Dairy Cattle, Beef Cattle, Sheep	Unallocated Potentially Agricultural Land	Total Area of Holdings – cropped area	Dairy, Beef, Sheep

Appendix 1 – Mapping of Commodity classes used in this study to ABS Level 3 classes, the SPREAD classes used in the BRS land use maps, the Agricultural Land Use classes used for tabular reporting and Broad Agricultural Land Uses used for mapping in this study. Note that processing is involved to relate livestock land uses (Dairy Cattle, Beef Cattle and Sheep) between the different classifications (see Section 2.2.6.2).

6.2 AgStats Items Used in this Study

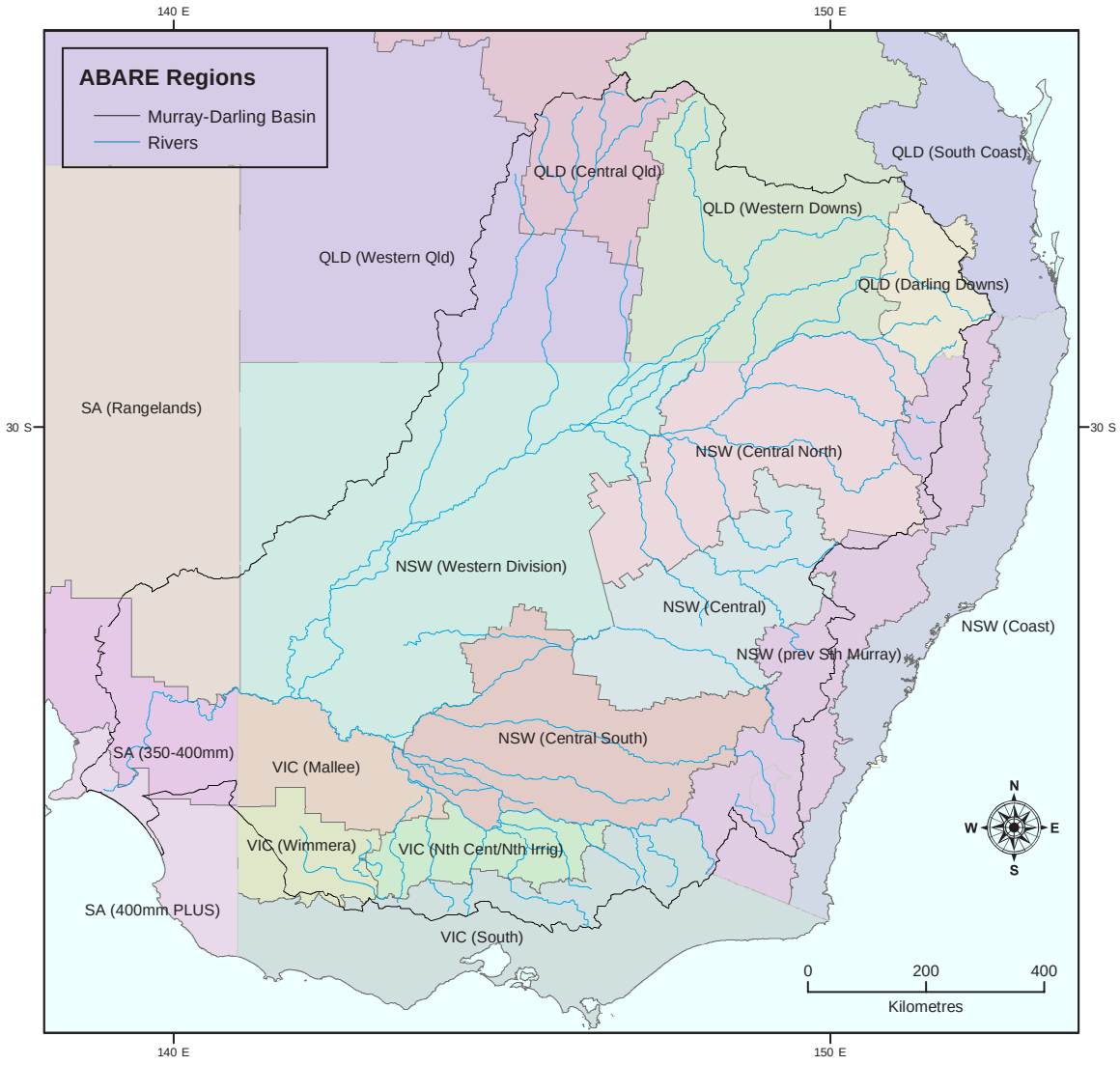
	ABS AgStats PRODUCTION ITEMS			ABS AgStats AREA ITEMS			ABS AgStats VALUE ITEMS		
Commodity Class	**Id**	**Name**	**Units**	**Id**	**Name**	**Units**	**Id**	**Name**	**Units**
Non-Livestock Commodity Classes									
Almonds	4208103	Almonds - Production (kernel weight)	KG	4208115	Almonds - Total trees	N	4208158	Almonds - Value	$
Apples	4523004	Apples - Total Production of fresh fruit	KG	4523015	Apples - Total trees	N	4202258	Apples - Value (97)	$
							4523058	Apples - Total value (01)	$
Apricots	4203903	Apricots - Production	KG	4203915	Apricots - Total trees	N	4203958	Apricots - Value	$
Barley	1501702	Barley for grain - Production	T	1501701	Barley for grain - Area	HA	1501758	Barley for grain - Value	$
Canola	1900902	Rapeseed/Canola - Production (clean seed)	T	1900901	Rapeseed/Canola - Area	HA	1900958	Rapeseed/Canola - Value	$
Cereals for Hay/Silage	1510802	Cereals (incl forage sorghum) cut for Hay - Production	T	1510801	Cereals (incl forage sorghum) cut for Hay - Area	HA	1510858	Cereals (incl forage sorghum) cut for Hay - Value	$
				1511001	Cereals fed off or for silage - Area	HA			
Cherries	4204303	Cherries - Production	KG	4204315	Cherries - Total trees	N	4204358	Cherries - Value	$
Chick Peas	1900302	Chick peas - Production	T	1900301	Chick peas - Area	HA	1900358	Chick peas - Value	$
Cotton	1803203	Cotton - Total Production (lint)	KG	1803201	Cotton - Total Area	HA	1803258	Cotton - Total value (lint)	$
Faba Beans	1907602	Faba beans (incl tick and horse) - Production	T	1907601	Faba beans (incl tick and horse) - Area	HA	1907658	Faba beans (incl tick and horse) - Value	$
Field Peas	1809102	Field peas for grain - Production	T	1809101	Field peas for grain - Area	HA	1809158	Field peas for grain - Value	$
Grain Sorghum	1504102	Grain sorghum for grain - Production	T	1504101	Grain sorghum for grain - Area	HA	1504158	Grain Sorghum for grain - Value	$
Grapes	5109921	Grapes - Total Production (fresh weight)	T	5109917	Grapes - Total Area	HA	5110058	Grapes - Total value	$
Lentils	1905202	Lentils - Production	T	1905201	Lentils - Area	HA	1905258	Lentils - Value	$
Lupins	1807002	Lupins for grain - Production	T	1807001	Lupins for grain - Area	HA	1807058	Lupins for grain - Value	$
Maize	1505302	Maize for grain - Production	T	1505301	Maize for grain - Area	HA	1505358	Maize for grain - Value	$
Millet	1507602	Millet & panicum (incl canary seed) - Production	T	1507601	Millet & panicum (incl canary seed) - Area	HA	1507658	Millet & panicum (incl canary seed) - Value	$
Mung Beans	1800602	Mung beans - Production	T	1800601	Mung beans - Area	HA	1800658	Mung beans - Value	$
Nectarines	4205503	Nectarines - Production	KG	4205515	Nectarines - Total trees	N	4205558	Nectarines - Value	$
Non-Cereal Crops Cut for Hay	1909302	Crops (excl cereals) cut for Hay - Production	T	1909301	Crops (excl cereals) cut for Hay - Area	HA	1909358	Non cereal crops cut for Hay - Value	$
Oats	1500802	Oats for grain - Production	T	1500801	Oats for grain - Area	HA	1500858	Oats for grain - Value	$
Oranges	4200713	Oranges - Total Production	KG	4200715	Oranges - Total trees	N	4200758	Oranges - Total value	$
Other Cereal Crops	1502302	Cereal Rye for grain - Production	T	1502301	Cereal Rye for grain - Area	HA	1502358	Cereal Rye for grain - Value	$
	1503002	Buckwheat for grain - Production	T	1503001	Buckwheat for grain - Area	HA	1503058	Buckwheat for grain - Value	$
Other Citrus	4201403	Mandarins - Production	KG	4201415	Mandarins - Total trees	N	4201458	Mandarins - Value	$
	4201203	Lemons and limes - Production	KG	4201215	Lemons and limes - Total trees	N	4201258	Lemons and limes - Value	$
Other non-Cereal Crops	1804702	Hops (harvested) - Total Production (dry weight)	KG	1804701	Hops (harvested) - Total Area	HA	1804758	Hops (harvested) - Total value	$
		Not recorded - placeholder tonnage used here		1908601	Cultivated turf – Area (97)	HA	1908658	Cultivated turf – Value (97)	$
		Not recorded - placeholder tonnage used here		1908501	Cultivated turf – Area (01)	HA	1908558	Cultivated turf - Value (01)	$
		Not recorded - placeholder tonnage used here		1918401	Cut flowers - Area (97)	HA	1918458	Cut Flowers - Value (97)	$
		Not recorded - placeholder tonnage used here		1918301	Cut flowers - Area (01)	HA	1918358	Cut flowers - Value (01)	$
		Not recorded - placeholder tonnage used here		1918201	Nurseries - Area (97)	HA	1918258	Nurseries - Value (97)	$
		Not recorded - placeholder tonnage used here		1918101	Nurseries - Area (01)	HA	1918158	Nurseries - Value (01)	$
	1908902	Peppermint - Production	T	1908901	Peppermint – Area	HA	1908958	Peppermint - Value	$
Other Nuts	4208503	Chestnuts - Production	KG	4208515	Chestnuts - Total trees	N	4208558	Chestnuts - Value	$
	4209703	Nuts nec - Production	KG	4209715	Nuts nec - Total trees	N	4209758	Nuts nec - Value	$
	4209203	Pecans - Production	KG	4209215	Pecans - Total trees	N	4209258	Pecans - Value	$
	4209303	Pistachios - Production	KG	4209315	Pistachios - Total trees	N	4209358	Pistachios - Value	$
Other Oilseeds	1806702	Linseed / Linola (clean seed) - Production	T	1806701	Linseed / Linola (clean seed) - Area	HA	1806758	Linseed / Linola (clean seed) - Value	$
	1901502	Sesame - Production (clean seed)	T	1901501	Sesame - Area	HA	1901558	Sesame - Value	$

	ABS AgStats PRODUCTION ITEMS			ABS AgStats AREA ITEMS			ABS AgStats VALUE ITEMS		
Commodity Class	**Id**	**Name**	**Units**	**Id**	**Name**	**Units**	**Id**	**Name**	**Units**
Other Stone Fruit	4204103	Avocados - Production	KG	4204115	Avocados - Total trees	N	4204158	Avocados - Value	$
	4305003	Kiwi fruit / zespri - Production	KG	4305015	Kiwi fruit / zespri - Total Area	HA	4305058	Kiwi fruit / zespri - Value	$
	4205703	Olives - Production	KG	4205715	Olives - Total trees	N	4205758	Olives - Value	$
	4207803	Orchard fruit nec - Production	KG	4207815	Orchard fruit nec - Total trees	N	4207858	Orchard fruit nec - Value	$
	4206703	Prunes - Production	KG	4206715	Prunes - Total trees	N	4206758	Prunes - Value	$
Other Vegetables	3600202	Artichokes - Production	KG	3600201	Artichokes - Area	HA	3600258	Artichokes - Value	$
	3600602	Asparagus - Production	T	3600601	Asparagus - Area	HA	3600658	Asparagus - Value	$
	3601312	Beans, french and runner - Total Production	KG	3601311	Beans, french and runner - Total Area	HA	3601358	Beans, french and runner - Total value	$
	3601502	Beetroot - Production	T	3601501	Beetroot - Area	HA	3601558	Beetroot - Value	$
	3601002	Broad beans - Production	KG	3601001	Broad beans - Area	HA	3601058	Broad beans - Value	$
	3601702	Broccoli - Production	KG	3601701	Broccoli - Area	HA	3601758	Broccoli - Value	$
	3601802	Brussel sprouts - Production	KG	3601801	Brussel sprouts - Area	HA	3601858	Brussel sprouts - Value	$
	3601902	Cabbages - Production	T	3601901	Cabbages - Area	HA	3601958	Cabbages - Value	$
	3602102	Capsicum, chillies and peppers - Production	KG	3602101	Capsicum, chillies and peppers - Area	HA	3602158	Capsicum, chillies and peppers - Value	$
	3602402	Carrots - Production	T	3602401	Carrots - Area	HA	3602458	Carrots - Value	$
	3602702	Cauliflower - Production	T	3602701	Cauliflower - Area	HA	3602758	Cauliflower - Value	$
	3602902	Celery - Production	KG	3602901	Celery - Area	HA	3602958	Celery - Value	$
	3602002	Chinese cabbage (Buckchoi and Wombak) - Production	KG	3602001	Chinese cabbage (Buckchoi and Wombak) - Area	HA	3602058	Chinese cabbage (Buckchoi and Wombak) - Value	$
	3603202	Cucumbers - Production	KG	3603201	Cucumbers - Area	HA	3603258	Cucumbers - Value	$
	3603402	Eggplant - Production	KG	3603401	Eggplant - Area	HA	3603458	Eggplant - Value	$
	3601202	French and runner beans (fresh market) - Production	KG	3601201	French and runner beans (fresh market) - Area	HA	3601258	French and runner beans (fresh market) - Value	$
	3601102	French and runner beans (processing) - Production	KG	3601101	French and runner beans (processing) - Area	HA	3601158	French and runner beans (processing) - Value	$
	3603902	Garlic - Production	KG	3603901	Garlic - Area	HA	3603958	Garlic - Value	$
	3604102	Gherkins - Production	KG	3604101	Gherkins - Area	HA	3604158	Gherkins - Value	$
	3606702	Green peas for fresh market (pod weight) - Production	KG	3606701	Green peas for fresh market (pod weight) - Area	HA	3606758	Green peas for fresh market (pod weight) - Value	$
	3606602	Green peas for processing (shelled weight) - Production	KG	3606601	Green peas for processing (shelled weight) - Area	HA	3606658	Green peas for processing (shelled weight) - Value	$
	3604302	Horse radish - Production	KG	3604301	Horse radish - Area	HA	3604358	Horse radish - Value	$
	3604402	Leeks - Production	KG	3604401	Leeks - Area	HA	3604458	Leeks - Value	$
	3604502	Lettuce - Production	T	3604501	Lettuce - Area	HA	3604558	Lettuce - Value	$
	3604702	Marrows and squashes - Production	KG	3604701	Marrows and squashes - Area	HA	3604758	Marrows and squashes - Value	$
	3605802	Mushrooms - Production	KG	3605801	Mushrooms - Area	HA	3605858	Mushrooms - Value	$
	3605902	Okra - Production	KG	3605901	Okra - Area	HA	3605958	Okra - Value	$
	3606102	Onions, white and brown - Production	T	3606101	Onions, white and brown - Area	HA	3606158	Onions, white and brown - Value	$
	1800902	Other field beans - Production	T	1800901	Other field beans - Area	HA	1800958	Other field beans - Value	$
	3606302	Parsley - Production	KG	3606301	Parsley - Area	HA	3606358	Parsley - Value	$
	3606402	Parsnips - Production	T	3606401	Parsnips - Area	HA	3606458	Parsnips - Value	$
	3402502	Peas, green - for seed - Production	KG	3402501	Peas, green - for seed - Area	HA	3402558	Peas, green - for seed - Value	$
	3607102	Pumpkins, triambles, trombones, etc - Production	T	3607101	Pumpkins, triambles, trombones, etc - Area	HA	3607158	Pumpkins, triambles, trombones, etc - Value	$
	3607202	Radish - Production	KG	3607201	Radish - Area	HA	3607258	Radish - Value	$
	3607802	Silver beet and spinach - Production	KG	3607801	Silver beet and spinach - Area	HA	3607858	Silver beet and spinach - Value	$
	3606002	Spring Onions and Shallots - Production	KG	3606001	Spring Onions and Shallots - Area	HA	3606058	Spring Onions and Shallots - Value	$
	3607902	Sprouts (alfalfa, mung bean, etc) - Production	T				3607958	Sprouts (alfalfa, mung bean, etc) - Value	$
	3608902	Swedes - Production	T	3608901	Swedes - Area	HA	3608958	Swedes - Value	$
	3608002	Sweet corn - Production	T	3608001	Sweet corn - Area	HA	3608058	Sweet corn - Value	$
	3608102	Sweet potatoes - Production	T	3608101	Sweet potatoes - Area	HA	3608158	Sweet potatoes - Value	$
	3608812	Tomatoes - Total Production	T	3608811	Tomatoes - Total Area	HA	3608858	Tomatoes - Total value	$

	ABS AgStats PRODUCTION ITEMS			ABS AgStats AREA ITEMS			ABS AgStats VALUE ITEMS		
Commodity Class	**Id**	**Name**	**Units**	**Id**	**Name**	**Units**	**Id**	**Name**	**Units**
Peaches	4206213	Peaches - Total Production	KG	4206215	Peaches - Total trees	N	4206258	Peaches - Total value	$
Peanuts	1808102	Peanuts (in shell) - Production	KG	1808101	Peanuts (in shell) - Area	HA	1808158	Peanuts (in shell) - Value	$
Pears	4617004	Pears (excluding Nashi) - Production of fresh fruit (01)	KG	4617015	Pears (excl Nashi) - Total trees	N	4202858	Pears (excl Nashi) - Value (97)	$
	4617014	Pears (excl Nashi) - Production of fresh fruit (97)	KG				4617058	Pears (excl Nashi) - Value (01)	$
	4613004	Nashi - Production of fresh fruit	KG	4613015	Nashi - Total trees	N	4203158	Nashi - Value (97)	$
							4613058	Nashi - Value (01)	$
Plums	4206603	Plums - Production	KG	4206615	Plums - Total trees	N	4206658	Plums - Value	$
Popcorn	1900502	Popcorn - Production	T	1900501	Popcorn - Area	HA	1900558	Popcorn - Value	$
Potatoes	3505902	Potatoes - Total Production	T	3505901	Potatoes - Total Area	HA	3505958	Potatoes - Total value	$
Rice	1508502	Rice for grain - Production	T	1508501	Rice for grain - Area	HA	1508558	Rice for grain - Value	$
Safflower	1901402	Safflower - Production (clean seed)	T	1901401	Safflower - Area	HA	1901458	Safflower - Value	$
Soybeans	1801702	Soybeans - Production	T	1801701	Soybeans - Area	HA	1801758	Soybeans - Value	$
Sunflower	1903902	Sunflower - Production	T	1903901	Sunflower - Area	HA	1903958	Sunflower - Value	$
Tobacco	1904402	Tobacco - Production	KG	1904401	Tobacco - Area	HA	1904458	Tobacco - Value	$
Triticale	1508802	Triticale for grain - Production	T	1508801	Triticale for grain - Area	HA	1508858	Triticale for grain - Value	$
Vetches	1904802	Vetches for seed - Production	KG	1904801	Vetches for seed - Area	HA	1904858	Vetches for seed - Value	$
Wheat	1500102	Wheat for grain - Production	T	1500101	Wheat for grain - Area	HA	1500158	Wheat for grain - Value	$
Livestock Commodity Classes									
Beef and Dairy Cattle	7004801	Dairy cattle (excl house cows) at y/e Ref Period		100101	Total Area of Holdings				
	7009801	Meat cattle at y/e Ref Period - Total	N						
	7704511	Sales of cattle and calves - Total	N				7704558	Cattle and calves slaughtered - Value	$
	7000101	Total Whole Milk Equivalent-quantity	L				7002058	Milk - Value	$
Sheep	6000601	Sheep and lambs - Total number (at y/e Ref Period)	N						
	7701001	Sales of sheep and lambs - Total	N				7701058	Sheep and lambs slaughtered - Value	$
	6300402	Wool Production	KG				6300459	Wool - Value	$

Appendix 2 – Individual ABS AgStats Production Items, Area Items and Value Items used in calculating the total production, area and value of each Commodity class for use in Commodity mapping and calculation of the profit function. Suffixes of (97) or a (01) indicate items that occurred either in AgStats 1997 or AgStats 2001 but not both. In most cases the items simply changed code. Note that the area of livestock Commodities was distributed amongst pasture pixels and Unallocated Potentially Agricultural Land pixels as described in Section 2.2.6.2 . Note also that Dairy Cattle and Sheep have a primary and secondary product. Lastly, note that the ABS Level 3 classes of Cultivated Turf, Cut Flowers, and Nurseries did not have production figures in AgStats. Negative placeholder values were inserted so that the classes could be included in the profit function. These values manifest as negative numbers in the P1 and Q1 layers but cancel out to the correct positive number when the profit function is calculated.

6.3 ABARE Regions in the MDB



Appendix 3 – ABARE regions in the Murray-Darling Basin used to construct cost parameters for the profit function.

6.4 Cost Function Parameter Values

Commodity	System	Data	NSW (Central North)	NSW (Central South)	NSW (Central)	NSW (prev Sth Murray)	NSW (Western Division)	QLD (Central Qld)	QLD (Darling Downs)	QLD (South Coast)	QLD (Western Downs)	QLD (Western Qld)	SA (350-400mm)	SA (400mm PLUS)	SA (Rangelands)	VIC (Mallee)	VIC (Nth Cent/Nth Irrig)	VIC (South)	VIC (Wimmera)
Almonds	Dryland	AC														1,653.00			
		QC														200.00			
		WR														0.00			
		FOC														562.50			
		FDC														337.50			
		FLC														675.00			
	Irrigated	AC											2,156.40	2,156.40	2,156.40	2,156.40			
		QC											200.00	200.00	200.00	200.00			
		WR											7.00	7.00	7.00	7.00			
		FOC											562.50	562.50	562.50	562.50			
		FDC											337.50	337.50	337.50	337.50			
		FLC											675.00	675.00	675.00	675.00			
Apples	Irrigated	AC				5,793.90			5,793.90								5,793.90	5,793.90	
		QC				388.50			388.50								388.50	388.50	
		WR				6.50			6.50								6.50	6.50	
		FOC				656.25			656.25								656.25	656.25	
		FDC				393.75			393.75								393.75	393.75	
		FLC				787.50			787.50								787.50	787.50	
Apricots	Dryland	AC											3,282.30				3,282.30		
		QC											371.00				371.00		
		WR											0.00				0.00		
		FOC											656.25				656.25		
		FDC											393.75				393.75		
		FLC											787.50				787.50		
	Irrigated	AC		0.00									4,376.40			4,376.40	4,376.40		
		QC		371.00									371.00			371.00	371.00		
		WR		0.00									7.00			7.00	7.00		
		FOC		0.00									656.25			656.25	656.25		
		FDC		0.00									393.75			393.75	393.75		
		FLC		0.00									787.50			787.50	787.50		
Barley	Dryland	AC	208.15	251.08	251.08	251.08	251.08	175.63	141.00	89.95	89.95	78.72	118.50	66.50	107.39	104.00	106.95	107.00	104.24
		QC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		WR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		FOC	87.98	87.90	87.90	87.90	58.37	58.37	136.88	42.53	42.53	42.53	42.53	46.00	27.56	58.37	58.37	58.37	58.37
		FDC	13.91	13.91	13.91	13.91	26.13	26.13	16.15	16.97	16.97	16.97	16.97	16.57	9.95	26.13	26.13	26.13	26.13
		FLC	38.45	38.44	38.44	38.44	38.95	38.95	51.11	34.15	34.15	34.15	34.15	44.47	18.59	38.95	38.95	38.95	38.95
	Irrigated	AC	273.20	273.20	273.20		273.20		211.50		135.00		177.75	99.75		156.00	160.50		
		QC	0.00	0.00	0.00		0.00		0.00		0.00		0.00	0.00		0.00	0.00		
		WR	3.90	2.70	3.00		3.90		2.90		2.90		4.50	4.50		3.80	3.80		
		FOC	87.98	87.98	87.98		58.37		136.88		42.53		42.53	46.00		58.37	58.37		
		FDC	13.91	13.91	13.91		26.13		16.15		16.97		16.97	16.57		26.13	26.13		
		FLC	38.45	38.45	38.45		38.95		51.11		34.15		34.15	44.47		38.95	38.95		
Beef Cattle	Dryland	AC	11.21	11.21	11.21	11.21	5.20	4.96	9.92	9.58	9.58	4.96	6.88	11.21	4.99	6.88	13.80	14.84	8.56
		QC	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
		WR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		FOC	15.26	15.26	15.26	15.26	0.54	1.12	15.26	8.01	8.01	0.52	15.26	28.36	0.80	15.26	28.36	28.36	18.46
		FDC	5.65	5.65	5.65	5.65	0.17	1.92	5.65	1.44	1.44	0.51	5.65	5.36	0.27	5.65	5.36	5.36	5.58
		FLC	6.39	6.39	6.39	6.39	0.53	0.72	6.39	3.32	3.32	0.17	6.39	17.62	0.64	6.39	17.62	17.62	9.13
	Irrigated	AC	11.21	11.21	11.21	11.21	5.20		9.92		9.58		6.88	11.21		7.34	13.75	14.86	6.88
		QC	2.00	2.00	2.00	2.00	2.00		2.00		2.00		2.00	2.00		2.00	2.00	2.00	2.00
		WR	4.30	4.00	4.30	3.90	4.50		5.50		5.50		4.50	3.50		4.00	4.00	3.00	4.00
		FOC	15.26	15.26	15.26	15.26	15.26		15.26		10.00		15.26	28.36		16.13	28.36	28.36	15.26
		FDC	5.65	5.65	5.65	5.65	5.65		5.65		1.44		5.65	5.36		5.63	5.36	5.36	5.65
		FLC	6.39	6.39	6.39	6.39	6.39		6.39		3.32		6.39	17.62		7.14	17.62	17.62	6.39
Canola	Dryland	AC	204.71	237.06	247.15	237.06							146.40	146.40		166.40	185.84	178.22	155.47
		QC	0.00	0.00	0.00	0.00							0.00	0.00		0.00	0.00	0.00	0.00
		WR	0.00	0.00	0.00	0.00							0.00	0.00		0.00	0.00	0.00	0.00
		FOC	70.32	70.32	70.32	70.32							34.02	43.42		46.70	46.70	46.70	46.70
		FDC	11.13	11.13	11.13	11.13							13.58	15.64		20.90	20.90	20.90	20.90
		FLC	30.75	30.75	30.75	30.75							27.32	42.01		31.16	31.16	31.16	31.16
	Irrigated	AC		397.89	397.89											166.40	238.88		
		QC		0.00	0.00											0.00	0.00		
		WR		2.70	3.00											3.80	3.80		
		FOC		70.32	70.32											46.70	46.70		
		FDC		11.13	11.13											20.90	20.90		
		FLC		30.75	30.75											31.16	31.16		
Cereals for Hay/Silage	Dryland	AC	49.50	49.50	49.50	49.50	49.50	49.50	49.50	49.50	49.50		49.50	49.50		49.50	49.50	49.50	49.50
		QC	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00		14.00	14.00		14.00	14.00	14.00	14.00
		WR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00
		FOC	39.56	39.56	39.56	39.56	26.27	26.27	61.60	19.14	19.14		19.14	24.43		26.27	26.27	26.27	26.27
		FDC	6.26	6.26	6.26	6.26	11.76	11.76	7.27	7.64	7.64		7.64	8.80		11.76	11.76	11.76	11.76
		FLC	17.30	17.30	17.30	17.30	17.53	17.53	23.00	15.37	15.37		15.37	23.63		17.53	17.53	17.53	17.53
	Irrigated	AC	49.50	49.50	49.50	49.50	49.50		49.50		49.50		49.50	49.50		49.50	49.50		
		QC	14.00	14.00	14.00	14.00	14.00		14.00		14.00		14.00	14.00		14.00	14.00		
		WR	10.00	10.00	10.00	10.00	10.00		10.00		0.00		10.00	10.00		10.00	10.00		
		FOC	39.56	39.56	39.56	39.56	26.27		61.60		0.00		19.14	24.43		26.27	26.27		
		FDC	6.26	6.26	6.26	6.26	11.76		7.27		0.00		7.64	8.80		11.76	11.76		
		FLC	17.30	17.30	17.30	17.30	17.53		23.00		0.00		15.37	23.63		17.53	17.53		
Cherries	Dryland	AC		2,730.00		2,730.00											3,282.30		
		QC		1,000.00		1,000.00											1,000.00		
		WR		0.00		0.00											0.00		
		FOC		656.25		656.25											656.25		
		FDC		393.75		393.75											393.75		
		FLC		787.50		787.50											787.50		
	Irrigated	AC		2,730.00		2,730.00							2,730.00				4,376.40		
		QC		1,000.00		1,000.00							1,000.00				1,000.00		
		WR		7.00		7.00							7.00				7.00		
		FOC		656.25		656.25							656.25				656.25		
		FDC		393.75		393.75							393.75				393.75		
		FLC		787.50		787.50							787.50				787.50		

Commodity	System	Data	NSW (Central North)	NSW (Central South)	NSW (Central)	NSW (prev Sth Murray)	NSW (Western Division)	QLD (Central Qld)	QLD (Darling Downs)	QLD (South Coast)	QLD (Western Downs)	QLD (Western Qld)	SA (350-400mm)	SA (400mm PLUS)	SA (Rangelands)	VIC (Mallee)	VIC (Nth Cent/Nth Irrig)	VIC (South)	VIC (Wimmera)
Chick Peas	Dryland	AC	190.20	176.40	176.40				102.00		102.43		106.80	0.00		105.00	92.40	92.40	92.40
		QC	0.00	0.00	0.00				0.00		0.00		0.00	0.00		0.00	0.00	0.00	0.00
		WR	0.00	0.00	0.00				0.00		0.00		0.00	0.00		0.00	0.00	0.00	0.00
		FOC	52.74	52.74	52.74				82.13		25.52		25.52	0.00		35.02	35.02	35.02	35.02
		FDC	8.35	8.35	8.35				9.69		10.18		10.18	0.00		15.68	15.68	15.68	15.68
		FLC	23.06	23.06	23.06				30.67		20.49		20.49	0.00		23.37	23.37	23.37	23.37
	Irrigated	AC		220.50	220.50												115.50		
		QC		0.00	0.00												0.00		
		WR		2.70	3.00												3.80		
		FOC		52.74	52.74												35.02		
		FDC		8.35	8.35												15.68		
		FLC		23.06	23.06												23.37		
Cotton	Dryland	AC	571.50		516.85				448.20		186.60								
		QC	525.00		525.00				525.00		525.00								
		WR	0.00		0.00				0.00		0.00								
		FOC	51.43		51.43				51.43		51.43								
		FDC	25.72		25.72				25.72		25.72								
		FLC	77.14		77.14				77.14		77.14								
	Irrigated	AC	762.00	762.00	1,118.39		762.00		872.40		708.16								
		QC	525.00	525.00	525.00		525.00		525.00		525.00								
		WR	7.30	5.80	7.30		12.80		4.50		6.00								
		FOC	51.43	51.43	51.43		51.43		51.43		51.43								
		FDC	25.72	25.72	25.72		25.72		25.72		25.72								
		FLC	77.14	77.14	77.14		77.14		77.14		77.14								
Dairy Cattle	Dryland	AC	243.25	299.25	299.25	299.25	243.25	288.75	288.75	288.75	288.75		266.00	266.00		244.14	299.25	299.25	259.72
		QC	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.50		10.50	10.50		10.50	10.50	10.50	10.50
		WR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00
		FOC	78.24	102.39	78.24	102.39	78.24	78.96	78.96	78.96	78.96		61.02	61.02		102.39	102.34	95.41	102.39
		FDC	46.65	60.98	46.65	60.98	46.65	34.00	34.00	34.00	34.00		35.76	35.76		60.98	60.93	54.01	60.98
		FLC	26.70	45.32	26.70	45.33	26.70	23.14	23.14	23.14	23.14		24.14	24.14		45.32	45.30	41.84	45.33
	Irrigated	AC	243.25	299.25	299.25	299.25			288.75				266.00	266.00		261.22	299.25		243.25
		QC	10.50	10.50	10.50	10.50			10.50				10.50	10.50		10.50	10.50		10.50
		WR	8.00	7.80	8.00	7.80			9.50				7.00	3.50		8.89	7.80		9.40
		FOC	78.24	102.39	78.24	102.39			78.96				61.02	61.02		102.39	102.39		102.39
		FDC	46.65	60.98	46.65	60.98			34.00				35.76	35.76		60.98	60.98		60.98
		FLC	26.70	45.33	26.70	45.33			23.14				24.14	24.14		45.32	45.32		45.33
Faba Beans	Dryland	AC	187.65	187.65	178.20						148.50		148.50	148.50		146.70	185.24	187.65	147.27
		QC	0.00	0.00	0.00						0.00		0.00	0.00		0.00	0.00	0.00	0.00
		WR	0.00	0.00	0.00						0.00		0.00	0.00		0.00	0.00	0.00	0.00
		FOC	79.11	79.11	79.11						38.28		38.28	48.85		52.53	52.53	52.53	52.53
		FDC	12.52	12.52	12.52						15.27		15.27	17.60		23.52	23.52	23.52	23.52
		FLC	34.60	34.60	34.60						30.74		30.74	47.26		35.06	35.06	35.06	35.06
	Irrigated	AC		250.20															
		QC		0.00															
		WR		2.70															
		FOC		79.11															
		FDC		12.52															
		FLC		34.60															
Field Peas	Dryland	AC	107.40	168.00	168.00				107.40				107.40	124.80		95.40	118.80	118.80	95.99
		QC	0.00	0.00	0.00				0.00				0.00	0.00		0.00	0.00	0.00	0.00
		WR	0.00	0.00	0.00				0.00				0.00	0.00		0.00	0.00	0.00	0.00
		FOC	52.74	52.74	25.52				25.52				25.52	32.57		35.02	35.02	35.02	35.02
		FDC	8.35	8.35	10.18				10.18				10.18	11.73		15.68	15.68	15.68	15.68
		FLC	23.06	23.06	20.49				20.49				20.49	31.51		23.37	23.37	23.37	23.37
	Irrigated	AC		218.40	218.40											0.00	148.50		
		QC		0.00	0.00											0.00	0.00		
		WR		2.70	3.00											0.00	3.80		
		FOC		52.74	25.52											0.00	35.02		
		FDC		8.35	10.18											0.00	15.68		
		FLC		23.06	20.49											0.00	23.37		
Grain Sorghum	Dryland	AC	135.45	135.45	135.45	114.99	135.45		215.25	77.44	77.44					323.66	323.66		323.66
		QC	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00					0.00	0.00		0.00
		WR	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00					0.00	0.00		0.00
		FOC	92.29	92.30	92.30	92.30	61.29		144.23	44.66	44.66					61.29	61.29		61.29
		FDC	14.61	14.61	14.61	14.61	27.44		17.02	17.82	17.82					27.44	27.44		27.44
		FLC	40.36	40.36	40.36	40.36	40.90		53.84	35.86	35.86					40.90	40.90		40.90
	Irrigated	AC	265.65	176.09					324.45		411.85						431.55		
		QC	0.00	0.00					0.00		0.00						0.00		
		WR	5.50	5.50					4.00		5.50						5.50		
		FOC	91.13	92.30					144.23		44.66						61.29		
		FDC	14.43	14.61					17.02		17.82						27.44		
		FLC	39.85	40.36					53.84		35.86						40.90		
Grapes	Dryland	AC		2,343.00	2,343.00		2,343.00		2,343.00				2,343.00	2,343.00		2,343.00	2,343.00		2,343.00
		QC		50.00	50.00		50.00		50.00				50.00	50.00		50.00	50.00		50.00
		WR		0.00	0.00		0.00		0.00				0.00	0.00		0.00	0.00		0.00
		FOC		1,925.00	1,925.00		1,443.75		1,925.00				1,443.75	1,925.00		1,443.75	1,443.75		1,925.00
		FDC		1,375.00	1,375.00		1,031.25		1,375.00				1,031.25	1,375.00		1,031.25	1,031.25		1,375.00
		FLC		1,650.00	1,650.00		1,237.50		1,650.00				1,237.50	1,650.00		1,237.50	1,237.50		1,650.00
	Irrigated	AC		2,343.00	2,343.00	2,343.00	2,343.00		2,343.00		2,343.00		2,343.00	2,343.00		2,343.00	2,343.00	2,343.00	
		QC		50.00	50.00	50.00	50.00		50.00		50.00		50.00	50.00		50.00	50.00	50.00	
		WR		7.10	7.10	7.10	7.10		3.50		3.50		8.30	6.30		5.00	5.00	5.00	
		FOC		1,925.00	1,925.00	1,443.75	1,443.75		1,925.00		1,925.00		1,443.75	1,925.00		1,443.75	1,443.75	1,804.69	
		FDC		1,375.00	1,375.00	1,031.25	1,031.25		1,375.00		1,375.00		1,031.25	1,375.00		1,031.25	1,031.25	1,289.06	
		FLC		1,650.00	1,650.00	1,237.50	1,237.50		1,650.00		1,650.00		1,237.50	1,650.00		1,237.50	1,237.50	1,546.88	
Lentils	Dryland	AC														259.20	259.20		259.20
		QC														0.00	0.00		0.00
		WR														0.00	0.00		0.00
		FOC														70.04	70.04		70.04
		FDC														31.36	31.36		31.36
		FLC														46.74	46.74		46.74

Commodity	System	Data	NSW (Central North)	NSW (Central South)	NSW (Central)	NSW (prev Sth Murray)	NSW (Western Division)	QLD (Central Qld)	QLD (Darling Downs)	QLD (South Coast)	QLD (Western Downs)	QLD (Western Qld)	SA (350-400mm)	SA (400mm PLUS)	SA (Rangelands)	VIC (Mallee)	VIC (Nth Cent/Nth Irrig)	VIC (South)	VIC (Wimmera)
Lupins	Dryland	AC	133.25	133.25	133.25		97.50						87.10	87.10		91.00	94.59	82.61	79.72
		QC	0.00	0.00	0.00		0.00						0.00	0.00		0.00	0.00	0.00	0.00
		WR	0.00	0.00	0.00		0.00						0.00	0.00		0.00	0.00	0.00	0.00
		FOC	57.14	57.13	57.14		37.94						27.64	35.28		37.94	37.94	37.94	37.94
		FDC	9.04	9.04	9.04		16.98						11.03	12.71		16.98	16.98	16.98	16.98
		FLC	24.99	24.99	24.99		25.32						22.20	34.13		25.32	25.32	25.32	25.32
	Irrigated	AC		162.50	162.50								0.00	113.23			123.37		
		QC		0.00	0.00								0.00	0.00			0.00		
		WR		2.70	3.00								0.00	4.50			3.80		
		FOC		57.14	57.14								0.00	35.28			37.94		
		FDC		9.04	9.04								0.00	12.71			16.98		
		FLC		24.99	24.99								0.00	34.13			25.32		
Maize	Dryland	AC	340.20	340.20	340.20	340.20	340.20		340.20		288.00						770.85		
		QC	0.00	0.00	0.00	0.00	0.00		0.00		0.00						0.00		
		WR	0.00	0.00	0.00	0.00	0.00		0.00		0.00						0.00		
		FOC	158.22	158.22	158.22	158.22	105.07		247.25		76.55						105.07		
		FDC	25.04	25.04	25.04	25.04	47.03		29.18		30.55						47.03		
		FLC	69.19	69.19	69.19	69.19	70.11		92.30		61.47						70.11		
	Irrigated	AC	1,154.29	1,229.36			1,154.29		1,056.60										
		QC	0.00	0.00			0.00		0.00										
		WR	5.50	5.50			5.50		4.00										
		FOC	158.22	158.22			105.07		247.25										
		FDC	25.04	25.04			47.03		29.18										
		FLC	69.19	69.19			70.11		92.30										
Millet	Dryland	AC		79.00	79.00	79.00			79.00		70.00					151.50	151.50	151.50	151.50
		QC		0.00	0.00	0.00			0.00		0.00					0.00	0.00	0.00	0.00
		WR		0.00	0.00	0.00			0.00		0.00					0.00	0.00	0.00	0.00
		FOC		87.90	87.90	137.36			137.36		42.53					58.37	58.37	58.37	58.37
		FDC		13.91	13.91	16.21			16.21		16.97					26.13	26.13	26.13	26.13
		FLC		38.44	38.44	51.28			51.28		34.15					38.95	38.95	38.95	38.95
	Irrigated	AC							296.00								202.00		
		QC							0.00								0.00		
		WR							2.90								3.80		
		FOC							42.53								58.37		
		FDC							16.97								26.13		
		FLC							34.15								38.95		
Mung Beans	Dryland	AC	168.35	168.35	168.35				168.35		168.35					157.74			
		QC	0.00	0.00	0.00				0.00		0.00					0.00			
		WR	0.00	0.00	0.00				0.00		0.00					0.00			
		FOC	57.14	57.14	57.14				27.64		27.64					37.94			
		FDC	9.04	9.04	9.04				11.03		11.03					16.98			
		FLC	24.99	24.99	24.99				22.20		22.20					25.32			
	Irrigated	AC		240.50	240.50				240.50										
		QC		0.00	0.00				0.00										
		WR		5.50	5.50				4.00										
		FOC		57.14	57.14				27.64										
		FDC		9.04	9.04				11.03										
		FLC		24.99	24.99				22.20										
Nectarines	Dryland	AC		3,165.75		3,165.75			3,165.75							3,165.75	3,165.75		
		QC		416.00		416.00			416.00							416.00	416.00		
		WR		0.00		0.00			0.00							0.00	0.00		
		FOC		562.50		562.50			562.50							562.50	562.50		
		FDC		337.50		337.50			337.50							337.50	337.50		
		FLC		675.00		675.00			675.00							675.00	675.00		
	Irrigated	AC				4,221.00			4,221.00				4,221.00			4,221.00	4,221.00		
		QC				416.00			416.00				416.00			416.00	416.00		
		WR				7.00			7.00				7.00			7.00	7.00		
		FOC				562.50			562.50				562.50			562.50	562.50		
		FDC				337.50			337.50				337.50			337.50	337.50		
		FLC				675.00			675.00				675.00			675.00	675.00		
Non-Cereal Crops Cut for Hay	Dryland	AC	108.00	108.00	108.00	108.00			108.00		108.00		108.00	108.00		108.00	108.00	108.00	108.00
		QC	24.00	24.00	24.00	24.00			24.00		24.00		24.00	24.00		24.00	24.00	24.00	24.00
		WR	0.00	0.00	0.00	0.00			0.00		0.00		0.00	0.00		0.00	0.00	0.00	0.00
		FOC	26.37	26.37	26.37	26.37			41.21		12.76		12.76	16.28		17.51	17.51	17.51	17.51
		FDC	4.17	4.17	4.17	4.17			4.86		5.09		5.09	5.87		7.84	7.84	7.84	7.84
		FLC	11.53	11.53	11.53	11.53			15.38		10.25		10.25	15.75		11.69	11.69	11.69	11.69
	Irrigated	AC		108.00	108.00								108.00			108.00	108.00		
		QC		24.00	24.00								24.00			24.00	24.00		
		WR		10.00	10.00								10.00			10.00	10.00		
		FOC		26.37	26.37								12.76			17.51	17.51		
		FDC		4.17	4.17								5.09			7.84	7.84		
		FLC		11.53	11.53								10.25			11.69	11.69		
Oats	Dryland	AC	82.80	82.80	82.80	82.80	82.80		82.80		84.49		36.00	47.25	44.44	39.60	42.20	44.92	34.19
		QC	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
		WR	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
		FOC	39.56	39.56	39.55	61.81	61.81		61.81		19.14		19.14	24.97	23.51	26.27	26.27	26.27	26.27
		FDC	6.26	6.26	6.26	7.29	7.29		7.29		7.64		7.64	8.99	8.65	11.76	11.76	11.76	11.76
		FLC	17.30	17.30	17.30	23.08	23.08		23.08		15.37		15.37	24.15	21.96	17.53	17.53	17.53	17.53
	Irrigated	AC	90.00	90.00	90.00		90.00		90.00								54.99	54.99	
		QC	0.00	0.00	0.00		0.00		0.00								0.00	0.00	
		WR	3.90	2.70	3.00		3.90		2.90								3.80	3.80	
		FOC	39.56	39.56	39.56		61.81		61.81								26.27	26.27	
		FDC	6.26	6.26	6.26		7.29		7.29								11.76	11.76	
		FLC	17.30	17.30	17.30		23.08		23.08								17.53	17.53	
Oranges	Dryland	AC		2,484.00	2,484.00		2,484.00						2,484.00			2,484.00			
		QC		66.00	66.00		66.00						66.00			66.00			
		WR		0.00	0.00		0.00						0.00			0.00			
		FOC		1,687.50	1,687.50		1,687.50						1,687.50			1,687.50			
		FDC		1,012.50	1,012.50		1,012.50						1,012.50			1,012.50			
		FLC		2,025.00	2,025.00		2,025.00						2,025.00			2,025.00			
	Irrigated	AC		2,484.00			2,484.00						2,484.00		2,484.00	2,484.00	2,484.00		
		QC		66.00			66.00						66.00		66.00	66.00	66.00		
		WR		9.00			9.00						9.00		9.00	9.00	9.00		
		FOC		1,687.50			1,687.50						1,687.50		1,687.50	1,687.50	1,687.50		
		FDC		1,012.50			1,012.50						1,012.50		1,012.50	1,012.50	1,012.50		
		FLC		2,025.00			2,025.00						2,025.00		2,025.00	2,025.00	2,025.00		

Commodity	System	Data	NSW (Central North)	NSW (Central South)	NSW (Central)	NSW (prev Sth Murray)	NSW (Western Division)	QLD (Central Qld)	QLD (Darling Downs)	QLD (South Coast)	QLD (Western Downs)	QLD (Western Qld)	SA (350-400mm)	SA (400mm PLUS)	SA (Rangelands)	VIC (Mallee)	VIC (Nth Cent/Nth Irrig)	VIC (South)	VIC (Wimmera)
Other Cereal Crops	Dryland	AC	20.00	20.00	20.00	20.00							20.00			20.00		20.00	
		QC	0.00	0.00	0.00	0.00							0.00			0.00		0.00	
		WR	0.00	0.00	0.00	0.00							0.00			0.00		0.00	
		FOC	11.69	11.69	11.69	11.69							11.69			11.69		11.69	
		FDC	5.22	5.22	5.22	5.22							5.22			5.22		5.22	
		FLC	7.79	7.79	7.79	7.79							7.79			7.79		7.79	
	Irrigated	AC			54.65														
		QC			0.00														
		WR			3.00														
		FOC			17.58														
		FDC			2.78														
		FLC			7.69														
Other Citrus	Dryland	AC											3,450.00				3,450.00		
		QC											99.00				99.00		
		WR											0.00				0.00		
		FOC											2,343.75				2,343.75		
		FDC											1,406.25				1,406.25		
		FLC											2,812.50				2,812.50		
	Irrigated	AC		3,450.00	3,450.00		3,450.00						3,450.00			3,450.00			
		QC		99.00	99.00		99.00						99.00			99.00			
		WR		9.00	9.00		9.00						9.00			9.00			
		FOC		2,343.75	2,343.75		2,343.75						2,343.75			2,343.75			
		FDC		1,406.25	1,406.25		1,406.25						1,406.25			1,406.25			
		FLC		2,812.50	2,812.50		2,812.50						2,812.50			2,812.50			
Other non-Cereal Crops	Dryland	AC	13,230.00	13,230.00	13,230.00	13,230.00		13,230.00	13,230.00		13,230.00					10,605.00		15,330.00	10,780.00
		QC	0.00	0.00	0.00	0.00		0.00	0.00		0.00					0.00		0.00	0.00
		WR	0.00	0.00	0.00	0.00		0.00	0.00		0.00					0.00		0.00	0.00
		FOC	9,615.20	9,615.20	9,615.20	9,615.20		9,615.20	9,615.20		9,615.20					4,085.90		4,085.90	4,085.90
		FDC	1,134.70	1,134.70	1,134.70	1,134.70		1,134.70	1,134.70		1,134.70					1,829.10		1,829.10	1,829.10
		FLC	3,589.60	3,589.60	3,589.60	3,589.60		3,589.60	3,589.60		3,589.60					2,726.50		2,726.50	2,726.50
	Irrigated	AC		41,090.00	41,090.00				41,090.00		41,090.00			12,194.00		14,140.00	14,140.00	22,995.00	
		QC		0.00	0.00				0.00		0.00			0.00		0.00	0.00	0.00	
		WR		2.70	3.00				2.90		2.90			4.50		3.80	3.80	3.80	
		FOC		9,615.20	9,615.20				9,615.20		9,615.20			3,799.60		4,085.90	4,085.90	4,085.90	
		FDC		1,134.70	1,134.70				1,134.70		1,134.70			1,368.50		1,829.10	1,829.10	1,829.10	
		FLC		3,589.60	3,589.60				3,589.60		3,589.60			3,675.70		2,726.50	2,726.50	2,726.50	
Other Nuts	Dryland	AC											1,377.50						
		QC											0.00						
		WR											0.00						
		FOC											468.75						
		FDC											281.25						
		FLC											562.50						
	Irrigated	AC	1,797.00				1,797.00						1,797.00			1,797.00			
		QC	0.00				0.00						0.00			0.00			
		WR	7.00				7.00						7.00			7.00			
		FOC	468.75				468.75						468.75			468.75			
		FDC	281.25				281.25						281.25			281.25			
		FLC	562.50				562.50						562.50			562.50			
Other Oilseeds	Dryland	AC	163.10		163.10				163.10										
		QC	0.00		0.00				0.00										
		WR	0.00		0.00				0.00										
		FOC	95.82		95.82				95.82										
		FDC	11.31		11.31				11.31										
		FLC	35.78		35.78				35.78										
Other Stone Fruit	Dryland	AC		2,126.25													2,605.13		2,605.13
		QC		357.00													357.00		357.00
		WR		0.00													0.00		0.00
		FOC		468.75													468.75		468.75
		FDC		281.25													281.25		281.25
		FLC		562.50													562.50		562.50
	Irrigated	AC		2,835.00		2,835.00			2,835.00				2,835.00			3,473.50	3,473.50		
		QC		357.00		357.00			357.00				357.00			357.00	357.00		
		WR		7.00		7.00			7.00				7.00			7.00	7.00		
		FOC		468.75		468.75			468.75				468.75			468.75	468.75		
		FDC		281.25		281.25			281.25				281.25			281.25	281.25		
		FLC		562.50		562.50			562.50				562.50			562.50	562.50		
Other Vegetables	Dryland	AC									3,800.00								
		QC									0.00								
		WR									0.00								
		FOC									1,781.25								
		FDC									1,068.75								
		FLC									2,137.50								
	Irrigated	AC		3,800.00	3,800.00	3,344.00	3,800.00		3,800.00		3,800.00		3,800.00			3,800.00	3,800.00		
		QC		0.00	0.00	0.00	0.00		0.00		0.00		0.00			0.00	0.00		
		WR		4.00	4.30	3.90	4.50		5.50		5.50		4.50			5.00	5.00		
		FOC		1,781.25	1,781.25	1,781.25	1,781.25		1,781.25		1,781.25		1,781.25			1,781.25	1,781.25		
		FDC		1,068.75	1,068.75	1,068.75	1,068.75		1,068.75		1,068.75		1,068.75			1,068.75	1,068.75		
		FLC		2,137.50	2,137.50	2,137.50	2,137.50		2,137.50		2,137.50		2,137.50			2,137.50	2,137.50		
Peaches	Dryland	AC		1,562.63		1,562.63			1,562.63				1,562.63				1,562.63		
		QC		258.00		258.00			258.00				258.00				258.00		
		WR		0.00		0.00			0.00				0.00				0.00		
		FOC		281.25		281.25			281.25				281.25				281.25		
		FDC		168.75		168.75			168.75				168.75				168.75		
		FLC		337.50		337.50			337.50				337.50				337.50		
	Irrigated	AC		2,083.50	2,083.50	2,083.50			2,083.50				2,083.50			2,083.50	2,083.50		
		QC		258.00	258.00	258.00			258.00				258.00			258.00	258.00		
		WR		7.00	7.00	7.00			7.00				7.00			7.00	7.00		
		FOC		281.25	281.25	281.25			281.25				281.25			281.25	281.25		
		FDC		168.75	168.75	168.75			168.75				168.75			168.75	168.75		
		FLC		337.50	337.50	337.50			337.50				337.50			337.50	337.50		
Peanuts	Dryland	AC	540.00				450.00		540.00	540.00	540.00								
		QC	80.50				80.50		80.50	80.50	80.50								
		WR	0.00				0.00		0.00	0.00	0.00								
		FOC	123.62				123.62		123.62	38.28	38.28								
		FDC	14.59				14.59		14.59	15.27	15.27								
		FLC	46.15				46.15		46.15	30.74	30.74								

Commodity	System	Data	NSW (Central North)	NSW (Central South)	NSW (Central)	NSW (prev Sth Murray)	NSW (Western Division)	QLD (Central Qld)	QLD (Darling Downs)	QLD (South Coast)	QLD (Western Downs)	QLD (Western Qld)	SA (350-400mm)	SA (400mm PLUS)	SA (Rangelands)	VIC (Mallee)	VIC (Nth Cent/Nth Irrig)	VIC (South)	VIC (Wimmera)
	Irrigated	AC							935.48										
		QC							80.50										
		WR							2.90										
		FOC							123.62										
		FDC							14.59										
		FLC							46.15										
Pears	Dryland	AC															5,557.60		
		QC															200.00		
		WR															0.00		
		FOC															750.00		
		FDC															450.00		
		FLC															900.00		
	Irrigated	AC															5,557.60		
		QC															200.00		
		WR															6.50		
		FOC															750.00		
		FDC															450.00		
		FLC															900.00		
Plums	Dryland	AC		1,701.00		1,701.00			1,701.00				1,701.00			1,701.00	1,701.00		
		QC		357.00		357.00			357.00				357.00			357.00	357.00		
		WR		0.00		0.00			0.00				0.00			0.00	0.00		
		FOC		375.00		375.00			375.00				375.00			375.00	375.00		
		FDC		225.00		225.00			225.00				225.00			225.00	225.00		
		FLC		450.00		450.00			450.00				450.00			450.00	450.00		
	Irrigated	AC		2,268.00		2,268.00			2,268.00				2,268.00			2,268.00	2,268.00		
		QC		357.00		357.00			357.00				357.00			357.00	357.00		
		WR		7.00		7.00			7.00				7.00			7.00	7.00		
		FOC		375.00		375.00			375.00				375.00			375.00	375.00		
		FDC		225.00		225.00			225.00				225.00			225.00	225.00		
		FLC		450.00		450.00			450.00				450.00			450.00	450.00		
Popcorn	Dryland	AC							342.60							342.60	342.60		342.60
		QC							0.00							0.00	0.00		0.00
		WR							0.00							0.00	0.00		0.00
		FOC							108.88							46.70	46.70		46.70
		FDC							12.86							20.90	20.90		20.90
		FLC							40.66							31.16	31.16		31.16
	Irrigated	AC	456.80	456.80					456.80	456.80									
		QC	0.00	0.00					0.00	0.00									
		WR	5.50	5.50					4.00	5.50									
		FOC	46.70	46.70					108.88	46.70									
		FDC	20.90	20.90					12.86	20.90									
		FLC	31.16	31.16					40.66	31.16									
Potatoes	Dryland	AC		2,640.00					2,640.00				2,640.00	2,640.00				2,640.00	
		QC		30.00					30.00				30.00	30.00				30.00	
		WR		0.00					0.00				0.00	0.00				0.00	
		FOC		1,406.25					1,406.25				1,406.25	1,406.25				1,406.25	
		FDC		843.75					843.75				843.75	843.75				843.75	
		FLC		1,687.50					1,687.50				1,687.50	1,687.50				1,687.50	
	Irrigated	AC		2,640.00	2,640.00				2,640.00	0.00			2,640.00	2,640.00		2,640.00	2,640.00	2,640.00	
		QC		30.00	30.00				30.00	30.00			30.00	30.00		30.00	30.00	30.00	
		WR		4.00	4.30				5.50	0.00			4.50	3.50		5.00	5.00	5.00	
		FOC		1,406.25	1,406.25				1,406.25	0.00			1,406.25	1,406.25		1,406.25	1,406.25	1,406.25	
		FDC		843.75	843.75				843.75	0.00			843.75	843.75		843.75	843.75	843.75	
		FLC		1,687.50	1,687.50				1,687.50	0.00			1,687.50	1,687.50		1,687.50	1,687.50	1,687.50	
Rice	Irrigated	AC		900.00			900.00										900.00		
		QC		0.00			0.00										0.00		
		WR		10.80			10.80										10.80		
		FOC		150.00			150.00										150.00		
		FDC		25.00			25.00										25.00		
		FLC		50.00			50.00										50.00		
Safflower	Dryland	AC	60.00	60.00	60.00		60.00		60.00				60.00			52.80	60.00	60.00	60.00
		QC	0.00	0.00	0.00		0.00		0.00				0.00			0.00	0.00	0.00	0.00
		WR	0.00	0.00	0.00		0.00		0.00				0.00			0.00	0.00	0.00	0.00
		FOC	52.74	52.74	35.02		35.02		82.42				25.52			35.02	35.02	35.02	35.02
		FDC	8.35	8.35	15.68		15.68		9.73				10.18			15.68	15.68	15.68	15.68
		FLC	23.06	23.06	23.37		23.37		30.77				20.49			23.37	23.37	23.37	23.37
	Irrigated	AC	78.00	78.00			78.00										60.00		
		QC	0.00	0.00			0.00										0.00		
		WR	3.90	2.70			3.90										3.80		
		FOC	52.74	52.74			35.02										35.02		
		FDC	8.35	8.35			15.68										15.68		
		FLC	23.06	23.06			23.37										23.37		
Sheep	Dryland	AC	2.26	2.26	2.26	2.26	2.42	2.42	2.26		2.26	2.42	2.26	2.26	2.42	2.26	2.44	4.32	2.26
		QC	4.00	4.00	4.00	4.00	4.00	4.00	4.00		4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
		WR	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		FOC	12.82	12.84	12.84	29.18	0.88	3.26	12.81		3.26	3.26	12.83	29.18	0.38	12.84	29.18	29.18	29.18
		FDC	4.52	4.54	4.54	13.06	1.31	0.58	4.52		0.58	0.58	4.53	13.06	0.15	4.54	13.07	13.07	13.07
		FLC	8.30	8.32	8.32	19.47	0.45	1.07	8.30		1.06	1.07	8.30	19.47	0.28	8.32	19.48	19.48	19.48
	Irrigated	AC	2.26	2.26	2.26	2.26	2.42						2.26	2.26		2.26	2.44	4.32	2.26
		QC	4.00	4.00	4.00	4.00	4.00						4.00	4.00		4.00	4.00	4.00	4.00
		WR	4.00	4.00	4.00	4.00	4.00						4.00	4.00		4.00	4.00	4.00	4.00
		FOC	12.82	12.84	12.84	29.18	0.88						12.83	29.18		12.84	29.18	29.18	29.18
		FDC	4.52	4.54	4.54	13.06	1.31						4.53	13.06		4.54	13.07	13.07	13.07
		FLC	8.30	8.32	8.32	19.47	0.45						8.30	19.47		8.32	19.48	19.48	19.48
Soybeans	Dryland	AC	201.30	201.30	201.30	289.30			173.80							288.75	288.75		
		QC	0.00	0.00	0.00	0.00			0.00							0.00	0.00		
		WR	0.00	0.00	0.00	0.00			0.00							0.00	0.00		
		FOC	96.69	96.69	96.69	96.69			151.10							64.21	64.21		
		FDC	15.30	15.30	15.30	15.30			17.83							28.74	28.74		
		FLC	42.28	42.28	42.28	42.28			56.41							42.85	42.85		
	Irrigated	AC		423.50	423.50	635.80			423.50								385.00		
		QC		0.00	0.00	0.00			0.00								0.00		
		WR		5.50	5.50	5.50			4.00								5.50		
		FOC		96.69	96.69	96.69			151.10								64.21		
		FDC		15.30	15.30	15.30			17.83								28.74		
		FLC		42.28	42.28	42.28			56.41								42.85		

Commodity	System	Data	NSW (Central North)	NSW (Central South)	NSW (Central)	NSW (prev Sth Murray)	NSW (Western Division)	QLD (Central Qld)	QLD (Darling Downs)	QLD (South Coast)	QLD (Western Downs)	QLD (Western Qld)	SA (350-400mm)	SA (400mm PLUS)	SA (Rangelands)	VIC (Mallee)	VIC (Nth Cent/Nth Irrig)	VIC (South)	VIC (Wimmera)
Sunflower	**Dryland**	AC	153.15	93.56	93.56	93.56	113.02		124.00		113.02					136.20	136.20		136.20
		QC	0.00	0.00	0.00	0.00	0.00		0.00		0.00					0.00	0.00		0.00
		WR	0.00	0.00	0.00	0.00	0.00		0.00		0.00					0.00	0.00		0.00
		FOC	70.32	70.32	70.32	70.32	46.70		109.89		34.02					46.70	46.70		46.70
		FDC	11.13	11.13	11.13	11.13	20.90		12.97		13.58					20.90	20.90		20.90
		FLC	30.75	30.75	30.75	30.75	31.16		41.02		27.32					31.16	31.16		31.16
	Irrigated	AC	199.10	121.63	121.63	121.63	146.92				146.92						181.60		
		QC	0.00	0.00	0.00	0.00	0.00				0.00						0.00		
		WR	5.50	5.50	5.50	5.50	5.50				5.50						5.50		
		FOC	70.32	70.32	70.32	70.32	46.70				34.02						46.70		
		FDC	11.13	11.13	11.13	11.13	20.90				13.58						20.90		
		FLC	30.75	30.75	30.75	30.75	31.16				27.32						31.16		
Tobacco	**Dryland**	AC																6,700.00	
		QC																760.00	
		WR																0.00	
		FOC																937.50	
		FDC																562.50	
		FLC																1,125.00	
	Irrigated	AC																6,700.00	
		QC																760.00	
		WR																3.80	
		FOC																937.50	
		FDC																562.50	
		FLC																1,125.00	
Triticale	**Dryland**	AC	196.49	196.49	118.13	116.10	116.10		135.00		91.80		91.80	112.50	98.10	98.10	96.30	96.30	98.07
		QC	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
		WR	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
		FOC	79.11	79.11	79.11	52.53	52.53		123.62		38.28		38.28	49.93	23.43	52.53	52.53	52.53	52.53
		FDC	12.52	12.52	12.52	23.52	23.52		14.59		15.27		15.27	17.98	8.32	23.52	23.52	23.52	23.52
		FLC	34.60	34.60	34.60	35.06	35.06		46.15		30.74		30.74	48.30	15.30	35.06	35.06	35.06	35.06
	Irrigated	AC		196.49												98.10	180.90		
		QC		0.00												0.00	0.00		
		WR		2.70												3.80	3.80		
		FOC		79.11												52.53	51.53		
		FDC		12.52												23.52	23.07		
		FLC		34.60												35.06	34.38		
Vetches	**Dryland**	AC		39.30									42.90			39.30	39.30		39.30
		QC		0.00									0.00			0.00	0.00		0.00
		WR		0.00									0.00			0.00	0.00		0.00
		FOC		26.37									12.76			17.51	17.51		17.51
		FDC		4.17									5.09			7.84	7.84		7.84
		FLC		11.53									10.25			11.69	11.69		11.69
	Irrigated	AC		51.09															
		QC		0.00															
		WR		2.70															
		FOC		26.37															
		FDC		4.17															
		FLC		11.53															
Wheat	**Dryland**	AC	189.71	275.47	189.72	275.47	175.63	175.63	133.00	78.72	78.72	78.72	136.50	100.50	128.79	100.00	134.15	158.60	134.00
		QC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		WR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		FOC	87.88	87.90	87.90	87.95	58.37	58.37	137.36	42.53	42.53	42.53	42.52	55.18	27.56	58.45	58.42	58.39	58.37
		FDC	13.91	13.91	13.91	13.94	26.13	26.13	16.21	16.97	16.97	16.97	16.97	19.92	9.96	26.10	26.11	26.12	26.13
		FLC	38.43	38.44	38.44	38.53	38.95	38.95	51.28	34.15	34.15	34.15	34.14	53.18	18.59	38.95	38.95	38.95	38.95
	Irrigated	AC	273.23	273.23	273.23	288.00	288.00		288.00		273.23					155.28	273.23	273.23	201.00
		QC	0.00	0.00	0.00	0.00	0.00		0.00		0.00					0.00	0.00	0.00	0.00
		WR	3.90	2.70	3.00	2.70	3.90		2.90		2.90					3.80	3.80	3.80	3.80
		FOC	87.88	87.90	87.90	87.95	58.37		137.36		42.53					58.44	58.42	58.37	58.37
		FDC	13.91	13.91	13.91	13.94	26.13		16.21		16.97					26.10	26.11	26.13	26.13
		FLC	38.43	38.44	38.44	38.53	38.95		51.28		34.15					38.95	38.95	38.95	38.95

Appendix 4 – Cost function parameter values used in the calculation of profit at full equity for each commodity in the Murray-Darling Basin 1996/97 and 2000/01 by ABARE region.

6.5 Level of Government Assistance

Commodity	System	Gov't Assistance ($/Ha)	NSW (Central North)	NSW (Central South)	NSW (Central)	NSW (prev Sth Murray)	NSW (Western Division)	QLD (Central Qld)	QLD (Darling Downs)	QLD (South Coast)	QLD (Western Downs)	QLD (Western Qld)	SA (350-400mm)	SA (400mm PLUS)	SA (Rangelands)	VIC (Mallee)	VIC (Nth Cent/Nth Irrig)	VIC (South)	VIC (Wimmera)
Almonds	Dryland	1996/97														417			
		2000/01											119			119			
	Irrigated	1996/97											1,085	1,157	1,157	1,175			
		2000/01		73									310		331	336			
Apples	Irrigated	1996/97				300			300								533	300	
		2000/01																	
Apricots	Dryland	1996/97											610				110		
		2000/01																	
	Irrigated	1996/97											1,218			211	211		
		2000/01											348			60	60		
Barley	Dryland	1996/97	8	7	7	7	7	4	7	5	5	5	6	6	4	7	7	8	8
		2000/01	8	7	7	7	7	4	7		5		6	6	4	7	7	8	8
	Irrigated	1996/97	13	13	13		13		10		7		9	9		11	10		
		2000/01	13	13	13		13		10		7		9	9		11	10		
Beef Cattle	Dryland	1996/97	3	3	3	5	0	1	9	2	2	0	2	4	0	2	6	7	4
		2000/01	1	1	1	1	0	0	2		0	0	0	1	0	0	1	1	1
	Irrigated	1996/97	2	3	3	4	0		8		2		1	5		4	3	7	3
		2000/01	0	1	1	1	0		2		0		0	1		1	1	1	1
Canola	Dryland	1996/97	5	12	13	13							11	10		8	10	10	10
		2000/01	5	12	13	13	11		12		11		11	10		8	10	10	10
	Irrigated	1996/97		13	12											10	11		
		2000/01	21	13	12								14			10	10		
Cereals for Hay/Silage	Dryland	1996/97	4	4	4	4	4	4	4	4	4		4	4		4	4	5	5
		2000/01	4	4	4	4	4	4	4		4		4	4		4	4	5	5
	Irrigated	1996/97	4	4	4	4	4		4				4	4		4	4		
		2000/01	4	4	4		4		4					4		4	4		
Cherries	Dryland	1996/97		4,200		4,200											534		
		2000/01		1,200		1,200												153	
	Irrigated	1996/97		4,200		4,200							4,200				573		
		2000/01		1,200		1,200											124	204	
Chick Peas	Dryland	1996/97	6	4	4				9		5		8			5	7	5	7
		2000/01	6	4	4	4	4	4	9		5					5	6		7
	Irrigated	1996/97		9	9												7		
		2000/01	6		9												7		
Cotton	Dryland	1996/97																	
		2000/01	50		41	41			40		32								
	Irrigated	1996/97																	
		2000/01	76	76	76	76	89		57		66	66							
Dairy Cattle	Dryland	1996/97	11	12	11	10	0	2	14	7	7		7	13		7	17	23	11
		2000/01	8	9	8	7	0	2	10		5	0	5	9	1	5	12	17	7
	Irrigated	1996/97	11	10	12	10			11				9	15		14	20		10
		2000/01	8	7	9		1		8				6	11		10	15	16	
Faba Beans	Dryland	1996/97	8	8	7						10		10	11		4	8	8	8
		2000/01	8	8	7		10	10			10		10	11		5	8	8	8
	Irrigated	1996/97		8															
		2000/01	8	8	7		10										8		
Field Peas	Dryland	1996/97	6	6	6				6				6	8		10	10	10	10
		2000/01	6	6	6				6		6		6	7		10	10	10	10
	Irrigated	1996/97		6	6												10		
		2000/01		6	6											5	10		
Grain Sorghum	Dryland	1996/97	10	11	11	8	11		9	6	6					12	12		12
		2000/01	10	11	11	8	11	6	9		6					12	12	12	12
	Irrigated	1996/97	6	11					12		6						31		
		2000/01	7	11	11				12		6								
Grapes	Dryland	1996/97		937	536		1,118		569				923	645		1,008	397		211
		2000/01		843	482		1,006						831	580		907	357	284	
	Irrigated	1996/97		896	366	479	968		848		1,937		1,032	710		913	395	255	
		2000/01		806	330	431	871		763		1,743		928	639		822	343	209	190
Lentils	Dryland	1996/97														19	19		19
		2000/01														19	19	19	19
Lupins	Dryland	1996/97	3	5	5		2						5	6		4	5	5	4
		2000/01	3	5	5	5							5	6		4	5	4	4
	Irrigated	1996/97		5	5									7			7		
		2000/01		5	5									7			7		
Maize	Dryland	1996/97	16	16	16	16	16		16		18						37		
		2000/01	16	16	16	16	16		16		18						37		
	Irrigated	1996/97	25	33			13		17										
		2000/01	25	33	29				17								37		
Millet	Dryland	1996/97		7	7	7			7		6					10	10	10	10
		2000/01	7	7	7				7		6					10			
	Irrigated	1996/97							6								10		
		2000/01		6					6										

Commodity	System	Gov't Assistance ($/Ha)	NSW (Central North)	NSW (Central South)	NSW (Central)	NSW (prev Sth Murray)	NSW (Western Division)	QLD (Central Qld)	QLD (Darling Downs)	QLD (South Coast)	QLD (Western Downs)	QLD (Western Qld)	SA (350-400mm)	SA (400mm PLUS)	SA (Rangelands)	VIC (Mallee)	VIC (Nth Cent/Nth Irrig)	VIC (South)	VIC (Wimmera)
Mung Beans	Dryland	1996/97	11	11	11				11		11					8			
		2000/01	11	11	11	9			11		11								8
	Irrigated	1996/97		11	11				11										
		2000/01	11	11			11		11										
Nectarines	Dryland	1996/97		2,456		2,456			2,456							2,456	2,456		
		2000/01				702			702							702	702		
	Irrigated	1996/97				3,015			3,015				3,015			3,015	3,015		
		2000/01				861							861			861	861		
Non-Cereal Crops	Dryland	1996/97	7	9	8	6			8		6		4	5		7	9	8	7
Cut for Hay		2000/01	7	9	8	6		6	8		6		4			7	9	9	8
	Irrigated	1996/97		10	3								4			8	10		
		2000/01		10	3											8	10		
Oats	Dryland	1996/97	2	2	2	2	2		2		1		2	2	2	2	2	2	2
		2000/01	5	5	5	5	5	5	5		2		7	7	7	7	6	7	6
	Irrigated	1996/97	2	2	2		2		2								2	2	
		2000/01	5	5	5	5			5					8		7	6		
Oranges	Dryland	1996/97		158	158		158						158			158			
		2000/01		105			105						105			105			
	Irrigated	1996/97		158			158						158		158	158	158		
		2000/01		105	105		105						105		105	105	105		
Other Cereal Crops	Dryland	1996/97	7	7	7	7							7			7		7	
		2000/01																	
	Irrigated	1996/97			6														
		2000/01																	
Other Citrus	Dryland	1996/97											158				158		
		2000/01			105								105						
	Irrigated	1996/97		158	158		158						158			158			
		2000/01		105			105						105			105	105		
Other non-Cereal	Dryland	1996/97	16	16	16	16		16	16		16					10		10	7
Crops		2000/01	16		16	16		16	16		16		6				10	10	7
	Irrigated	1996/97		17	17				17		17			7		10	10	14	
		2000/01	17	17	17			17	17		17		7	7		10	10	14	7
Other Nuts	Dryland	1996/97											417						
		2000/01	119				119						119						
	Irrigated	1996/97	1,085				1,085						1,085			1,175			
		2000/01	310										310			336			
Other Oilseeds	Dryland	1996/97	12		12				12										
		2000/01																	
Other Stone Fruit	Dryland	1996/97		1,361													904		904
		2000/01		389					389				389	389		258	258		258
	Irrigated	1996/97		1,361		1,361			1,361				1,361			904	904		
		2000/01	389	389	389	389	389		389		389		389	389		258	258	258	
Other Vegetables	Dryland	1996/97																	
		2000/01				95													
	Irrigated	1996/97																	
		2000/01	95	59	69	95	117		119		119		125			65	101		
Peaches	Dryland	1996/97		904		904			904				904				904		
		2000/01				258			258								258		
	Irrigated	1996/97		904	904	904			904				904			904	904		
		2000/01		258		258			258				258			258	258	258	
Peanuts	Dryland	1996/97	12				12		12	26	26								
		2000/01	12				12	12	12		26								
	Irrigated	1996/97							44										
		2000/01																	
Pears	Dryland	1996/97															224		
		2000/01																	
	Irrigated	1996/97															275		
		2000/01																	
Plums	Dryland	1996/97		1,361		1,361			1,361				1,361			1,361	1,361		
		2000/01		389					389							389			
	Irrigated	1996/97		1,361		1,361			1,361				1,361			1,361	1,361		
		2000/01		389					389				389			389	389		
Popcorn	Dryland	1996/97							6							6	6		6
		2000/01							6		6								
	Irrigated	1996/97	6	6					6	6									
		2000/01	6	6					6		6								
Potatoes	Dryland	1996/97																	
		2000/01		95					95					95				95	
	Irrigated	1996/97																	
		2000/01		95		95	95		95		48		95	95		95	95	95	
Rice	Irrigated	1996/97		169			169										166		
		2000/01		101	101											100	100	101	
Safflower	Dryland	1996/97	2	2	2		2		2				2			3	8	8	7
		2000/01	2	2			2		2		2		2			3	8	8	7
	Irrigated	1996/97	2	2			2										8		
		2000/01		2															
Sheep	Dryland	1996/97	9	13	15	20	1	2	7		4	1	8	25	1	10	27	28	16
		2000/01	9	13	15	20	1	2	7		4	1	8	22	1	10	27	28	15
	Irrigated	1996/97	9	25	15	20	1	2	7		4	1	8	25	1	10	27	28	16
		2000/01	9	25	15	20	1	2	7		4	1	8	22	1	10	27	28	15

Commodity	System	Gov't Assistance ($/Ha)	NSW (Central North)	NSW (Central South)	NSW (Central)	NSW (prev Sth Murray)	NSW (Western Division)	QLD (Central Qld)	QLD (Darling Downs)	QLD (South Coast)	QLD (Western Downs)	QLD (Western Qld)	SA (350-400mm)	SA (400mm PLUS)	SA (Rangelands)	VIC (Mallee)	VIC (Nth Cent/Nth Irrig)	VIC (South)	VIC (Wimmera)
Soybeans	Dryland	1996/97	7	7	7	12			11							22	22		
		2000/01	7	7	7	12			11		11					22	22		
	Irrigated	1996/97		14	14	12			11								22		
		2000/01		14	14				11								22		
Sunflower	Dryland	1996/97	6	12	12	12	5		8		5					12	12		12
		2000/01	7	12	12				8		5								
	Irrigated	1996/97	6	12	12	12	5				5						12		
		2000/01	6	12															
Tobacco	Dryland	1996/97																17,052	
		2000/01																	
	Irrigated	1996/97																19,894	
		2000/01																203	
Triticale	Dryland	1996/97	7	7	1	2	2		2		2		2	4	4	4	7	6	6
		2000/01	5	7	1	2	2		2				2	2	4	4	7	6	6
	Irrigated	1996/97		9												6	8		
		2000/01		9													8		
Vetches	Dryland	1996/97		6									6			6	6		6
		2000/01											6	6		6	6	6	6
	Irrigated	1996/97		6															
		2000/01																	
Wheat	Dryland	1996/97	21	24	22	26	11	11	22	17	17	18	20	23	15	17	22	21	24
		2000/01	4	5	4	5	2	2	4		3		4	4	3	3	4	4	5
	Irrigated	1996/97	14	14	14	27	27		27		14					17	14	14	25
		2000/01	3	3	3	5	5		5		3		3	3		3	3		5

Appendix 5 – Level of government assistance in $/ha for each commodity in the Murray-Darling Basin 1996/97 and 2000/01.

6.6 Area of Commodities by CMR

Commodity	Area (Ha)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	Total
Almonds	1996/97										1,400			0				1,426				**2,826**
	2000/01										3,074			155				1,878				**5,108**
	% Change										119.5			-				31.7				**80.7**
Apples	1996/97			1,018	783		948		59				93	1,048		483	89					**4,519**
	2000/01			1,175	602		1,722		248				75	961		336	89					**5,207**
	% Change			15.3	-23.1		81.7		322.2				-19.6	-8.2		-30.4	0.6					**15.2**
Apricots	1996/97						569		0		173		0	8				1,112				**1,861**
	2000/01						911		14		231		21	0				629				**1,806**
	% Change						59.9		-		34.0		-	-100.0				-43.4				**-3.0**
Barley	1996/97		71,107	35,968	100,384	107,806	11,554	54,982	133,140	6,364	276,854	12,799	79,092	129,522	73,713	120,423	80	242,410	1,105	11,479	127,692	**1,596,473**
	2000/01		56,448	19,747	69,196	70,165	13,975	44,218	137,597	8,625	267,636	9,406	99,731	134,604	50,117	157,131	148	257,603	694	8,923	179,758	**1,585,720**
	% Change		-20.6	-45.1	-31.1	-34.9	20.9	-19.6	3.3	35.5	-3.3	-26.5	26.1	3.9	-32.0	30.5	84.2	6.3	-37.2	-22.3	40.8	**-0.7**
Beef Cattle	1996/97	22,519	967,972	1,946,651	2,259,316	1,389,105	378,265	1,214,834	1,457,029	999,596	200,713	4,333,814	799,783	1,539,425	1,611,684	252,772	601,529	650,576	4,832,458	2,171,347	44,512	**27,673,901**
	2000/01	19,367	960,919	2,194,582	2,473,914	1,415,800	381,837	1,127,275	2,001,035	721,152	146,589	4,667,303	749,123	1,439,605	1,744,641	274,161	543,461	535,318	6,355,069	3,117,988	45,955	**30,915,091**
	% Change	-14.0	-0.7	12.7	9.5	1.9	0.9	-7.2	37.3	-27.9	-27.0	7.7	-6.3	-6.5	8.2	8.5	-9.7	-17.7	31.5	43.6	3.2	**11.7**
Canola	1996/97	0	170	0	8,899	0	4,549	684	61,419	0	6,038	0	32,101	68,414	0	23,242	391	1,097	0	0	35,903	**242,906**
	2000/01	500	1,812	856	60,940	234	24,980	2,225	162,685	1,018	27,522	978	129,484	145,876	12,228	74,234	1,386	19,792	241	4,216	72,659	**743,866**
	% Change	-	966.0	-	584.8	-	449.2	225.3	164.9	-	355.8	-	303.4	113.2	-	219.4	254.9	1,704.2	-	-	102.4	**206.2**
Cereals for Hay/Silage	1996/97		11,660	14,467	33,600	35,158	13,362	10,600	23,852	2,598	7,332	14,744	12,032	18,213	16,701	16,836	1,671	34,803	2,483	1,009	3,466	**274,588**
	2000/01		3,828	7,150	3,936	20,518	16,383	2,598	9,088	1,980	4,797	13,858	8,462	11,471	2,860	23,329	688	28,741	1,501	1,103	4,640	**166,933**
	% Change		-67.2	-50.6	-88.3	-41.6	22.6	-75.5	-61.9	-23.8	-34.6	-6.0	-29.7	-37.0	-82.9	38.6	-58.8	-17.4	-39.6	9.4	33.9	**-39.2**
Cherries	1996/97				176		141		1,060					170			86	14				**1,647**
	2000/01				230		476		1,138					329			0	0				**2,173**
	% Change				30.5		237.5		7.4					93.5			-100.0	-100.0				**31.9**
Chick Peas	1996/97		10,462	2,627	2,687	9,145	88	7,609	698		27,588	1,758	669	854	2,812	26,097		101	0	4,909	76,104	**174,209**
	2000/01		22,208	22,444	21,588	12,808	251	38,263	2,218		392	11,056	0	1,812	12,172	1,673		0	2,589	25,117	4,673	**179,263**
	% Change		112.3	754.2	703.3	40.1	185.0	402.9	217.7		-98.6	529.0	-100.0	112.1	332.9	-93.6		-100.0	-	411.6	-93.9	**2.9**
Cotton	1996/97		43,925	22,087	33,148	60,405		84,216	0	210		23,315		266	69,476				1,201	17,514		**355,764**
	2000/01		55,850	32,231	57,031	59,657		114,952	2,489	0		47,862		14,897	84,295				293	20,727		**490,283**
	% Change		27.1	45.9	72.1	-1.2		36.5	-	-100.0		105.3		5,500.2	21.3				-75.6	18.3		**37.8**
Dairy Cattle	1996/97	612	6,632	7,406	27,859	158,198	293,094	3,385	17,654		30,759	7,446	149,136	25,486	15,626	294,801	127,260	207,669	11,856	59	2,596	**1,387,535**
	2000/01	0	5,840	5,244	54,787	162,728	339,278	3,377	40,238		44,403	16,352	220,654	27,994	21,266	310,326	142,595	235,666	15,055	3,446	4,160	**1,653,410**
	% Change	-100.0	-11.9	-29.2	96.7	2.9	15.8	-0.2	127.9		44.4	119.6	48.0	9.8	36.1	5.3	12.1	13.5	27.0	5,775.1	60.2	**19.2**
Faba Beans	1996/97		2,591	100	437	0	213	1,840	253	0	2,330		14	953	1,578	8,297	0	803	0	202	14,838	**34,449**
	2000/01		4,357	1,769	1,495	80	681	13,231	1,658	84	3,026		545	6,527	11,758	15,044	116	4,134	367	1,641	34,488	**101,001**
	% Change		68.2	1,669.4	242.2	-	220.6	619.1	555.2	-	29.8		3,791.6	584.9	645.0	81.3	-	415.1	-	712.6	132.4	**193.2**
Field Peas	1996/97		502	0	1,456	55	986	292	2,096		70,353	0	3,838	5,936	586	39,714		10,774			57,170	**193,759**
	2000/01		254	157	2,240	43	1,292	617	6,936		50,652	109	4,683	7,631	625	40,685		12,574			47,263	**175,759**
	% Change		-49.5	-	53.8	-22.6	31.0	111.5	230.9		-28.0	-	22.0	28.5	6.6	2.4		16.7			-17.3	**-9.3**
Grain Sorghum	1996/97		32,046	36,045	4,127	143,069	110	21,768	249		54	34,851	102	430	52,656	505			682	599	531	**327,823**
	2000/01		64,661	59,991	12,338	125,049	0	68,383	744		1,076	43,919	119	789	93,185	553			1,930	11,087	181	**484,005**
	% Change		101.8	66.4	199.0	-12.6	-100.0	214.1	199.1		1,910.4	26.0	17.3	83.5	77.0	9.5			183.0	1,751.7	-65.9	**47.6**
Grapes	1996/97				316	1,068		851			1,127	3,969	19,181	166	663	8,073		828	1,171	16,126	0	457	244	**54,240**
	2000/01				534	2,321		2,095			2,574	6,272	24,092	0	1,102	15,123		1,540	2,836	26,486	286	678	613	**86,552**
	% Change				69.3	117.3		146.3			128.5	58.0	25.6	-100.0	66.1	87.3		86.0	142.2	64.2	-	48.5	150.6	**59.6**
Lentils	1996/97										980					860					9,428	**11,268**
	2000/01										21,480					18,658					57,528	**97,666**
	% Change										2,091.8					2,069.1					510.2	**766.7**
Lupins	1996/97		75		3,984		5,741	0	13,463	182	8,674		22,224	23,552	391	14,840	657	12,257		0	6,505	**112,546**
	2000/01		113		17,669		2,691	410	22,587	0	8,970		12,921	35,092	2,476	10,706	320	18,048		229	4,376	**136,610**
	% Change		50.4		343.5		-53.1	-	67.8	-100.0	3.4		-41.9	49.0	533.0	-27.9	-51.2	47.2	-		-32.7	**21.4**
Maize	1996/97		1,495	248	904	10,588	114	468	6,071	500		95	725	12,974	3,867	483				200		**38,731**
	2000/01		2,986	459	1,022	13,792	296	472	3,331	432		85	890	7,944	6,105	255				0		**38,069**
	% Change		99.7	84.8	13.0	30.3	159.3	0.9	-45.1	-13.5		-10.4	22.8	-38.8	57.9	-47.1				-100.0		**-1.7**
Millet	1996/97		120	1,412	306	10,299	397	0	395		215	822	187	285	0	887	72				90	**15,485**
	2000/01		160	2,142	44	20,326	0	80	113		0	1,683	425	184	129	110	0				0	**25,395**
	% Change		33.3	51.7	-85.6	97.4	-100.0	-	-71.5		-100.0	104.8	126.8	-35.5	-	-87.6	-100.0				-100.0	**64.0**
Mung Beans	1996/97		6,375	3,930	291	12,090		5,132	173		60	3,538	40	64	2,382	240			0		0	**34,315**
	2000/01		8,639	8,267	1,843	19,489		9,012	118		0	7,704	98	385	5,312	0			1,062		41	**61,970**
	% Change		35.5	110.4	533.5	61.2		75.6	-31.5		-100.0	117.7	145.6	502.1	123.0	-100.0			-	-		**80.6**
Nectarines	1996/97				489	9		221		50		605		0	843		0		105				**2,321**
	2000/01				438	26		557		52		988		77	497		247		164				**3,047**
	% Change				-10.4	201.3		152.4		5.8		63.3		-	-41.1		-		56.8				**31.3**
Non-Cereal Crops Cut for Hay	1996/97		329	0	494	1,662	1,244	499	375		1,018	0	756	190	172	1,874	221	1,501	0	125	814	**11,273**
	2000/01		91	557	322	4,271	1,623	223	945		1,435	249	1,171	115	102	3,861	0	264	303	0	1,538	**17,071**
	% Change		-72.2	-	-34.8	157.0	30.5	-55.2	152.0		41.0	-	54.9	-39.6	-40.8	106.0	-100.0	-82.4	-	-100.0	88.8	**51.4**
Oats	1996/97	0	8,863	5,299	110,179	12,328	24,285	12,376	117,798	1,433	16,817	6,712	39,335	70,155	17,142	59,092	4,113	24,722	116	1,411	19,297	**551,474**
	2000/01	50	5,611	1,870	41,232	3,533	13,384	6,510	52,837	702	9,010	2,919	16,096	30,964	8,369	43,116	2,000	15,936	153	939	19,863	**275,094**
	% Change	-	-36.7	-64.7	-62.6	-71.3	-44.9	-47.4	-55.1	-51.0	-46.4	-56.5	-59.1	-55.9	-51.2	-27.0	-51.4	-35.5	31.4	-33.5	2.9	**-50.1**

Oranges	1996/97				202		232			1,761	2,973		82	6,097		0		5,097		0		**16,444**
	2000/01				234		285			1,619	2,521		131	6,261		233		5,081		130		**16,497**
	% Change				16.3		22.9			-8.0	-15.2		60.9	2.7		-		-0.3		-		**0.3**
Other Cereal Crops	1996/97		97		660		200		1,224		3,898			70	28	203		8,730				**15,110**
	2000/01		0		0		0		0		0			0	0	0		0				**0**
	% Change		-100.0		-100.0		-100.0		-100.0		-100.0			-100.0	-100.0	-100.0		-100.0				**-100.0**
Other Citrus	1996/97				27		63			207	487		0	98				799		0		**1,683**
	2000/01				31		65			249	296		7	44				954		112		**1,758**
	% Change				14.3		2.4			20.2	-39.4		-	-55.5				19.3		-		**4.5**
Other non- Cereal Crops	1996/97		756	49	168	640	643	535	209	5	99	880	27	355	221	794	381	90	894		437	**7,184**
	2000/01		0	10	129	292	341	1	32	0	54	1	17	108	13	5	586	296	1		698	**2,585**
	% Change		-100.0	-80.3	-23.1	-54.5	-47.0	-99.9	-84.8	-100.0	-45.5	-99.9	-37.2	-69.5	-94.1	-99.3	53.7	230.9	-99.9		59.8	**-64.0**
Other Nuts	1996/97		196					489	0		84			133				286				**1,189**
	2000/01		348					348	170		148			0				275				**1,290**
	% Change		78.0					-28.8	-		76.2			-100.0				-3.8				**8.5**
Other Oilseeds	1996/97		52		145	262		157							20							**636**
	2000/01		0		0	0		0							0							**0**
	% Change		-100.0		-100.0	-100.0		-100.0							-100.0							**-100.0**
Other Stone Fruit	1996/97		0	0	4	44	282	0	332	0	309			298		0	0	379			124	**1,771**
	2000/01		18	914	156	1,165	378	143	418	80	963			946		261	76	1,930			123	**7,571**
	% Change		-	-	4,147.2	2,530.7	33.8	-	26.0	-	212.2			217.4		-	-	409.6			-0.5	**327.5**
Other Vegetables	1996/97		152	1,735	1,651	907	1,695		2,232	269	2,276	141	118	5,713	0	1,006		1,808				**19,702**
	2000/01		121	2,254	628	1,716	3,316		1,126	218	2,630	0	63	7,418	103	2,350		1,983				**23,925**
	% Change		-20.7	29.9	-62.0	89.2	95.7		-49.6	-18.7	15.6	-100.0	-46.6	29.8	-	133.6		9.7				**21.4**
Peaches	1996/97			589	0		1,986		98		280			985		0		219				**4,157**
	2000/01			565	9		2,307		0		192			1,076		192		83				**4,423**
	% Change			-4.1	-		16.2		-100.0		-31.5			9.2		-		-62.0				**6.4**
Peanuts	1996/97		0	412		1,059		45				410			135				0	447		**2,508**
	2000/01		183	134		759		0				67			202				376	148		**1,869**
	% Change		-	-67.6		-28.4		-100.0				-83.7			49.6				-	-66.8		**-25.5**
Pears	1996/97						3,098						73									**3,171**
	2000/01						3,445						0									**3,445**
	% Change						11.2						-100.0									**8.6**
Plums	1996/97		54	429			431		379		312			560		0		180				**2,345**
	2000/01		0	399			905		637		0			178		509		81				**2,708**
	% Change		-100.0	-7.0			110.2		67.7		-100.0			-68.2		-		-54.9				**15.5**
Popcorn	1996/97					375	36				176	0		890	18						75	**1,571**
	2000/01					286	0				0	0		1,167	701						0	**2,155**
	% Change					-23.7	-100.0				-100.0	-		31.1	3,796.2						-100.0	**37.2**
Potatoes	1996/97		0		121	610	531				349		1,927	1,949		1,367		3,192			0	**10,046**
	2000/01		85		0	452	377				619		1,646	2,995		1,630		4,345			101	**12,249**
	% Change		-		-100.0	-25.9	-29.1				77.5		-14.6	53.7		19.2		36.1			-	**21.9**
Rice	1996/97						640		547				69,522	81,158		0	0					**151,868**
	2000/01						1,259		1,103				82,826	89,919		395	105					**175,608**
	% Change						96.7		101.6				19.1	10.8		-	-					**15.6**
Safflower	1996/97		111	0	311	110	60	669	120	3,436	909		413	4,256	399	6,085		257		654	5,124	**22,915**
	2000/01		444	111	569	99	77	319	115	574	462		123	2,994	114	1,190		33		1,642	734	**9,601**
	% Change		298.5	-	83.0	-9.8	28.2	-52.3	-4.2	-83.3	-49.2		-70.2	-29.6	-71.4	-80.4		-87.3		151.0	-85.7	**-58.1**
Sheep	1996/97	20,532	746,147	1,111,207	3,704,514	213,977	446,306	673,263	4,208,608	4,396,934	1,221,494	1,563,251	1,151,466	3,092,385	974,841	889,796	199,147	4,247,529	7,604,917	11,449,272	643,470	**48,559,060**
	2000/01	29,190	567,774	749,721	3,578,501	152,049	474,512	536,406	4,154,858	4,713,626	1,239,294	946,117	1,224,899	3,075,074	882,887	976,280	163,449	3,731,850	5,972,568	11,297,401	657,232	**45,123,688**
	% Change	42.2	-23.9	-32.5	-3.4	-28.9	6.3	-20.3	-1.3	7.2	1.5	-39.5	6.4	-0.6	-9.4	9.7	-17.9	-12.1	-21.5	-1.3	2.1	**-7.1**
Soybeans	1996/97		1,898	336	937	4,506	1,591	1,096	646		0		2,434	4,519	1,251	39				104		**19,359**
	2000/01		1,737	259	924	2,823	678	1,289	664		130		1,656	3,465	3,054	0				958		**17,638**
	% Change		-8.5	-22.9	-1.4	-37.4	-57.4	17.6	2.9		-		-32.0	-23.3	144.1	-100.0				818.5		**-8.9**
Sunflower	1996/97		5,240	637	1,843	14,069		8,450	566	890	125	660	516	1,361	19,723	466				1,377	20	**55,943**
	2000/01		2,669	232	357	5,641		3,095	0	0	0	165	532	2,216	7,863	0				0	0	**22,769**
	% Change		-49.1	-63.6	-80.6	-59.9		-63.4	-100.0	-100.0	-100.0	-75.0	3.0	62.8	-60.1	-100.0				-100.0	-100.0	**-59.3**
Tobacco	1996/97																1,366					**1,366**
	2000/01																1,095					**1,095**
	% Change																-19.9					**-19.9**
Triticale	1996/97		66		3,503	1,504	15,373	634	33,117	280	43,089	28	36,291	40,634	261	12,154	2,211	54,868			5,913	**249,927**
	2000/01		94		5,285	458	34,566	164	28,328	285	43,695	0	47,954	40,620	259	22,556	5,883	67,274			7,832	**305,252**
	% Change		41.9		50.9	-69.6	124.8	-74.2	-14.5	1.8	1.4	-100.0	32.1	0.0	-0.4	85.6	166.1	22.6			32.4	**22.1**
Vetches	1996/97						0				15,409		366	1,121		4,589	0	4,007			7,395	**32,886**
	2000/01						32				5,278		0	0		4,220	434	2,366			2,788	**15,117**
	% Change						-				-65.7		-100.0	-100.0		-8.0	-	-41.0			-62.3	**-54.0**
Wheat	1996/97	0	270,892	306,312	747,375	131,125	46,122	301,701	610,848	47,258	412,426	238,897	248,433	480,767	375,732	216,947	6,572	305,425	10,892	87,536	196,237	**5,041,498**
	2000/01	500	226,421	257,946	819,231	112,948	51,442	330,205	788,762	75,260	500,029	212,666	346,991	574,412	333,968	260,983	5,440	398,348	12,642	160,655	191,090	**5,659,939**
	% Change	-	-16.4	-15.8	9.6	-13.9	11.5	9.4	29.1	59.3	21.2	-11.0	39.7	19.5	-11.1	20.3	-17.2	30.4	16.1	83.5	-2.6	**12.3**
Total Area (Ha) 1996/97		**43,663**	**2,189,985**	**3,499,769**	**7,051,568**	**2,319,095**	**1,256,020**	**2,405,725**	**6,695,888**	**5,465,893**	**2,375,839**	**6,244,328**	**2,652,458**	**5,630,213**	**3,241,417**	**1,995,720**	**947,017**	**5,838,360**	**12,466,605**	**13,748,700**	**1,257,988**	**87,326,253**
Total Area (Ha) 2000/01		**49,608**	**1,993,671**	**3,372,158**	**7,228,833**	**2,207,177**	**1,376,417**	**2,303,816**	**7,424,857**	**5,532,177**	**2,411,684**	**5,982,498**	**2,952,523**	**5,691,848**	**3,284,804**	**2,246,769**	**870,709**	**5,372,132**	**12,365,130**	**14,657,142**	**1,338,332**	**88,662,284**
Total % Change		**13.6**	**-9.0**	**-3.6**	**2.5**	**-4.8**	**9.6**	**-4.2**	**10.9**	**1.2**	**1.5**	**-4.2**	**11.3**	**1.1**	**1.3**	**12.6**	**-8.1**	**-8.0**	**-0.8**	**6.6**	**6.4**	**1.5**

Appendix 6 – Area (ha) of each Commodity by Catchment Management Region in the Murray-Darling Basin 1996/97 and 2000/01 including % change.

6.7 Gross Revenue of Commodities by CMR

Commodity	Gross revenue ($'000)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	Total
Almonds	1996/97										23,734			0				8,829				**32,564**
	2000/01										19,717			501				15,050				**35,268**
	% Change										-16.9			-				70.5				**8.3**
Apples	1996/97			26,553	40,862		55,809		2,427				3,798	38,492		11,929	3,112					**182,981**
	2000/01			20,489	13,087		47,826		6,293				1,465	17,194		7,028	2,715					**116,097**
	% Change			-22.8	-68.0		-14.3		159.3				-61.4	-55.3		-41.1	-12.7					**-36.6**
Apricots	1996/97						5,815		0		555		0	52				20,717				**27,139**
	2000/01						12,609		58		829		94	0				8,158				**21,748**
	% Change						116.9		-		49.3		-	-100.0				-60.6				**-19.9**
Barley	1996/97		41,410	11,376	49,650	44,075	4,333	31,974	61,871	1,960	106,155	3,572	36,202	59,639	40,156	49,417	26	62,962	282	4,753	64,002	**673,817**
	2000/01		16,924	3,206	18,832	12,682	7,575	13,031	52,833	4,307	125,789	1,091	41,897	57,599	14,932	70,608	41	84,892	103	1,724	93,251	**621,315**
	% Change		-59.1	-71.8	-62.1	-71.2	74.8	-59.2	-14.6	119.8	18.5	-69.5	15.7	-3.4	-62.8	42.9	58.9	34.8	-63.5	-63.7	45.7	**-7.8**
Beef Cattle	1996/97	1,406	46,159	83,117	106,433	96,259	57,380	50,140	65,090	3,791	5,587	82,322	54,398	85,921	86,886	29,645	57,213	13,085	35,708	11,341	4,178	**976,059**
	2000/01	2,057	72,055	170,104	199,676	185,328	93,189	85,578	153,961	7,439	6,673	192,301	83,791	155,121	138,876	76,526	84,341	23,592	107,705	26,360	8,603	**1,873,276**
	% Change	46.3	56.1	104.7	87.6	92.5	62.4	70.7	136.5	96.2	19.4	133.6	54.0	80.5	59.8	158.1	47.4	80.3	201.6	132.4	105.9	**91.9**
Canola	1996/97	0	126	0	7,490	0	3,078	463	45,799	0	2,793	0	21,764	49,964	0	11,389	198	566	0	0	19,181	**162,812**
	2000/01	273	419	116	25,346	39	13,054	458	80,239	268	11,372	109	60,019	76,524	4,464	32,342	751	7,094	0	1,071	29,804	**343,762**
	% Change	-	232.5	-	238.4	-	324.1	-1.3	75.2	-	307.2	-	175.8	53.2	-	184.0	278.8	1,153.4	-	-	55.4	**111.1**
Cereals for Hay/Silage	1996/97		554	211	6,401	1,948	5,953	621	5,500	78	1,299	567	4,085	4,785	1,421	6,357	573	10,126	37	184	910	**51,609**
	2000/01		4,982	1,804	1,509	6,505	8,762	2,394	3,748	1,522	1,415	2,675	4,395	5,668	1,073	11,330	367	11,696	272	1,267	2,276	**73,661**
	% Change		799.0	753.6	-76.4	234.0	47.2	285.6	-31.8	1,838.7	8.9	371.5	7.6	18.5	-24.5	78.2	-36.0	15.5	632.2	590.1	150.3	**42.7**
Cherries	1996/97				2,006		789		8,519					2,366			1,982	50				**15,712**
	2000/01				4,164		5,331		13,363					4,784			0	0				**27,641**
	% Change				107.6		575.4		56.9					102.2			-100.0	-100.0				**75.9**
Chick Peas	1996/97		4,527	923	712	4,466	41	3,196	244		7,276	525	190	188	730	10,046		30	0	1,171	29,303	**63,569**
	2000/01		7,909	7,026	5,813	2,667	44	10,321	1,293		130	3,328	0	1,257	3,385	736		0	407	6,746	2,405	**53,467**
	% Change		74.7	660.9	716.5	-40.3	8.4	222.9	428.8		-98.2	533.6	-100.0	569.3	363.4	-92.7		-100.0	-	476.3	-91.8	**-15.9**
Cotton	1996/97		160,794	75,155	138,154	167,027		320,745	0	574		88,099		994	232,368				4,867	77,624		**1,266,400**
	2000/01		125,889	72,588	157,546	113,887		294,372	4,518	0		123,280		52,280	201,638				1,700	52,079		**1,199,778**
	% Change		-21.7	-3.4	14.0	-31.8		-8.2	-	-100.0		39.9		5,159.8	-13.2				-65.1	-32.9		**-5.3**
Dairy Cattle	1996/97	33	3,167	808	15,685	66,166	556,946	1,541	9,147		9,412	640	72,022	16,439	8,179	347,918	101,106	95,859	511	1	1,817	**1,307,395**
	2000/01	0	2,750	903	27,084	89,407	741,541	1,622	27,759		16,165	1,314	124,732	22,417	14,950	459,081	129,924	125,883	521	98	3,479	**1,789,630**
	% Change	-100.0	-13.2	11.9	72.7	35.1	33.1	5.3	203.5		71.7	105.3	73.2	36.4	82.8	32.0	28.5	31.3	2.0	8,206.2	91.5	**36.9**
Faba Beans	1996/97		1,204	21	171	0	116	926	98	0	735		9	511	787	3,632	0	329	0	79	7,356	**15,974**
	2000/01		1,135	375	301	5	299	2,589	1,144	20	1,194		350	5,447	3,318	6,217	54	2,346	64	279	14,866	**40,003**
	% Change		-5.7	1,728.1	75.6	-	156.3	179.6	1,070.2	-	62.5		3,602.6	965.7	321.6	71.2	-	613.8	-	255.5	102.1	**150.4**
Field Peas	1996/97		154	0	416	11	420	82	544		17,572	0	1,134	1,685	109	11,912		3,619			20,920	**58,578**
	2000/01		16	9	181	6	386	20	1,634		12,518	0	976	1,997	90	11,102		3,806			13,922	**46,662**
	% Change		-89.6	-	-56.5	-47.7	-8.1	-74.9	200.3		-28.8	-	-13.9	18.5	-17.9	-6.8		5.2			-33.5	**-20.3**
Grain Sorghum	1996/97		15,453	12,428	3,005	80,170	48	10,140	81		38	10,262	44	304	43,733	211			242	279	264	**176,700**
	2000/01		24,448	13,571	4,284	51,377	0	24,316	187		403	7,511	45	270	49,072	306			364	2,265	79	**178,500**
	% Change		58.2	9.2	42.6	-35.9	-100.0	139.8	132.8		952.4	-26.8	2.2	-11.2	12.2	45.1			50.3	711.8	-70.0	**1.0**
Grapes	1996/97			2,078	4,448		2,087		3,930	43,640	195,774	3,898	5,319	74,038		5,687	4,179	167,265	0	4,993	520	**517,855**
	2000/01			1,648	10,995		11,147		15,990	70,171	304,825	0	9,297	113,342		7,973	16,381	419,732	6,367	8,141	1,624	**997,631**
	% Change			-20.7	147.2		434.1		306.9	60.8	55.7	-100.0	74.8	53.1		40.2	292.0	150.9	-	63.0	212.5	**92.6**
Lentils	1996/97										991					975					12,358	**14,324**
	2000/01										10,893					11,513					37,821	**60,226**
	% Change										998.8					1,081.0					206.0	**320.4**
Lupins	1996/97		26		1,267		1,983	0	4,655	26	2,183		7,413	7,503	73	4,417	168	3,535		0	1,727	**34,976**
	2000/01		9		3,574		1,043	88	6,834	0	2,710		5,410	12,736	387	3,231	116	4,914		82	1,312	**42,445**
	% Change		-65.4		182.2		-47.4	-	46.8	-100.0	24.2		-27.0	69.7	427.7	-26.9	-30.7	39.0		-	-24.0	**21.4**
Maize	1996/97		2,189	290	1,231	8,434	227	706	10,740	910		32	1,102	24,654	5,516	1,056				282		**57,369**
	2000/01		2,878	326	1,153	10,125	639	344	5,222	376		62	1,546	13,522	5,534	444				0		**42,170**
	% Change		31.5	12.4	-6.4	20.1	182.0	-51.3	-51.4	-58.7		91.4	40.2	-45.2	0.3	-58.0				-100.0		**-26.5**
Millet	1996/97		33	505	138	3,870	291	0	175		166	181	73	147	0	452	69				58	**6,158**
	2000/01		58	517	31	7,222	0	32	56		0	337	322	160	88	71	0				0	**8,894**
	% Change		76.9	2.5	-77.5	86.6	-100.0	-	-68.1		-100.0	86.2	341.7	8.8	-	-84.3	-100.0				-100.0	**44.4**
Mung Beans	1996/97		2,931	1,450	26	4,525		2,135	37		23	1,054	17	25	894	89			0		0	**13,207**
	2000/01		3,339	2,428	541	6,010		3,026	71		0	1,328	31	143	1,664	0			115		9	**18,705**
	% Change		13.9	67.4	1,953.3	32.8		41.7	94.2		-100.0	26.0	80.0	469.0	86.1	-100.0			-		-	**41.6**
Nectarines	1996/97			3,529	126		3,048		405		6,342		0	5,302		0		2,184				**20,935**
	2000/01			3,455	117		15,849		749		12,530		679	4,090		3,422		2,438				**43,328**
	% Change			-2.1	-6.9		420.0		84.8		97.6		-	-22.9		-		11.6				**107.0**
Non-Cereal Crops Cut for Hay	1996/97		110	0	192	638	440	139	108		372	0	337	83	76	758	95	291	0	54	310	**4,003**
	2000/01		41	244	58	1,624	1,276	65	238		441	72	282	39	42	1,646	0	90	127	0	547	**6,831**
	% Change		-62.4	-	-69.7	154.4	189.7	-53.3	119.4		18.5	-	-16.3	-53.6	-44.1	117.2	-100.0	-69.1	-	-100.0	76.1	**70.6**
Oats	1996/97	0	1,549	797	22,922	1,568	6,277	2,189	27,343	235	2,476	638	10,352	16,617	3,180	13,738	958	3,781	10	272	4,764	**119,666**
	2000/01	5	655	123	4,262	573	4,073	661	8,927	72	1,723	135	3,556	6,518	851	12,414	564	3,159	8	73	6,021	**54,374**
	% Change	-	-57.7	-84.6	-81.4	-63.5	-35.1	-69.8	-67.4	-69.2	-30.4	-78.9	-65.7	-60.8	-73.2	-9.6	-41.1	-16.5	-18.9	-73.2	26.4	**-54.6**

Oranges	1996/97				2,535		2,907			24,892	44,242		1,100	78,905		0		78,594		0		**233,173**
	2000/01				2,782		4,810			22,371	45,671		1,678	78,422		4,035		91,788		114		**251,670**
	% Change				9.7		65.5			-10.1	3.2		52.5	-0.6		-		16.8		-		**7.9**
Other Cereal Crops	1996/97		62		120		30		369		383			22	3	27		455				**1,472**
	2000/01		0		0		0		0		0			0	0	0		0				**0**
	% Change		-100.0		-100.0		-100.0		-100.0		-100.0			-100.0	-100.0	-100.0		-100.0				**-100.0**
Other Citrus	1996/97				443		682			5,219	8,168		0	2,908				21,139		0		**38,559**
	2000/01				204		2,104			5,313	4,040		20	328				22,422		117		**34,549**
	% Change				-54.0		208.4			1.8	-50.5		-	-88.7				6.1		-		**-10.4**
Other non- Cereal Crops	1996/97		36,520	1,182	10,390	35,460	36,166	39,856	15,567	441	6,474	34,803	1,231	24,715	15,930	30,990	3,993	1,984	49,516		12,021	**357,241**
	2000/01		8	313	10,631	17,286	23,856	64	822	0	5,518	22	1,124	8,551	949	534	4,158	6,748	124		20,951	**101,659**
	% Change		-100.0	-73.5	2.3	-51.3	-34.0	-99.8	-94.7	-100.0	-14.8	-99.9	-8.7	-65.4	-94.0	-98.3	4.1	240.1	-99.7		74.3	**-71.5**
Other Nuts	1996/97		0					0	0		987			4,099				42				**5,128**
	2000/01		986					822	2,705		1,613			0				478				**6,604**
	% Change		-					-	-		63.4			-100.0				1,043.2				**28.8**
Other Oilseeds	1996/97		16		92	172		49							0							**329**
	2000/01		0		0	0		0							0							**0**
	% Change		-100.0		-100.0	-100.0		-100.0							-							**-100.0**
Other Stone Fruit	1996/97		0	0	31	584	2,310	0	3,952	0	2,743			5,600		0	0	7,026			429	**22,675**
	2000/01		16	4,759	27	237	2,936	250	4,659	720	2,926			6,629		58	227	10,814			483	**34,742**
	% Change		-	-	-10.6	-59.5	27.1	-	17.9	-	6.7			18.4		-	-	53.9			12.5	**53.2**
Other Vegetables	1996/97		698	27,590	7,470	11,017	23,896		15,015	4,555	46,889	92	763	39,766	0	7,189		44,625				**229,565**
	2000/01		1,052	38,969	5,830	20,846	64,244		7,244	1,416	57,313	0	363	61,115	21	16,648		57,362				**332,422**
	% Change		50.6	41.2	-22.0	89.2	168.8		-51.8	-68.9	22.2	-100.0	-52.5	53.7	-	131.6		28.5				**44.8**
Peaches	1996/97			3,363	0		20,934		979		2,354			4,630		0		3,733				**35,993**
	2000/01			3,865	55		27,106		0		2,907			5,113		3,092		2,284				**44,421**
	% Change			14.9	-		29.5		-100.0		23.5			10.4		-		-38.8				**23.4**
Peanuts	1996/97		0	799		849		166				784			455				0	208		**3,261**
	2000/01		299	180		759		0				88			176				745	216		**2,464**
	% Change		-	-77.5		-10.6		-100.0				-88.7			-61.2				-	3.8		**-24.4**
Pears	1996/97						92,380						1,641									**94,021**
	2000/01						78,270						0									**78,270**
	% Change						-15.3						-100.0									**-16.8**
Plums	1996/97		316	2,598			3,021		1,994		1,102			556		0		1,557				**11,144**
	2000/01		0	2,932			9,352		3,740		0			1,330		3,486		791				**21,632**
	% Change		-100.0	12.9			209.6		87.6		-100.0			139.1		-		-49.2				**94.1**
Popcorn	1996/97					140	5				123	0		912	11						26	**1,216**
	2000/01					389	0				0	1		2,957	1,389						0	**4,735**
	% Change					178.0	-100.0				-100.0	-		224.2	12,627.0						-100.0	**289.4**
Potatoes	1996/97		0		994	7,877	5,727				2,368		16,494	14,703		19,316		44,421			0	**111,900**
	2000/01		1,222		0	3,943	3,590				5,884		20,953	28,532		26,426		56,345			1,561	**148,454**
	% Change		-		-100.0	-49.9	-37.3				148.5		27.0	94.0		36.8		26.8			-	**32.7**
Rice	1996/97						2,217		1,110				140,358	165,868		0	0					**309,553**
	2000/01						2,587		2,371				163,078	179,727		912	191					**348,866**
	% Change						16.7		113.6				16.2	8.4		-	-					**12.7**
Safflower	1996/97		26	0	55	50	9	277	17	1,307	209		48	1,016	83	866		44		185	958	**5,148**
	2000/01		79	24	68	55	12	55	40	192	83		41	573	15	218		2		526	198	**2,179**
	% Change		208.2	-	23.4	10.7	39.8	-80.3	131.9	-85.3	-60.4		-14.9	-43.6	-82.4	-74.9		-96.0		184.8	-79.3	**-57.7**
Sheep	1996/97	1,445	38,089	27,737	209,993	6,694	84,544	40,522	273,775	36,690	52,376	23,733	100,943	242,657	55,496	143,978	20,626	83,541	60,642	102,834	81,127	**1,687,440**
	2000/01	2,522	34,959	23,557	243,108	6,123	97,623	40,139	314,890	38,548	58,598	17,963	112,336	252,840	57,330	173,410	20,294	85,438	60,256	107,203	95,814	**1,842,950**
	% Change	74.6	-8.2	-15.1	15.8	-8.5	15.5	-0.9	15.0	5.1	11.9	-24.3	11.3	4.2	3.3	20.4	-1.6	2.3	-0.6	4.2	18.1	**9.2**
Soybeans	1996/97		1,610	350	837	3,017	1,836	1,107	509		0		2,047	4,412	1,010	31				127		**16,892**
	2000/01		998	193	328	1,623	559	590	369		52		1,066	2,731	1,503	0				75		**10,086**
	% Change		-38.0	-45.0	-60.8	-46.2	-69.6	-46.7	-27.6		-		-47.9	-38.1	48.8	-100.0				-40.9		**-40.3**
Sunflower	1996/97		1,751	147	734	6,201		2,583	270	607	48	137	316	888	7,629	245				462	8	**22,025**
	2000/01		1,347	63	148	1,916		1,639	0	0	0	10	588	933	5,107	0				0	0	**11,750**
	% Change		-23.1	-57.1	-79.8	-69.1		-36.5	-100.0	-100.0	-100.0	-92.7	85.9	5.1	-33.1	-100.0				-100.0	-100.0	**-46.7**
Tobacco	1996/97																20,504					**20,504**
	2000/01																18,866					**18,866**
	% Change																-8.0					**-8.0**
Triticale	1996/97		23		1,185	710	6,321	330	14,029	62	10,409	4	15,763	16,543	172	4,221	975	7,721			2,079	**80,549**
	2000/01		25		1,206	89	17,160	58	10,137	77	14,273	0	18,148	15,111	93	8,313	2,307	12,843			3,047	**102,884**
	% Change		6.6		1.7	-87.5	171.5	-82.5	-27.7	23.4	37.1	-100.0	15.1	-8.7	-46.0	96.9	136.6	66.3			46.5	**27.7**
Vetches	1996/97						0				286		15	16		276	0	406			995	**1,995**
	2000/01						1				914		0	0		662	74	113			473	**2,237**
	% Change						-				219.3		-100.0	-100.0		140.0	-	-72.1			-52.5	**12.2**
Wheat	1996/97	0	155,513	148,108	391,955	76,168	25,214	177,026	333,646	12,225	171,018	98,777	145,603	281,576	207,214	111,985	3,315	94,256	4,191	28,316	127,130	**2,593,236**
	2000/01	354	56,405	56,492	237,787	29,461	42,529	77,932	396,278	33,138	326,021	49,707	210,485	357,479	102,024	170,784	4,184	176,627	1,677	34,794	138,187	**2,502,343**
	% Change	-	-63.7	-61.9	-39.3	-61.3	68.7	-56.0	18.8	171.1	90.6	-49.7	44.6	27.0	-50.8	52.5	26.2	87.4	-60.0	22.9	8.7	**-3.5**
Gross revenue ($'000) 1996/97		**2,884**	**515,013**	**431,115**	**1,028,166**	**628,093**	**1,013,281**	**686,911**	**907,945**	**137,211**	**733,664**	**350,121**	**644,581**	**1,279,500**	**712,111**	**828,751**	**219,092**	**782,771**	**156,006**	**233,165**	**392,442**	**11,682,823**
Gross revenue ($'000) 2000/01		**5,211**	**360,904**	**430,280**	**980,727**	**570,183**	**1,341,382**	**560,465**	**1,128,371**	**185,949**	**1,055,138**	**401,333**	**868,766**	**1,553,978**	**608,968**	**1,124,566**	**285,555**	**1,236,904**	**180,556**	**243,229**	**476,730**	**13,599,197**
Total % Change		**80.7**	**-29.9**	**-0.2**	**-4.6**	**-9.2**	**32.4**	**-18.4**	**24.3**	**35.5**	**43.8**	**14.6**	**34.8**	**21.5**	**-14.5**	**35.7**	**30.3**	**58.0**	**15.7**	**4.3**	**21.5**	**16.4**

Appendix 7 – Gross revenue ($'000) of each commodity by Catchment Management Region in the Murray-Darling Basin 1996/97 and 2000/01 including % change.

6.8 Total Profit at Full Equity of Commodities by CMR

Commodity	Profit at Full Equity($'000)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	Total
Almonds	1996/97										17,277			0				2,842				**20,119**
	2000/01										4,374			-196				5,948				**10,126**
	% Change										-74.7			-				109.3				**-49.7**
Apples	1996/97			7,805	21,001		27,678		1,153				1,797	17,387		3,584	1,235					**81,641**
	2000/01			-1,960	126		11,045		417				-48	-1,299		791	667					**9,739**
	% Change			-125.1	-99.4		-60.1		-63.8				-102.7	-107.5		-77.9	-46.0					**-88.1**
Apricots	1996/97						112		0		-822		0	45				9,452				**8,786**
	2000/01						1,920		50		-1,171		82	0				1,433				**2,314**
	% Change						1,616.9		-		-		-	-100.0				-84.8				**-73.7**
Barley	1996/97		16,407	2,933	11,701	7,388	1,641	12,726	9,712	-452	43,126	1,201	5,056	8,178	13,958	21,087	7	12,567	66	-293	34,959	**201,968**
	2000/01		-4,866	-1,647	-9,756	-13,764	3,866	-3,955	-6,476	754	58,758	-809	-2,689	-2,296	-4,819	29,901	4	25,468	-52	-1,775	48,271	**114,117**
	% Change		-129.7	-156.2	-183.4	-286.3	135.6	-131.1	-166.7	-	36.2	-167.4	-153.2	-128.1	-134.5	41.8	-50.5	102.7	-179.6	-	38.1	**-43.5**
Beef Cattle	1996/97	262	635	21,141	529	39,363	22,304	-6,008	13,269	-3,761	-2,146	-27,226	8,312	7,912	9,710	5,823	8,542	-7,572	-21,969	-6,912	1,735	**63,945**
	2000/01	979	22,478	94,966	72,552	122,911	54,713	27,639	80,363	992	-9	62,021	36,244	67,214	46,853	51,491	34,969	908	24,266	-2,721	5,905	**804,734**
	% Change	273.6	3,440.4	349.2	13,606.9	212.2	145.3	-	505.6	-	-	-	336.1	749.5	382.5	784.3	309.4	-	-	-	240.3	**1,158.5**
Canola	1996/97	0	72	0	4,317	0	1,744	247	23,748	0	1,193	0	9,475	24,664	0	4,757	88	316	0	0	10,119	**80,741**
	2000/01	81	-221	-92	1,807	-51	5,220	-350	16,509	-6	3,374	-129	9,971	20,028	-178	9,971	328	2,103	-59	-96	9,553	**77,764**
	% Change	-	-405.5	-	-58.1	-	199.3	-241.8	-30.5	-	182.8	-	5.2	-18.8	-	109.6	271.6	565.0	-	-	-5.6	**-3.7**
Cereals for Hay/Silage	1996/97		-857	-1,344	1,779	-3,273	3,709	-653	1,973	-267	375	-847	2,115	1,833	-723	3,572	330	5,526	-220	-2	438	**13,463**
	2000/01		3,815	765	815	2,413	5,182	1,718	2,078	1,085	650	946	2,175	3,195	572	6,362	233	6,977	82	963	1,402	**41,426**
	% Change		-	-	-54.2	-	39.7	-	5.4	-	73.4	-	2.8	74.3	-	78.1	-29.5	26.3	-	-	220.2	**207.7**
Cherries	1996/97				689		-302		1,505					998			994	-27				**3,857**
	2000/01				2,314		1,281		5,422					2,348			0	0				**11,365**
	% Change				236.1		-		260.3					135.3			-100.0	-				**194.7**
Chick Peas	1996/97		1,657	507	-13	2,460	21	1,109	56		2,342	246	11	-42	-41	5,661		20	0	-176	16,632	**30,449**
	2000/01		1,212	3,106	-684	-317	-14	-1,235	657		53	1,399	0	738	-282	430		0	-253	-825	1,550	**5,536**
	% Change		-26.8	513.1	-	-112.9	-165.9	-211.4	1,082.9		-97.8	467.7	-100.0	-	-	-92.4		-100.0	-	-	-90.7	**-81.8**
Cotton	1996/97		81,553	38,125	69,718	77,958		164,696	0	61		47,129		506	111,937				2,582	28,323		**622,587**
	2000/01		27,631	18,456	34,751	22,820		77,302	-891	0		37,763		18,750	46,019				880	-5,918		**277,564**
	% Change		-66.1	-51.6	-50.2	-70.7		-53.1	-	-100.0		-19.9		3,606.6	-58.9				-65.9	-120.9		**-55.4**
Dairy Cattle	1996/97	-313	-79	-2,470	946	-10,549	326,447	0	-92		-6,579	-2,652	-15,562	1,635	766	120,366	28,350	3,092	-4,623	-22	274	**438,935**
	2000/01	0	-576	-1,697	-2,988	1,050	438,918	-97	4,367		-9,309	-6,560	-42,779	2,663	3,776	163,572	39,437	10,069	-6,596	-1,621	1,067	**592,692**
	% Change	-	-	-	-415.9	-	34.5	-34,713.8	-		-	-	-	62.9	393.0	35.9	39.1	225.7	-	-	288.9	**35.0**
Faba Beans	1996/97		390	-3	35	0	53	349	21	0	134		5	175	292	1,363	0	127	0	15	3,531	**6,488**
	2000/01		-396	-78	-222	5	75	-1,994	579	-1	336		162	2,940	-796	1,591	16	1,219	-30	-288	5,085	**8,203**
	% Change		-201.3	-	-730.3	-	41.0	-672.0	2,705.6	-	150.4		3,100.7	1,577.8	-372.4	16.7	-	859.8	-	-2,004.2	44.0	**26.4**
Field Peas	1996/97		58	0	104	2	224	26	6		5,649	0	95	124	-10	4,937		1,754			11,232	**24,200**
	2000/01		-37	-19	-328	-2	112	-109	-190		3,075	-20	-368	-117	-37	3,205		1,465			5,111	**11,740**
	% Change		-164.2	-	-417.0	-217.0	-49.9	-524.7	-3,053.3		-45.6	-	-488.1	-194.8	-	-35.1		-16.5			-54.5	**-51.5**
Grain Sorghum	1996/97		6,360	3,963	1,839	20,428	-2	3,970	13		14	4,055	8	174	28,647	-33			122	116	23	**69,697**
	2000/01		4,211	600	405	-4,386	0	2,886	-41		-133	-981	8	-19	19,576	30			-83	-1,146	-11	**20,915**
	% Change		-33.8	-84.9	-78.0	-121.5	-	-27.3	-417.6		-1,044.6	-124.2	-6.5	-111.2	-31.7	-			-168.2	-1,091.2	-149.4	**-70.0**
Grapes	1996/97			-285	-3,657		-3,372		-4,701	14,892	58,883	2,614	550	9,140		-151	-4,545	51,741	0	1,905	-1,242	**121,772**
	2000/01			-2,751	-8,680		-4,523		-5,872	19,812	114,613	0	-255	-19,163		-3,208	-7,766	204,064	3,937	2,876	-3,212	**289,872**
	% Change			-	-		-		-	33.0	94.6	-100.0	-146.4	-309.7		-	-	294.4	-	51.0	-	**138.0**
Lentils	1996/97										592					624					8,518	**9,734**
	2000/01										1,268					3,153					12,044	**16,464**
	% Change										114.1					404.9					41.4	**69.1**
Lupins	1996/97		9		367		875	0	1,586	-6	699		2,300	2,133	-14	1,887	53	1,633		0	697	**12,220**
	2000/01		-19		-818		460	-14	1,205	0	1,024		2,221	3,991	-224	1,234	54	1,839		25	551	**11,529**
	% Change		-298.9		-323.0		-47.4	-	-24.0	-	46.4		-3.5	87.0	-	-34.6	3.3	12.6		-	-21.0	**-5.7**
Maize	1996/97		1,242	118	695	507	113	429	7,151	629		-11	673	12,181	3,053	577				163		**27,521**
	2000/01		932	21	487	-1,094	316	36	2,749	108		20	965	3,277	1,418	126				0		**9,360**
	% Change		-25.0	-82.3	-30.0	-315.9	178.7	-91.6	-61.6	-82.8		-	43.5	-73.1	-53.6	-78.1				-100.0		**-66.0**
Millet	1996/97		-1	135	68	969	174	0	87		107	46	32	84	0	185	49				34	**1,968**
	2000/01		20	61	20	898	0	13	29		0	34	178	115	57	38	0				0	**1,463**
	% Change		-	-54.5	-69.9	-7.4	-100.0	-	-66.7		-100.0	-27.3	460.6	36.9	-	-79.6	-100.0				-100.0	**-25.7**
Mung Beans	1996/97		1,277	505	-59	1,753		803	-8		9	243	0	-2	276	32			0		0	**4,830**
	2000/01		874	308	15	1,080		453	38		0	-614	3	-96	95	0			-153		-2	**2,000**
	% Change		-31.5	-39.0	-	-38.4		-43.5	-		-100.0	-353.0	701.3	-	-65.7	-100.0			-		-	**-58.6**
Nectarines	1996/97			183	44		1,174		74		1,254		0	-445		0		1,207				**3,491**
	2000/01			315	-45		8,772		593		3,272		180	384		934		739				**15,144**
	% Change			72.4	-200.3		647.0		703.3		161.0		-	-		-		-38.8				**333.8**
Non-Cereal Crops Cut for Hay	1996/97		42	0	86	227	55	41	0		163	0	86	41	37	97	47	-183	0	26	141	**907**
	2000/01		16	132	-9	667	766	12	-130		135	27	-82	10	15	-212	0	32	60	0	206	**1,644**
	% Change		-62.0	-	-110.7	193.7	1,303.0	-70.7	-56,064.0		-17.1	-	-195.8	-75.1	-59.5	-319.9	-100.0	-	-	-100.0	46.1	**81.4**
Oats	1996/97	0	165	82	6,521	-547	3,829	324	9,857	-16	879	-212	4,540	6,041	669	7,885	550	1,770	-5	18	2,990	**45,341**
	2000/01	-4	-299	-139	-2,454	-121	2,559	-395	252	-63	782	-272	779	1,214	-520	7,660	346	1,735	-16	-80	4,026	**14,990**
	% Change	-	-281.4	-269.6	-137.6	-	-33.2	-222.0	-97.4	-	-11.1	-	-82.8	-79.9	-177.7	-2.9	-37.1	-2.0	-	-542.7	34.7	**-66.9**

Oranges	1996/97				777		850			8,197	15,649		349	23,640		0		28,431		0		**77,892**
	2000/01				424		1,972			5,238	19,263		356	13,480		1,589		35,262		-933		**76,652**
	% Change				-45.5		132.2			-36.1	23.1		1.9	-43.0		-		24.0		-		**-1.6**
Other Cereal Crops	1996/97		58		91		22		308		209			18	2	18		65				**790**
	2000/01		0		0		0		0		0			0	0	0		0				**0**
	% Change		-100.0		-100.0		-100.0		-100.0		-100.0			-100.0	-100.0	-100.0		-100.0				**-100.0**
Other Citrus	1996/97				138		-82			2,624	2,105		0	1,716				10,141		0		**16,641**
	2000/01				-167		1,057			1,857	90		-67	-209				8,360		-1,215		**9,704**
	% Change				-221.2		-			-29.2	-95.7		-	-112.2				-17.6		-		**-41.7**
Other non- Cereal Crops	1996/97		15,682	-256	4,156	4,260	20,239	25,098	9,803	337	4,521	10,537	-285	13,399	9,831	11,314	-8,172	83	24,879		3,533	**148,959**
	2000/01		1	-73	4,526	3,660	14,410	42	-348	0	4,143	-15	76	1,981	550	349	-15,849	64	63		6,034	**19,614**
	% Change		-100.0	-	8.9	-14.1	-28.8	-99.8	-103.5	-100.0	-8.4	-100.1	-	-85.2	-94.4	-96.9	-	-23.3	-99.7		70.8	**-86.8**
Other Nuts	1996/97		-633					-1,582	0		684			3,617				-829				**1,257**
	2000/01		-272					-360	2,202		1,018			0				-544				**2,043**
	% Change		-					-	-		48.9			-100.0				-				**62.6**
Other Oilseeds	1996/97		0		48	91		1							-6							**135**
	2000/01		0		0	0		0							0							**0**
	% Change		-100.0		-100.0	-100.0		-100.0							-							**-100.0**
Other Stone Fruit	1996/97		0	0	8	292	429	0	1,845	0	587			3,235		0	0	3,997			-100	**10,293**
	2000/01		-73	493	-718	-4,752	558	-470	1,915	159	-2,731			808		-1,321	-264	-32			-121	**-6,550**
	% Change		-	-	-8,822.0	-1,727.8	30.1	-	3.8	-	-565.3			-75.0		-	-	-100.8			-	**-163.6**
Other Vegetables	1996/97		-579	12,104	-6,931	2,927	8,786		-4,771	2,108	26,066	-1,165	-285	-10,645	0	-1,780		28,413				**54,248**
	2000/01		-68	16,893	-16	4,042	31,656		-3,775	-778	30,759	0	-256	-11,172	-933	-6,562		37,685				**97,475**
	% Change		-	39.6	-	38.1	260.3		-	-136.9	18.0	-	-	-	-	-		32.6				**79.7**
Peaches	1996/97			1,114	0		5,026		504		942			248		0		1,939				**9,772**
	2000/01			1,509	15		6,793		0		2,215			330		1,986		1,559				**14,407**
	% Change			35.5	-		35.2		-100.0		135.2			32.8		-		-19.6				**47.4**
Peanuts	1996/97		0	334		4		116				443			310				0	-97		**1,110**
	2000/01		116	65		67		0				31			-7				390	85		**749**
	% Change		-	-80.4		1,685.8		-100.0				-92.9			-102.2				-	-		**-32.6**
Pears	1996/97						39,624						705									**40,330**
	2000/01						16,171						0									**16,171**
	% Change						-59.2						-100.0									**-59.9**
Plums	1996/97		98	716			638		470		-385			-1,359		0		590				**768**
	2000/01		0	923			3,928		563		0			426		920		289				**7,049**
	% Change		-100.0	28.8			516.1		19.7		-			-		-		-50.9				**818.0**
Popcorn	1996/97					-52	-11				45	0		333	-1						-8	**307**
	2000/01					217	0				0	0		2,042	855						0	**3,115**
	% Change					-	-				-100.0	-		512.7	-						-	**914.2**
Potatoes	1996/97		0		107	4,018	1,745				-234		2,350	548		8,387		19,886			0	**36,808**
	2000/01		509		0	313	492				640		7,339	4,437		11,807		19,013			684	**45,234**
	% Change		-		-100.0	-92.2	-71.8				-		212.2	709.7		40.8		-4.4			-	**22.9**
Rice	1996/97						1,321		393				49,239	59,318		0	0					**110,270**
	2000/01						594		640				32,511	37,978		210	-38					**71,895**
	% Change						-55.1		63.1				-34.0	-36.0		-	-					**-34.8**
Safflower	1996/97		10	0	-17	30	1	180	1	846	93		-24	155	26	27		14		-21	271	**1,591**
	2000/01		9	10	-22	35	1	4	23	107	18		21	69	-3	42		-2		284	90	**684**
	% Change		-10.8	-	-	18.5	22.9	-97.8	1,702.5	-87.4	-80.5		-	-55.3	-113.5	57.5		-117.6		-	-67.0	**-57.0**
Sheep	1996/97	-385	-3,181	5,118	36,707	202	35,992	329	91,901	5,800	7,161	4,797	38,174	72,976	8,315	54,978	1,925	-9,104	-14,469	4,256	22,987	**364,479**
	2000/01	-346	-1,827	5,219	52,767	509	41,481	1,100	103,030	2,731	8,606	5,324	41,936	68,533	9,609	66,626	3,520	-10,565	-4,934	5,759	30,014	**429,091**
	% Change	-	-	2.0	43.8	152.6	15.2	234.3	12.1	-52.9	20.2	11.0	9.9	-6.1	15.6	21.2	82.9	-	-	35.3	30.6	**17.7**
Soybeans	1996/97		809	138	468	1,178	1,031	717	220		0		545	1,513	565	14				90		**7,288**
	2000/01		265	79	-34	369	160	86	67		-9		-67	861	336	0				-300		**1,813**
	% Change		-67.3	-42.5	-107.2	-68.7	-84.5	-88.0	-69.7		-		-112.3	-43.1	-40.5	-100.0				-433.9		**-75.1**
Sunflower	1996/97		379	27	321	2,176		341	109	419	18	-11	194	467	2,469	96				-121	3	**6,887**
	2000/01		533	15	67	263		715	0	0	0	-24	468	411	2,654	0				0	0	**5,101**
	% Change		40.7	-44.5	-79.0	-87.9		109.6	-100.0	-100.0	-100.0	-	140.5	-12.1	7.5	-100.0				-	-100.0	**-25.9**
Tobacco	1996/97																4,906					**4,906**
	2000/01																4,861					**4,861**
	% Change																-0.9					**-0.9**
Triticale	1996/97		8		249	256	3,100	126	4,353	20	1,373	-1	4,061	3,631	93	1,693	516	-2,004			844	**18,318**
	2000/01		1		-322	-52	9,025	7	1,154	5	4,217	0	1,036	832	20	2,958	964	-356			1,245	**20,735**
	% Change		-83.4		-229.3	-120.3	191.1	-94.1	-73.5	-72.8	207.2	-	-74.5	-77.1	-78.5	74.7	86.8	-			47.6	**13.2**
Vetches	1996/97						0				-890		-34	-75		-74	0	122			431	**-521**
	2000/01						-1				471		0	0		308	37	-71			239	**982**
	% Change						-				-		-	-		-	-	-158.6			-44.5	**-**
Wheat	1996/97	0	65,766	92,735	144,219	34,466	12,994	76,881	120,079	-1,942	78,274	57,070	42,348	86,044	80,564	56,345	1,612	24,245	2,142	-903	76,516	**1,049,455**
	2000/01	125	-26,436	5,202	-61,253	-10,855	27,121	-42,460	92,180	8,015	202,585	9,105	49,611	95,018	-22,232	96,561	2,589	75,753	-1,432	-22,192	83,870	**560,876**
	% Change	-	-140.2	-94.4	-142.5	-131.5	108.7	-155.2	-23.2	-	158.8	-84.0	17.2	10.4	-127.6	71.4	60.7	212.4	-166.8	-	9.6	**-46.6**
Total PFE ($'000) 1996/97		**-436**	**187,348**	**183,425**	**297,051**	**186,535**	**518,181**	**280,265**	**290,625**	**29,487**	**259,368**	**96,256**	**156,831**	**351,544**	**270,726**	**313,271**	**36,487**	**190,254**	**-11,496**	**26,365**	**194,557**	**3,856,643**
Total PFE ($'000) 2000/01		**834**	**27,532**	**140,683**	**82,574**	**125,924**	**686,085**	**60,573**	**299,359**	**40,015**	**452,375**	**107,245**	**139,709**	**319,506**	**102,374**	**452,541**	**64,109**	**430,411**	**16,071**	**-29,117**	**213,600**	**3,732,403**
Total % Change		**-**	**-85.3**	**-23.3**	**-72.2**	**-32.5**	**32.4**	**-78.4**	**3.0**	**35.7**	**74.4**	**11.4**	**-10.9**	**-9.1**	**-62.2**	**44.5**	**75.7**	**126.2**	**-**	**-210.4**	**9.8**	**-3.2**

Appendix 8 – Profit at Full Equity ($'000) of each commodity by Catchment Management Region in the Murray-Darling Basin 1996/97 and 2000/01 including % change.

6.9 Total Net Economic Returns of Commodities by CMR

Commodity	Net Economic Returns ($'000)	ACT	Border Rivers (NSW)	Border Rivers (QLD)	Central West (NSW)	Condamine (QLD)	Goulburn (VIC)	Gwydir (NSW)	Lachlan (NSW)	Lower Murray Darling (NSW)	Mallee (VIC)	Maranoa-Balonne (QLD)	Murray (NSW)	Murrumbidgee (NSW)	Namoi (NSW)	North Central (VIC)	North East (VIC)	River Murray (SA)	Warrego-Paroo (QLD)	Western (NSW)	Wimmera (VIC)	Total
Almonds	1996/97										15,774			0				1,281				**17,055**
	2000/01										3,368			-207				5,387				**8,548**
	% Change										-78.6			-				320.4				**-49.9**
Apples	1996/97			7,500	20,767		27,173		1,136				1,769	17,073		3,439	1,208					**80,064**
	2000/01			-1,960	126		11,045		417				-48	-1,299		791	667					**9,739**
	% Change			-126.1	-99.4		-59.4		-63.3				-102.7	-107.6		-77.0	-44.8					**-87.8**
Apricots	1996/97						9		0		-859		0	45				8,245				**7,441**
	2000/01						1,865		50		-1,185		82	0				1,214				**2,026**
	% Change						19,578.3		-		-		-	-100.0				-85.3				**-72.8**
Barley	1996/97		15,828	2,736	10,945	6,628	1,560	12,274	8,741	-499	41,100	1,140	4,467	7,175	13,354	20,195	7	11,132	61	-397	33,868	**190,317**
	2000/01		-5,329	-1,752	-10,289	-14,262	3,766	-4,317	-7,476	691	56,795	-853	-3,498	-3,371	-5,231	28,732	3	23,943	-56	-1,845	46,737	**102,388**
	% Change		-133.7	-164.0	-194.0	-315.2	141.5	-135.2	-185.5	-	38.2	-174.9	-178.3	-147.0	-139.2	42.3	-61.5	115.1	-191.6	-	38.0	**-46.2**
Beef Cattle	1996/97	153	-2,728	13,891	-6,380	30,242	20,015	-9,508	9,977	-4,001	-2,582	-34,116	5,749	2,886	5,144	4,514	4,445	-8,659	-25,278	-7,572	1,577	**-2,232**
	2000/01	960	21,825	93,473	71,050	121,107	54,248	26,982	79,505	956	-72	60,528	35,763	66,266	45,866	51,213	34,233	698	23,396	-2,921	5,873	**790,949**
	% Change	525.8	-	572.9	-	300.5	171.0	-	696.9	-	-	-	522.0	2,196.0	791.7	1,034.5	670.2	-	-	-	272.4	-
Canola	1996/97	0	71	0	4,210	0	1,698	243	22,972	0	1,143	0	9,077	23,817	0	4,528	84	305	0	0	9,776	**77,926**
	2000/01	75	-231	-101	1,130	-54	4,969	-362	14,452	-17	3,142	-140	8,373	18,226	-277	9,253	314	1,892	-61	-139	8,858	**69,301**
	% Change	-	-423.3	-	-73.2	-	192.6	-248.5	-37.1	-	174.9	-	-7.8	-23.5	-	104.3	272.4	521.2	-	-	-9.4	**-11.1**
Cereals for Hay/Silage	1996/97		-907	-1,408	1,632	-3,426	3,651	-699	1,869	-278	343	-912	2,062	1,753	-795	3,496	322	5,374	-231	-7	420	**12,258**
	2000/01		3,798	734	797	2,323	5,110	1,706	2,039	1,076	629	886	2,138	3,145	560	6,258	229	6,852	76	959	1,379	**40,692**
	% Change		-	-	-51.1	-	40.0	-	9.1	-	83.5	-	3.6	79.4	-	79.0	-28.8	27.5	-	-	228.0	**232.0**
Cherries	1996/97				-52		-363		-2,945					283			940	-85				**-2,223**
	2000/01				2,037		1,211		4,057					1,953			0	0				**9,258**
	% Change				-		-		-					590.4			-100.0	-				**-**
Chick Peas	1996/97		1,590	494	-27	2,379	20	1,060	53		2,203	238	8	-45	-59	5,493		20	0	-208	16,112	**29,331**
	2000/01		1,071	2,997	-817	-426	-15	-1,479	649		51	1,345	0	731	-356	419		0	-263	-983	1,518	**4,441**
	% Change		-32.7	506.7	-	-117.9	-175.8	-239.5	1,133.4		-97.7	465.5	-100.0	-	-	-92.4		-100.0	-	-	-90.6	**-84.9**
Cotton	1996/97		81,553	38,125	69,718	77,958		164,696	0	61		47,129		506	111,937				2,582	28,323		**622,587**
	2000/01		23,772	16,455	30,440	19,888		69,075	-1,084	0		34,757		17,607	39,949				861	-7,719		**244,000**
	% Change		-70.9	-56.8	-56.3	-74.5		-58.1	-	-100.0		-26.3		3,380.8	-64.3				-66.7	-127.3		**-60.8**
Dairy Cattle	1996/97	-319	-149	-2,530	647	-12,657	321,096	-36	-276		-6,788	-2,707	-17,312	1,344	596	116,067	25,395	1,186	-4,651	-22	250	**419,136**
	2000/01	0	-620	-1,735	-3,429	-543	434,282	-125	4,108		-9,533	-6,649	-44,538	2,433	3,603	160,062	36,983	8,557	-6,604	-1,622	1,037	**575,668**
	% Change	-	-	-	-629.7	-	35.2	-	-		-	-	-	81.0	504.8	37.9	45.6	621.8	-	-	314.5	**37.3**
Faba Beans	1996/97		370	-4	32	0	51	334	19	0	123		5	168	280	1,304	0	119	0	13	3,412	**6,224**
	2000/01		-431	-96	-233	5	69	-2,101	567	-2	321		158	2,887	-891	1,475	15	1,175	-33	-301	4,807	**7,389**
	% Change		-216.5	-	-832.8	-	35.0	-729.4	2,899.8	-	160.4		3,084.9	1,623.0	-418.6	13.1	-	891.7	-	-2,332.8	40.9	**18.7**
Field Peas	1996/97		55	0	95	1	215	24	-6		4,974	0	72	88	-14	4,557		1,685			10,683	**22,429**
	2000/01		-39	-20	-342	-2	100	-113	-231		2,589	-20	-396	-163	-41	2,815		1,387			4,657	**10,180**
	% Change		-170.5	-	-460.4	-262.3	-53.5	-571.0	-		-48.0	-	-651.6	-284.8	-	-38.2		-17.7			-56.4	**-54.6**
Grain Sorghum	1996/97		6,043	3,730	1,795	19,147	-3	3,751	10		13	3,857	7	170	28,133	-40			118	109	17	**66,857**
	2000/01		3,564	242	275	-5,483	0	2,201	-49		-146	-1,231	6	-28	18,667	24			-95	-1,259	-13	**16,675**
	% Change		-41.0	-93.5	-84.7	-128.6	-	-41.3	-581.7		-1,182.2	-131.9	-10.2	-116.5	-33.6	-			-180.1	-1,251.6	-180.5	**-75.1**
Grapes	1996/97			-494	-4,094		-3,708		-5,114	10,965	41,100	2,292	27	1,881		-748	-4,869	36,063	0	1,439	-1,306	**73,434**
	2000/01			-3,159	-9,467		-5,206		-6,984	14,301	94,744	0	-1,099	-31,400		-4,007	-8,400	181,241	3,438	2,285	-3,375	**222,914**
	% Change			-	-		-		-	30.4	130.5	-100.0	-4,187.8	-1,769.1		-	-	402.6	-	58.8	-	**203.6**
Lentils	1996/97										573					608					8,338	**9,520**
	2000/01										859					2,797					10,948	**14,604**
	% Change										49.7					360.0					31.3	**53.4**
Lupins	1996/97		9		350		844	0	1,520	-6	667		2,184	2,011	-16	1,816	49	1,566		0	671	**11,664**
	2000/01		-19		-887		446	-15	1,094	0	991		2,153	3,809	-233	1,183	53	1,740		24	533	**10,871**
	% Change		-308.0		-353.6		-47.2	-	-28.0	-	48.5		-1.4	89.4	-	-34.9	7.1	11.1		-	-20.6	**-6.8**
Maize	1996/97		1,218	114	681	337	109	421	7,054	621		-12	661	11,893	2,989	559				160		**26,806**
	2000/01		884	13	470	-1,316	305	28	2,692	101		18	951	3,075	1,319	117				0		**8,658**
	% Change		-27.4	-88.5	-30.9	-490.4	179.4	-93.3	-61.8	-83.7		-	43.9	-74.1	-55.9	-79.1				-100.0		**-67.7**
Millet	1996/97		-2	126	66	901	170	0	84		105	42	31	82	0	177	49				33	**1,861**
	2000/01		19	48	20	763	0	12	28		0	24	175	114	56	37	0				0	**1,296**
	% Change		-	-61.5	-69.4	-15.3	-100.0	-	-66.5		-100.0	-42.4	474.8	38.6	-	-79.2	-100.0				-100.0	**-30.3**
Mung Beans	1996/97		1,207	462	-62	1,621		746	-10		9	204	0	-3	250	30			0		0	**4,454**
	2000/01		780	217	-5	866		354	36		0	-699	2	-101	36	0			-164		-2	**1,320**
	% Change		-35.4	-53.0	-	-46.6		-52.5	-		-100.0	-442.6	-	-	-85.5	-100.0			-		-	**-70.4**
Nectarines	1996/97			-1,129	18		587		-48		-485		0	-2,752		0		891				**-2,918**
	2000/01			8	-63		8,308		593		2,460		180	3		721		597				**12,809**
	% Change			-	-449.8		1,315.9		-		-		-	-		-		-33.0				**-**
Non-Cereal Crops Cut for Hay	1996/97		40	0	83	214	44	38	-2		155	0	79	40	36	80	46	-190	0	26	135	**823**
	2000/01		16	129	-12	633	752	11	-135		125	25	-92	9	15	-248	0	31	58	0	195	**1,511**
	% Change		-61.2	-	-114.2	196.2	1,605.6	-72.1	-		-19.8	-	-216.9	-76.5	-60.0	-410.0	-100.0	-	-	-100.0	44.3	**83.7**
Oats	1996/97	0	151	77	6,346	-566	3,777	304	9,671	-18	840	-218	4,478	5,930	642	7,758	541	1,715	-5	16	2,950	**44,389**
	2000/01	-4	-326	-143	-2,649	-138	2,473	-425	2	-66	718	-279	702	1,065	-559	7,382	333	1,628	-17	-85	3,904	**13,515**
	% Change	-	-315.9	-286.6	-141.7	-	-34.5	-239.9	-100.0	-	-14.5	-	-84.3	-82.0	-187.2	-4.8	-38.5	-5.1	-	-633.1	32.3	**-69.6**

Oranges	1996/97				745		813			7,920	15,181		336	22,679		0		27,628		0		**75,302**
	2000/01				399		1,942			5,068	18,998		342	12,823		1,565		34,729		-947		**74,920**
	% Change				-46.5		138.9			-36.0	25.1		1.7	-43.5		-		25.7		-		**-0.5**
Other Cereal Crops	1996/97		57		86		20		300		182			18	2	17		5				**688**
	2000/01		0		0		0		0		0			0	0	0		0				**0**
	% Change		-100.0		-100.0		-100.0		-100.0		-100.0			-100.0	-100.0	-100.0		-100.0				**-100.0**
Other Citrus	1996/97				133		-92			2,591	2,028		0	1,701				10,015		0		**16,376**
	2000/01				-170		1,050			1,830	59		-68	-214				8,260		-1,227		**9,520**
	% Change				-227.6		-			-29.4	-97.1		-	-112.6				-17.5		-		**-41.9**
Other non- Cereal Crops	1996/97		15,670	-256	4,153	4,249	20,232	25,089	9,800	337	4,520	10,523	-286	13,393	9,828	11,306	-8,177	82	24,865		3,530	**148,858**
	2000/01		1	-73	4,524	3,655	14,407	42	-348	0	4,142	-15	75	1,979	550	349	-15,857	62	63		6,029	**19,585**
	% Change		-100.0	-	8.9	-14.0	-28.8	-99.8	-103.6	-100.0	-8.4	-100.1	-	-85.2	-94.4	-96.9	-	-25.1	-99.7		70.8	**-86.8**
Other Nuts	1996/97		-845					-2,113	0		585			3,472				-1,044				**55**
	2000/01		-380					-446	2,182		968			0				-623				**1,701**
	% Change		-					-	-		65.5			-100.0				-				**2,986.3**
Other Oilseeds	1996/97		0		46	88		-1							-6							**127**
	2000/01		0		0	0		0							0							**0**
	% Change		-		-100.0	-100.0		-							-							**-100.0**
Other Stone Fruit	1996/97		0	0	3	232	174	0	1,393	0	308			2,829		0	0	3,482			-212	**8,209**
	2000/01		-80	137	-778	-5,205	460	-526	1,752	128	-2,980			440		-1,389	-283	-782			-153	**-9,258**
	% Change		-	-	-24,174.2	-2,347.0	165.3	-	25.7	-	-1,067.8			-84.4		-	-	-122.5			-	**-212.8**
Other Vegetables	1996/97		-579	12,104	-6,931	2,927	8,786		-4,771	2,108	26,066	-1,165	-285	-10,645	0	-1,780		28,413				**54,248**
	2000/01		-80	16,624	-74	3,838	31,321		-3,853	-803	30,593	0	-260	-11,632	-943	-6,783		37,437				**95,386**
	% Change		-	37.3	-	31.1	256.5		-	-138.1	17.4	-	-	-	-	-		31.8				**75.8**
Peaches	1996/97			581	0		3,230		415		689			-643		0		1,742				**6,013**
	2000/01			1,363	12		6,197		0		2,215			52		1,936		1,538				**13,313**
	% Change			134.7	-		91.9		-100.0		221.5			-		-		-11.7				**121.4**
Peanuts	1996/97		0	320		-11		115				433			308				0	-102		**1,062**
	2000/01		113	62		57		0				30			-9				384	84		**720**
	% Change		-	-80.6		-		-100.0				-93.2			-103.0				-	-		**-32.2**
Pears	1996/97						38,798						689									**39,487**
	2000/01						16,171						0									**16,171**
	% Change						-58.3						-100.0									**-59.0**
Plums	1996/97		25	133			52		-47		-810			-2,121		0		345				**-2,423**
	2000/01		0	768			3,576		315		0			357		722		258				**5,996**
	% Change		-100.0	478.6			6,830.7		-		-			-		-		-25.2				**-**
Popcorn	1996/97					-54	-11				44	0		328	-1						-8	**297**
	2000/01					215	0				0	0		2,035	851						0	**3,101**
	% Change					-	-				-100.0	-		520.7	-						-	**942.7**
Potatoes	1996/97		0		107	4,018	1,745				-234		2,350	548		8,387		19,886			0	**36,808**
	2000/01		501		0	270	456				582		7,182	4,153		11,652		18,600			674	**44,071**
	% Change		-		-100.0	-93.3	-73.9				-		205.6	657.7		38.9		-6.5			-	**19.7**
Rice	1996/97						1,214		300				37,510	45,627		0	0					**84,652**
	2000/01						468		529				24,127	28,877		170	-48					**54,123**
	% Change						-61.5		76.1				-35.7	-36.7		-	-					**-36.1**
Safflower	1996/97		9	0	-17	30	0	179	1	839	90		-25	147	25	-16		13		-22	233	**1,487**
	2000/01		8	9	-23	35	0	3	23	106	17		21	64	-4	33		-2		281	84	**654**
	% Change		-17.8	-	-	18.7	2.1	-98.1	2,062.4	-87.4	-81.6		-	-56.7	-114.8	-		-118.7		-	-63.9	**-56.0**
Sheep	1996/97	-798	-12,641	297	-9,584	-1,020	23,818	-8,446	43,619	656	-4,895	-784	22,064	27,962	-2,144	32,826	-3,568	-30,068	-26,466	-14,800	12,487	**48,515**
	2000/01	-932	-9,450	1,781	7,074	-411	28,541	-6,513	52,493	-2,784	-3,605	1,946	25,415	24,463	64	42,151	-976	-30,484	-14,668	-11,462	19,305	**121,946**
	% Change	-	-	500.6	-	-	19.8	-	20.3	-524.5	-	-	15.2	-12.5	-	28.4	-	-	-	-	54.6	**151.4**
Soybeans	1996/97		794	134	461	1,131	997	709	214		0		513	1,451	556	13				89		**7,062**
	2000/01		250	76	-40	339	145	77	61		-11		-88	827	315	0				-306		**1,646**
	% Change		-68.5	-43.0	-108.7	-70.0	-85.4	-89.1	-71.4		-		-117.1	-43.0	-43.3	-100.0				-444.2		**-76.7**
Sunflower	1996/97		343	24	301	2,060		287	103	414	17	-15	188	451	2,333	90				-129	3	**6,469**
	2000/01		516	14	63	220		695	0	0	0	-25	461	385	2,597	0				0	0	**4,926**
	% Change		50.5	-41.7	-79.0	-89.3		142.1	-100.0	-100.0	-100.0	-	145.0	-14.8	11.3	-100.0				-	-100.0	**-23.9**
Tobacco	1996/97																-21,108					**-21,108**
	2000/01																4,639					**4,639**
	% Change																-					**-**
Triticale	1996/97		8		239	253	2,996	122	4,197	19	1,218	-1	3,814	3,365	92	1,624	502	-2,109			811	**17,150**
	2000/01		1		-335	-53	8,791	7	1,031	5	4,062	0	708	568	19	2,824	926	-488			1,202	**19,269**
	% Change		-85.4		-240.4	-120.8	193.4	-94.5	-75.4	-75.1	233.5	-	-81.4	-83.1	-79.1	73.9	84.4	-			48.2	**12.4**
Vetches	1996/97						0				-975		-36	-81		-100	0	97			390	**-705**
	2000/01						-2				441		0	0		285	35	-86			224	**897**
	% Change						-				-		-	-		-	-	-188.4			-42.7	**-**
Wheat	1996/97	0	60,093	87,576	128,020	31,676	12,015	70,589	106,622	-2,445	71,181	53,115	36,628	75,424	72,714	51,945	1,471	18,224	1,963	-2,411	71,865	**946,264**
	2000/01	122	-27,382	4,332	-64,787	-11,341	26,904	-43,836	88,733	7,852	200,875	8,399	48,070	92,503	-23,624	95,512	2,566	74,177	-1,467	-22,782	82,965	**537,793**
	% Change	-	-145.6	-95.1	-150.6	-135.8	123.9	-162.1	-16.8	-	182.2	-84.2	31.2	22.6	-132.5	83.9	74.5	307.0	-174.8	-	15.4	**-43.2**
Total NER ($'000) 1996/97		**-963**	**167,283**	**162,600**	**224,530**	**168,356**	**491,732**	**260,181**	**216,851**	**19,282**	**213,605**	**79,042**	**116,826**	**260,249**	**246,183**	**278,145**	**-2,663**	**137,359**	**-27,042**	**4,505**	**176,036**	**3,192,097**
Total NER ($'000) 2000/01		**220**	**12,751**	**130,444**	**24,018**	**114,979**	**664,156**	**40,935**	**237,248**	**28,443**	**412,209**	**98,047**	**106,999**	**242,433**	**82,299**	**418,053**	**55,431**	**378,936**	**4,846**	**-49,966**	**197,386**	**3,199,867**
Total % Change		**-**	**-92.4**	**-19.8**	**-89.3**	**-31.7**	**35.1**	**-84.3**	**9.4**	**47.5**	**93.0**	**24.0**	**-8.4**	**-6.8**	**-66.6**	**50.3**	**-**	**175.9**	**-**	**-1,209.1**	**12.1**	**0.2**

Appendix 9 – Net economic returns ($'000) of each commodity by Catchment Management Region in the Murray-Darling Basin 1996/97 and 2000/01 including % change.