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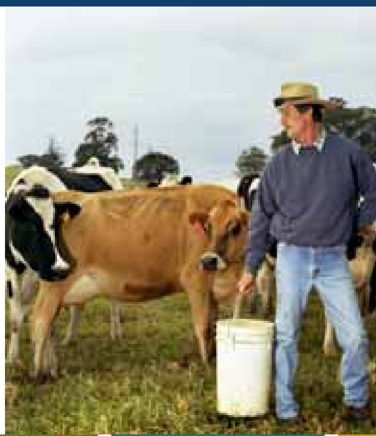


Signposts for Australian Agriculture

The Australian dairy industry

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2008

DAIRYAUSTRALIA

Australian Dairy Farmers

Kiri-ganai research

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Foreword

Agriculture is under pressure to demonstrate its performance credentials — in particular, its environmental credentials — and to inform the community about its management practices. The agricultural sector recognises that failure to respond to this pressure may constrain future access to natural resources and markets and increase the risk of regulation of agricultural practices.

Since 1997, the National Land & Water Resources Audit has played an important role in the national coordination, collation and reporting of data and information. Under Signposts, government, industry and research bodies have collaborated in providing strategic direction and in exchanging data and information.

Signposts provides access to social, economic and environmental data specific to an industry and geographical area to inform policy development, strategic decision making and future research priorities. The Signposts reporting framework has been designed to align with other government reporting initiatives, including the evaluation framework for natural resource management programs such as Caring for our Country and Landcare.

The partnership built under Signposts needs to continue, to ensure an ongoing legacy of cross-agency collaboration in reporting.

Geoff Gorrie

Chair

National Land & Water Resources Audit Advisory Council and Signposts Reference Group

Acronyms and abbreviations

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AGO	Australian Greenhouse Office
CO_2e	carbon dioxide equivalent
DairySAT	Dairy Self Assessment Tool
DIDCO	Dairy Industry Development Company
EMS	environmental management system
ESD	ecologically sustainable development
GHG	greenhouse gas
GRDC	Grains Research and Development Corporation
GVP	gross value of production
ha	hectare
HR	human resource(s)
ML	megalitre (1 megalitre = 10^6 litres)
NCDEA	National Centre for Dairy Education Australia
NFF	National Farmers' Federation
NLWRA	National Land & Water Resources Audit ('the Audit')
NRM	natural resources management
R&D	research and development
RDP	Regional Development Program
SFF	Sustainable Farm Families

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Industries are increasingly being required to account for their economic, social and environmental contribution.

Such accountability is driven by community expectations for socially and environmentally responsible business, market preferences for products and services produced in a sustainable and healthy way, and international and domestic regulations requiring compliance with social and environmental best practice.

Signposts is an initiative of the Australian Government that will provide industry and government with information to respond to community and market expectations and demands arising in Australia and internationally. Signposts currently relies on data derived primarily from the National Land & Water Resources Audit and hence depends on the continuation of this program.

The Signposts framework has been designed to answer the question: 'How do Australian agricultural industries contribute to ecologically sustainable development (ESD)?'

Through this question, Signposts provides a platform for compiling data and communicating information that can be used to:

- build an industry's credentials in markets and the community for highly valued economic, environmental and social performance
- address community perceptions of the industry's management and activities
- identify priority issues and areas for planning and action.

This report is based on data that have been compiled through the Signposts Industry Profile of the Australian dairy industry.[1]

In some cases, the Signpost data are supplemented from other government and industry sources where this provides a more complete and up-to-date description of the report's topics.

This report is about the contribution of the dairy industry to ESD as reflected in the current Signposts framework. It has been prepared with the cooperation of Dairy Australia and relates to dairy production to the farm gate.

The report is for both government and industry. From a public policy perspective, government monitors the economic, social and environmental performance of the dairy industry. It values its contribution to national and regional economies; to the nutrition and health of Australians; and the active participation of producers in natural resource management (NRM) and environmental conservation.

In its Strategic Plan 2008–2012, Dairy Australia notes: 'Policy decision makers and influencers want to see how dairy is making a positive and sustainable contribution to the environment and society. A good understanding of dairy's economic, environment and social contributions will inform policy decision making and potentially lead to positive effects on dairy profits and sustainability' (Dairy Australia 2008).

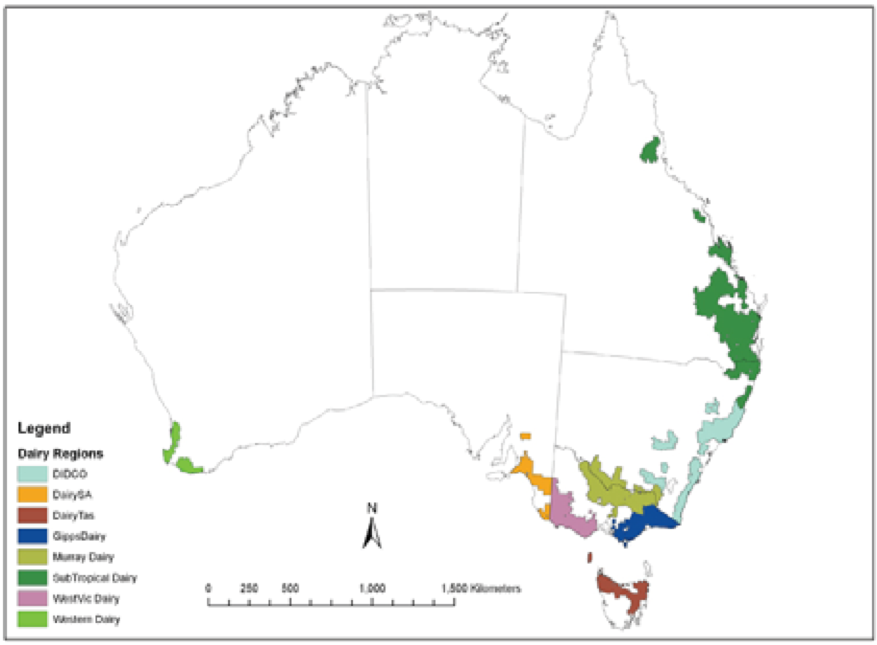
This report aims to reach conclusions on how the industry is performing based on Signposts' ESD indicators. Data and reports on which it is based are cited in the body of the report and support conclusions in this executive summary.

[1] This is web based and is available at http://signposts4ag.com

Key learnings from the Australian dairy industry

The Australian dairy industry is a major contributor to ESD in Australia in economic, environmental and social terms. Dairy production is Australia's fourth largest agricultural industry. In 2006–07, the gross value of production (GVP) was $3.2 billion. The industry is generally located in high-rainfall coastal or in irrigation areas (see Figure i), and it has close links with urban markets and regional and rural communities.

Figure i Australian dairy land use

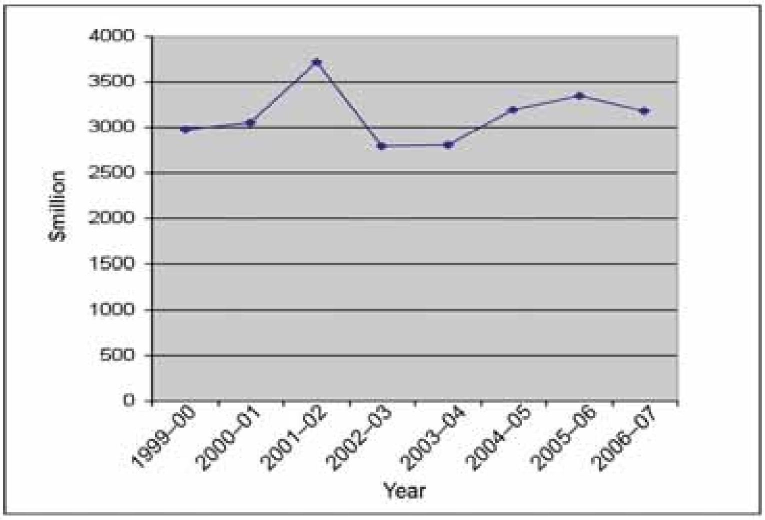


Sources: Dairy regions and BRS (2002).

Snapshot June 2007:
• 8055 dairy farms
• 1.8 million dairy cows
• annual milk production of 9.6 billion litres
• gross value of production $3.2 billion
• 80% of production is from Victoria, South Australia and Tasmania
• produces: milk, cheese, butter, milk powder, yoghurt and casein
• all states supply fresh milk.

Economic contribution

Figure ii Dairy industry gross value of production, 1999–00 to 2006–07



Source: ABARE (2007a)

Signposts measures the economic contribution of the dairy industry in terms of its:

- production and contribution to national incomes
- ability to increase exports to ensure industry growth
- net worth (ie total value of assets minus the value of liabilities) to undertake future investment
- productivity which must increase to maintain future profitability in the face of declining terms of trade.

Dairy production

The number of dairy farms has contracted by 63% since 1979–80, and by 32% over the past six years. Milk production has been affected by drought since 2000–01; however, average annual milk production is presently just below the record level at the turn of the century and substantially above the levels of 1979–80 and 1989–90.

This milk production has been achieved from a national herd of around two million dairy cows (average number from 2000–01 to 2006–07) and this is about 7% above the herd size in 1979–80. The key factor for achieving a greater level of production from far fewer dairy farms and an only slighter larger national dairy-cow herd, is that milk yield per cow is almost double the level it was in the late 1970s.

Since 2000–01, the main constraint on the industry has been climate variability and the impact on production and farm profitability of two severe droughts in quick succession.

Dairy exports

The Australian dairy industry relies on overseas markets for dairy products to sell 50% of annual milk production. Industry exports averaged $2.6 billion per year between 2000–01 and 2006–07.

Industry strategy is to shift the Australian export-product mix towards value-added, higher-return product lines and new dairy products.

Australia accounts for 12% of world dairy trade from a production base that represents only around 2% of world production. As an exporter, it ranks third behind New Zealand and the European Union. The Asian and east Asian markets accounted for 66% of the value of Australian exports in 2006–07.

Net worth

The increased land value in dairying regions since 2000–01 has raised the total capital value of farms. This has more than offset increases in farm debt, thereby maintaining farm equity ratios in the range of 82–85% to 2006–07.

The rate of return on farm capital (excluding capital appreciation) has been low since 2001–02. Including capital appreciation increases the average rate of return on farm capital to 8.3% over the period 2000–01 to 2006–07, due largely to rising land value.

Productivity

In the face of declining terms of trade, increases in dairy productivity are critical to the profitability and sustainability of Australian dairy farms.

The average rate of growth in on-farm total-factor productivity was 1.8% per year in the decade to 1994–95, but it slowed to 1.0% per year in the decade to 2003–04.

The adoption of new technologies by dairy farmers over the past decade has resulted in increased productivity on dairy farms. These technologies particularly apply to shed management, supplementary feeding, improved dairy-cattle genetics, pasture management and water management.

Stock in the Murray River woodland, Victoria (photo by Alison Pouliot 2008)

Environmental contribution

Dairy farmers are effective managers of their natural resources in producing milk for Australian and overseas consumers. They are important contributors to environmental conservation and the provision of ecosystem services.

The industry manages a complex set of NRM and environmental issues including soil fertility, irrigation-induced soil salinity, soil acidity, native vegetation conservation, greenhouse gas (GHG) emissions, water use and water quality.

Natural capacity to produce food

Proactive management of environmental concerns

Fertiliser management — increasing numbers of farmers undertake soil and plant-tissue testing, linked to nutrient management, to meet production and environmental goals.

Salinity — irrigation-induced salinity is a more significant problem to the dairy industry than dryland salinity. Best-practice irrigation prevents this NRM problem.

Acidity — on-farm application of lime to raise soil pH improve yields, alleviate long-term soil degradation and permanent loss of fertility.

Soil fertility

Nitrogen and phosphorus are macronutrients that are essential to pasture and fodder growth and to achieving high milk yields per cow. Australian soils are generally low in naturally occurring nitrogen and phosphorus, although this varies greatly between regions.

Dairy production takes place in high rainfall and irrigation areas where moderate to high soil nitrogen and phosphorus levels are required to ensure they do not become a production-limiting factor.

Use of nitrogen and phosphorus fertilisers has increased substantially since 2001–02, raising the level of environmental risk of surface and groundwater pollution and GHG emissions.

Soil salinity

Signposts addresses the issues of soil salinity and acidity, although the NRM survey (Watson 2006) found greater concern amongst dairy farmers about soil compaction and noxious weeds as land management issues.

The 2006 NRM survey found that the proportion of dairy farmers reporting irrigation-induced salinity as a problem had dropped from 15% in 2000 to 10% in 2006, although it remained a significant issue in northern Victoria, South Australia and Western Australia.

The dairy industry addresses both irrigation-induced and dryland salinity in its strategies to improve NRM.

Water use and quality

In most areas, irrigation is required to supplement rainfall to support dairy's intensive production system and this depends on a secure and reliable irrigation supply. Improving water-use efficiency is a key strategy involving improvement of irrigation infrastructure, irrigation systems, scheduling and water reuse. Dairy farmers adopt a range of management practices to achieve this.

The 2006 NRM survey found that 54% of dairy farms are irrigated. Further, since 2000, there has been a substantial increase in the percentage of dairy land irrigated, from 43% to 56%.

Total water consumption by dairy farms in 2001–02 was 2.6 million gigalitres or 17% of agricultural water use. In 2004–05, dairy farmers used less water (2.3 million megalitres [ML]), however this accounted for 19% of total agricultural water use. For both years, the industry used around 12% of national water consumption.

An arid slope testifying the effects of drought in a grazing area near Morrisons, Victoria — a wooden shed at the bottom links to a water tank through a water pipeline (photo by Alison Pouliot 2008)

Natural capacity to provide ecosystem services

Biodiversity conservation

The proportion of dairy farms with native vegetation has fallen since 2000, from 64% to 52%, although this varies considerably by Dairy Region (Watson 2006). For example, 82% of Tasmania respondents reported remnant native vegetation on their farms, compared with 52% in western Victoria.

Significantly higher proportions of the following groups of farmers have remnant native vegetation:

- those with low stocking rates (64% of farms with less than one cow per hectare compared with 43% of farms with more than three cows per hectare)
- environmental group members (53% compared with 46% of non-members)
- dryland farmers (34% compared with 25% for irrigators).

There has been a significant increase in farmers fencing all or most of their remnant native vegetation. Among the 2006 NRM survey respondents, 49% reported they had fenced their vegetation compared with 36% in 2000. A further 23% of respondents reported they had plans to fence their native vegetation within the following two years.

David and Leanne Hank's dairy farm, near Harvey, WA (photo by Arthur Mostead 2004)

There were significant differences between categories of dairy farmers who had fenced their native vegetation. These included:

- farmers with very large and large herds (86% compared with 50% with small- and medium-sized herds)
- younger farmers (71% of farmers aged 18–39 years compared with 64% of farmers aged 40–59 and 51% aged 61 years and over)
- dryland farmers (69% compared with 56% of irrigators)
- industry optimists (68% compared with 52% with negative outlooks)
- industry stayers (66% compared with 52% who were planning to leave the industry)
- environmental group members (64% compared with 55% of non-members).

Table i Native bush management on dairy farms

Native bush management	Respondents in 2000 (%)	Respondents in 2006 (%)
Have native bush	64	52
All fenced	23	30
Most fenced	13	19
Some fenced	22	13
None fenced	43	38
Plan to fence off within two years	not available	23

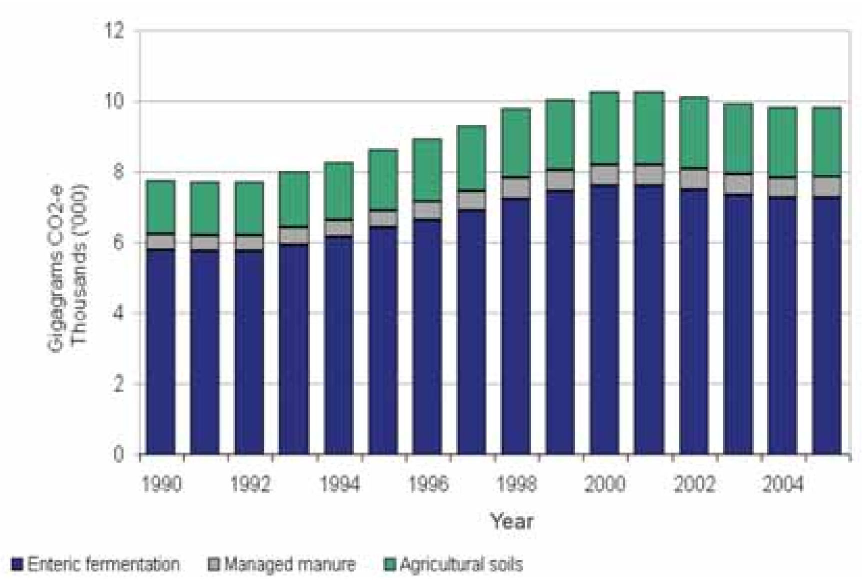
Source: Watson (2006)

Greenhouse gas emissions and sequestration

Sources of GHG in dairy farming include: methane from cows digesting feed (enteric fermentation); nitrous oxide from soils; methane emissions from managed manure (when manure is stored in piles); and carbon dioxide from the operation of fossil-fuelled machinery.

Signposts reports on emissions from these sources, apart from fossil-fuel use (see Figure iii). The dairy industry emitted 9.8 million tonnes of CO_2e in 2005, representing approximately 10% of total agricultural emissions.

Figure iii Estimated greenhouse gas emissions, by source, from the dairy industry, expressed in carbon dioxide equivalents



Source: Australian Greenhouse Office (2007)

Actions that can be taken by the dairy industry include improving the quality of feed for cattle, improving pasture and fertiliser management and breeding more feed-efficient cattle.

Social contribution

Signposts measures the social contribution of an industry in terms of its contribution to the development of human and social capital. The dairy industry gives high priority to development of human and social capital through the extensive programs of Dairy Australia and other industry bodies, such as the Gardiner Foundation (this has a portfolio of around $1 million invested in community-development projects).

The industry's national contribution to social systems includes employment and the nutritional value of dairy products, which are consumed by most Australians.

Local and regional communities receive many social benefits from the dairy industry via its contributions to employment and business activity, to community networks and to community heritage.

Employment

In the 2001 census, 28 649 persons were employed in dairy farming, representing around 13% of total agricultural employment. By state, Victoria has the greatest proportion of persons employed (57%).

Education, training and technical skills

The dairy industry gives priority to investment in its people through a wide range of programs. Dairy Australia recognises that dairy farmers acquire technical skills in a number of ways including formal training, extension activities and engagement with consultants/advisers.

Health

The most direct impact on the health of individuals in the industry is through injuries on farms. Fortunately, the previous decade has seen a trend of declining occupational injuries in the industry, being at their lowest level to date. The Sustainable Farm Families (SFF) project has significantly contributed to health and safety improvements in dairy farming. Dairy products contribute to the health of Australians by providing essential nutrients.

Regional communities

Industry research has estimated that producing an extra one billion litres of milk would produce an extra $300 million in farm-gate receipts, around 8000 dairy farming jobs and almost $1.6 billion in regional income (Dairy Australia 2008).

Dairy Australia has established Regional Development Programs (RDPs) in the eight major dairying areas of Australia. RDPs drive innovation in research and extension through the use of regional knowledge and skills. They are independent entities, co-ordinated and managed by the regions, which aim to improve local and national productivity, prosperity and sustainability.

Service provider networks

Dairy farming has led to the creation of an extensive service sector. In addition, there is an extensive informal network of social groups associated with the industry at local levels.

The dairy industry is one of the most active of all agricultural industries in ensuring it invests in its future economic, environmental and social contribution to Australia and the many rural communities in dairying regions.

Introduction

This Signposts report on the dairy industry is one of six initial reports on the contribution of Australia's major agricultural industries to ecologically sustainable development (ESD).

The *Australian National Strategy for Ecologically Sustainable Development* (Council of Australian Governments 1992) defines ESD as:

> Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.

In the Signposts framework, ESD is interpreted as an overall increase in the value of the nation's capital assets (ie its produced capital, human capital, social capital and natural capital) that is available to increase the wellbeing of the Australian population. Similarly, at an industry level, ESD is interpreted as an increase in the value of the industry's capital that is available to produce income and environmental and social benefits to both the industry's stakeholders and the broader society.

Partnership with industry

This report has been prepared with the cooperation of Dairy Australia and relates to dairy production to the farm gate. Dairy Australia is an industry-owned company that provides services to the Australian dairy industry. It invests approximately $30 million of dairy-farmer levy payments and $15 million of taxpayer funds in projects and services for the benefit of the industry.

Members of Dairy Australia are Australian dairy farmers and peak industry bodies. All dairy farmers who pay a levy are eligible to become Group A members and have a say in the direction of Dairy Australia and the election of its directors. At 30 June 2007, Dairy Australia had 12 188 Group A members representing 64% of commercially active dairy enterprises.

Group B membership is offered to the industry's peak representative organisations: Australian Dairy Farmers Ltd and the Australian Dairy Products Federation. Group B members are involved in the development of Dairy Australia's strategic plans and annual operational plans

Dairy Australia has a rolling strategic plan that enables it to adjust to rapidly changing circumstances. For the 2008–12 plan, its strategic priorities are to:

- protect and increase farm business margins, profitability and confidence
- coordinate and integrate industry responses to emerging issues, for example, climate change and variability, biosecurity and genetic modification technologies
- reduce funding for growing volume milk markets and shift the emphasis to maintaining and growing markets for higher margin products and components
- accelerate the transfer and commercial application of knowledge and innovation for dairy farming and manufacturing
- maintain and enhance the dairy industry's reputation as a valuable contributor to Australia's economy and the wider community, and as a responsible user of valuable resources
- provide foresight and analysis of emerging issues.

The Signposts framework

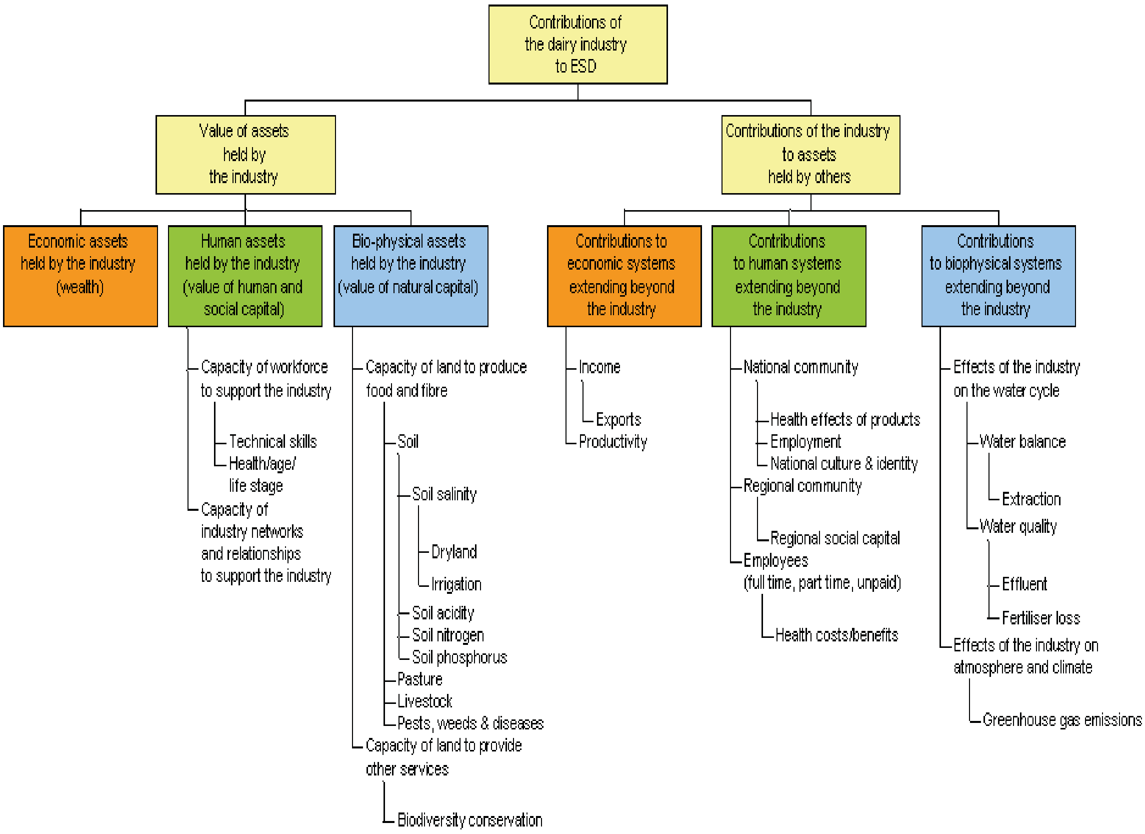
This report is based on data that have been compiled through the Signposts Industry Profile of the Australian dairy industry.[2]

In some cases, the Signpost data are supplemented from other government and industry sources where this provides a more complete and up-to-date description of the report's topics. The availability and quality of data varies and the ability to monitor trends on ESD objectives will depend on continuity and ongoing improvements in data collection and reporting for key indicators.

This report does not repeat the conceptual and definitional material of Signposts and readers seeking this information can access the Signposts link above.

The report recognises that, at this stage in the development of Signposts, many, components and sub-components have not been populated with the required data. Data imperfections are a fact of life in most industry reporting, but Signposts provides a platform where information can be updated, refined and extended over time. The Signposts framework envisages that a complete dataset and means of analysis of the industry's contribution to ESD, as shown in Figure 1, can be established.

Figure 1 Signposts for agriculture — dairy industry profile



ESD = ecologically sustainable development
Source: http://signposts4ag.com/signposts-horticulture/full-component-tree

The contributions of the industry are set out in the above 'component tree'. Each component includes a statement of the desired outcome, an indicator and a summary measure. Where data is available, results are provided for the indicator and summary measure. The industry profile also describes industry and government responses and the adoption of specific management practices. These are illustrated by case

[2] This is web based and is available at: http://signposts4ag.com.

studies that showcase sustainable production practices and social frameworks for individual farm business landowners, their employees and broader regional communities.

Use of Signpost reports

The report seeks to the greatest extent possible to accommodate the reporting needs of both government and industry.

From a public policy perspective, government is interested in and monitors the economic, social and environmental performance of the industry.

Similarly, the industry itself monitors these variables for a variety of purposes:

- in advising government and making a contribution to public policy development
- providing information about the industry back to its stakeholders to better inform decision making at the business level
- meeting reporting requirements arising from statutory obligations, the need to inform markets and consumers, and the need to inform financial markets which supply funds to the industry for investment
- to promote the industry within the broader society.

The economic contribution

Signposts examines the economic contribution of the dairy industry to Australia from four key perspectives:

- the contribution of the industry to national income through dairy production supplied to domestic and international markets
- its contribution to exports since growth in industry income and Australia's national income relies heavily on exports
- the value of industry assets which currently yield income or have the potential to yield future income
- the industry's total-factor productivity which indicates its actual performance and potential to contribute to growth in production, income and profits.

This report is about dairy production to the farm gate. The output of milk from the farm provides the raw material for the processing sector including drinking milk, cheese, butter and butterfat, milk powders (skim milk and whole milk), casein and other fresh or processed products. Output from the farm sector is supplied through a value chain that extends from the farm gate through to the sale of dairy products to consumers in Australia and overseas. The passage of dairy products through the value chain creates income for other industries.

Dairy farming, like other agricultural industries, has led to the creation of an extensive service sector that provides transport, storage, selling, marketing, brokering, financial, information, research, consulting, education and training services.

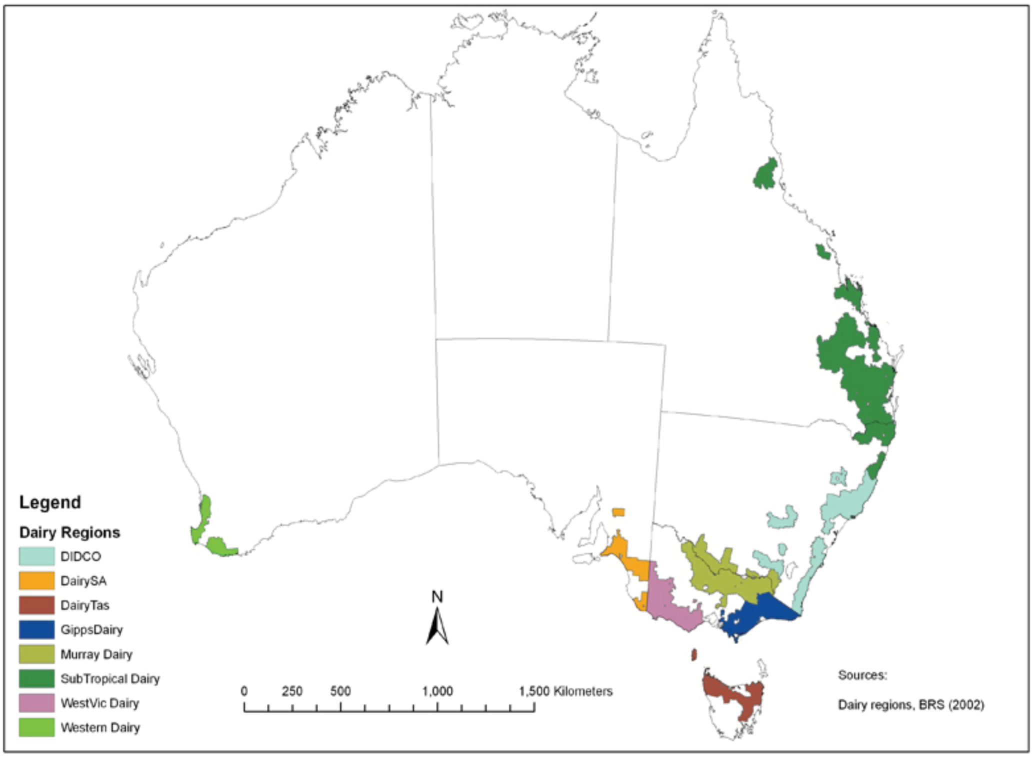
The on-farm sector also contributes to the wider economy through the effects of incomes earned from dairy production being spent in other sectors. This is a very important contribution to many regional communities within dairy farming areas.

Dairy Australia (2008) estimates that if the dairy industry is able to recover the one billion litres of milk production lost in the 2006–07 drought, it would produce an extra $300 million in farm-gate receipts, around 8000 dairy farming jobs and almost $1.6 billion in regional income (Dairy Australia 2008).

Dairy production

All states have a dairy industry that supplies fresh milk to urban markets (see Figure 1). Milk production is concentrated in the southeast corner of Australia, with Victoria, South Australia and Tasmania accounting for almost 80% of national production. The majority of their milk is for manufacturing, whereas in New South Wales, Queensland and Western Australia the majority of milk is produced for the fresh market. Nationally, more than 20% of production is drinking milk and almost 80% is for manufacturing.

Figure 2 Australian dairy land use



Source: BRS (2002)

Australia's milk production is strongly seasonal, with October having peak production and June the lowest production. The seasonality reflects the pasture base of production. In coastal areas, pastures generally depend on natural rainfall, whereas in inland areas the industry is highly dependent on irrigation.

As at June 2007, there were 8055 registered dairy farms (see Table 1). The number of farms has contracted each year and has declined by 63% since 1979–80 and 32% since 2000–01.

Table 1 Number of registered dairy farms, number of dairy cows ('000 head) and milk production (million litres)

Year	1979–80	1989–90	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07[a]
Farms[b]	21 994	15 396	12 896	11 839	11 048	10 654	9 611	9 243	8 844	8 055
Cows[c]	1 869	1 698	2 171	2 176	2 123	2 050	2 038	1 942	1 881	1 800
Milk production	5 430	6 262	10 847	10 547	11 271	10 328	10 076	10 127	10 089	9 583
Litres per cow	2 905	3 789	4 996	4 847	5 309	5 038	4 944	5 215	5 395	5 324

a preliminary results
b Source: Dairy Australia (2007a)
c Source: ABARE (2007a)
Note: Dairy cow numbers are cows in milk or dry as at 31 March before 1999–00 and 30 June thereafter. Excludes heifers and house cows.

The national herd of 1.8 million milking cows in 2006–07 was around the same level as in 1979–80, although declined from 2.2 million in 2000–01 due to two severe droughts. The total number of dairy cattle, including heifers and home cows, reached a peak of 3.2 million in 2000–01, but declined by around 16% to an estimated 2.7 million at 30 June 2007.

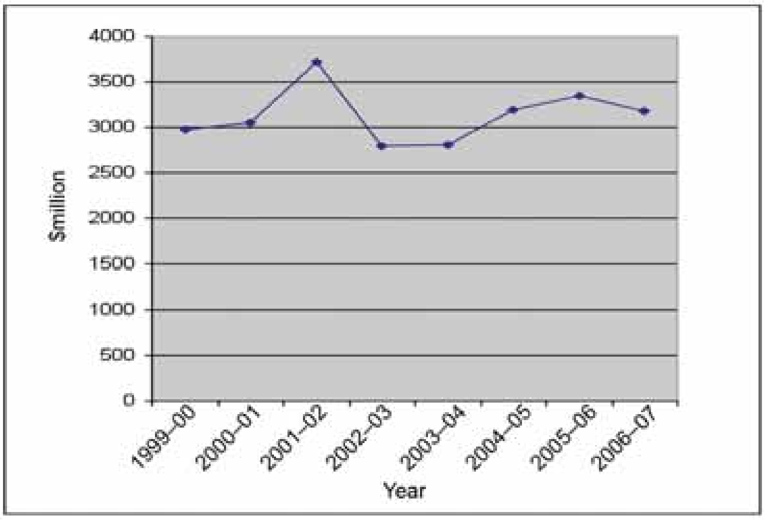
Total milk production for 2006–07 is estimated at 9.6 billion litres. While production has been affected by drought, the average annual level of milk production from 2000–01 to 2006–07 was around the same level as in 1999–00 and substantially above the levels of 1979–80 and 1989–90.

The main factors that allow the industry to increase its productive capacity over time are farm amalgamations and improved farm management practices. Milk yield per cow was 83% higher in 2006–07 than in 1979–80.

At the national level, the desired outcome for an industry is that its net contribution to the economy is positive and increasing over time. In the absence of net value of production statistics (ie aggregate farm business gross revenue generated from the production of agricultural goods minus production costs), gross value of production (GVP) is an indicator of the industry's income and productive capacity.

The output performance of the dairy industry from 1990–91 is shown in Figure 3.

Figure 3 Dairy industry gross value of production, 1999–00 to 2006–07



Source: ABARE (2007a)

The dairy industry is Australia's fourth largest agricultural industry (after grains, beef and horticulture) with a GVP in 2006–07 of $3.2 billion. This was 5% lower than in 2005–06 due to the impact of drought, but the trend over the past 20 years has been significantly upward. Since 2000, climate variability has been the major constraint to production growth with severe droughts in 2002–03 and 2006–07.

The immediate future for dairy farmers is clouded with a sense of increased risk among farmers and uncertainty as to what changes are needed to farm business systems to secure the industry's competitive base (Dairy Australia 2008). The 2006–07 season saw a substantial reduction in farm incomes, coupled with a rise of almost 50% in average farm debt. This meant the industry entered 2007–08 in a state of increased uncertainty.

Dairy Australia is focusing on an early recovery in farmer profitability to ensure the industry can take full advantage of emerging opportunities in high return markets.

Farmers are acutely aware of the need to make dairy farming practices adaptable, resilient and sustainable for themselves and their local communities in the face of climate change and variability (Dairy Australia 2008).

Dairy exports

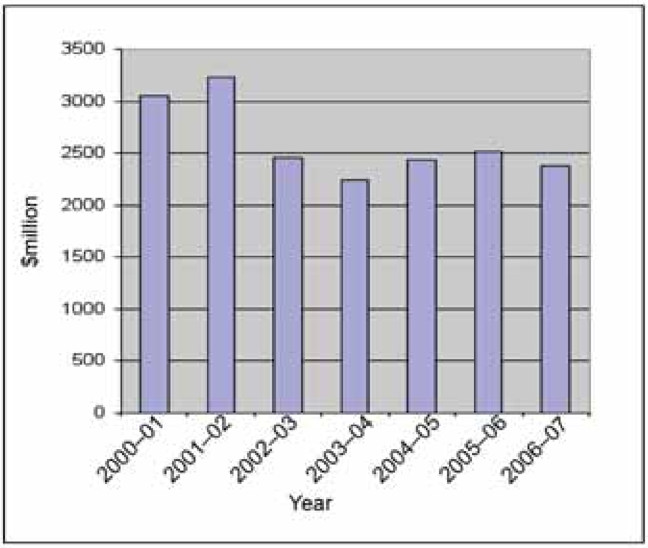
Australians consume around 2 billion litres of milk per year, which is just over 20% of annual milk production. A further 30% of milk production is consumed domestically in the form of products such as cheese, dairy spreads and yoghurt.

The industry relies on overseas markets to sell 50% of its production and future growth in the industry will depend on increasing the value of exports. Australia's exports comprise cheese, butter and butterfat, skim milk powder, casein, whole milk powder and other products including fresh milk. The main export markets are Japan, Southeast Asia, Saudi Arabia, the United States, New Zealand and South Korea. The Asian and east Asian markets accounted for 66% of the value of Australia's exports in 2006–07 (see Figure 4).

Australia is a significant player in world dairy trade. It ranks third behind New Zealand and the European Union. Australian production accounts for only around 2% of world milk production, but its exports represent around 12% of world dairy trade.

In 2006–07, the industry's exports were valued at $2.4 billion and have averaged $2.6 billion over the seven years from 2000–01.

Figure 4 Value of exports of dairy products, 2000–01 to 2006–07



Source: ABARE (2007a)

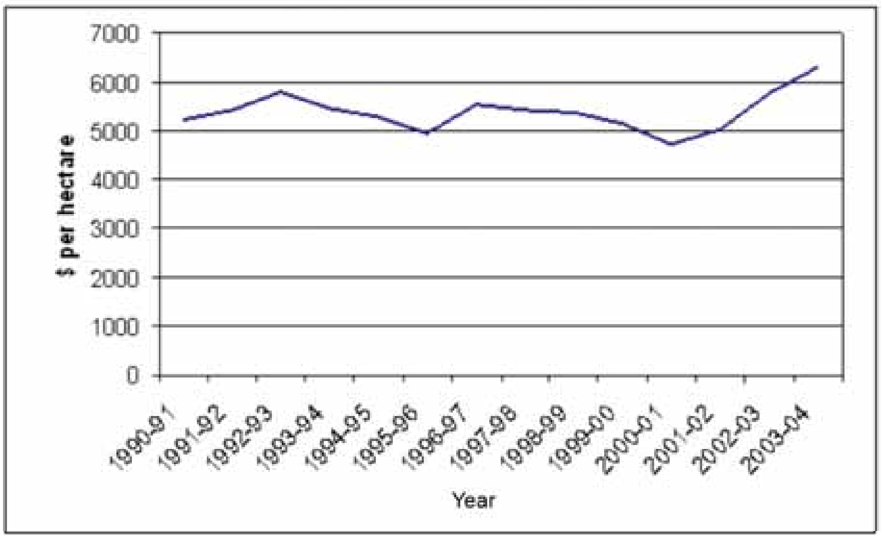
Dairy Australia expects that, for some time, reduced milk production and growing domestic demand will constrain future export volumes to levels below the 2001–02 peak. It predicts world dairy demand and trade will grow steadily in an increasingly competitive global market for dairy commodities. The industry's strategy is to support Australian exporters to shift their product mix towards value-added, higher-return product lines and new dairy components (Dairy Australia 2008).

Net worth

The value of industry assets or wealth can be measured as net worth (ie the total value of the industry's assets minus the value of its liabilities). The desired economic position of an industry is that its net worth is positive and increasing over time. Rising net worth reflects increasing capacity of the industry to generate future income and to attract investment.

Signposts uses land value as an indicator of net worth as land is often the major single asset of dairy farmers. Other indicators are the value of farm capital and farm equity (the value of 'owned' capital, less farm business debt) per farm as measured in the Australian Bureau of Agricultural and Resource Economics (ABARE) farm surveys.

Figure 5 Land value for dairy farms



Source: ABARE (2005), Carlisle (2007a)

Figure 5 shows land values declining over the period 1996–97 to 2000–01 and then rising sharply. The increased land value in many dairying regions has raised the total value of farm capital from $1.3 million in 2000–01 to an estimated $3.2 million in 2006–07 (see Table 2). This has more than offset increases in farm debt. This has maintained farm equity ratios at a relatively high average level of 83% during the period, rising to 85% in 2004–05. The rate of return including capital appreciation averaged 8% over the same period largely due to the rising land value.

Table 2 ABARE farm survey results for dairy farms, average per farm

	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06[a]	2006–07[b]
Farm capital ($ million)	1.3	1.6	1.9	2.05	2.3	2.8	3.2
Farm debt ($ million)	0.237	0.298	0.328	0.235	0.335	0.443	0.494
Equity ($ million)	1.1	1.4	1.5	1.7	2.0	2.4	2.7
Equity ratio (%)	82	82	82	83	85	84	84
Rate of return (%) (excluding capital)	3.1	5.7	–0.7	0.9	2.5	2.3	0.0
Rate of return (%) (including capital appreciation)	5.1	10.8	7.2	9.9	8.0	7.0	9.9

a preliminary results
b provisional results
Source: ABARE (2007b), ABARE (2008)

However, the financial performance of dairy farms is expected to have deteriorated in 2006–07 with lower total farm receipts and higher cash costs. Farm cash incomes are likely to have fallen by around 60% nationally and total farm debt is likely to have increased by 12%. Rates of return excluding capital appreciation are likely to have been around zero and among the lowest on record.

The increased land value in dairying regions since 2000–01 has raised the total capital value of farms and more than offset increases in farm debt, thereby maintaining farm equity ratios at a relatively high annual-average level of 83% between 2000–01 and 2005–06, rising to 85% in 2004–05. The net worth position of farms is likely to have deteriorated in 2006–07 due to the drought.

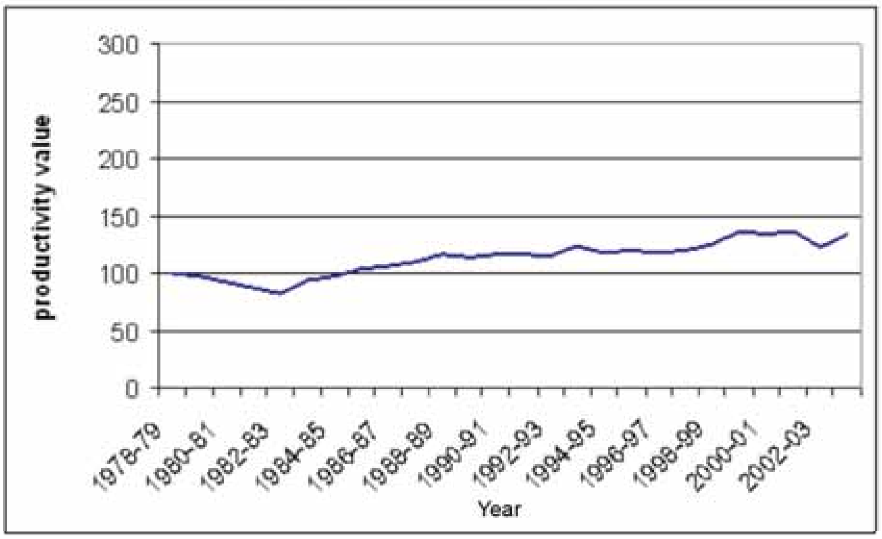
Productivity

ABARE (2007b) shows that, over the past three decades, prices received for agricultural commodities have failed to keep pace with the prices paid for agricultural inputs. Increasing productivity has been necessary to offset declining terms of trade and to maintain the viability of agricultural industries.

Total-factor productivity is a measure of on-farm productivity that compares output with the combined use of all resources and is expressed as an index. Total-factor productivity is frequently used as an indicator of industry performance because it measures the effect on output of factors such as technological advances, improvements in management and exploitation of economies of scale.

Total-factor productivity in the dairy industry has increased steadily since the early 1980s prior to a substantial decline in the 2002–03 drought (see Figure 6).

Figure 6 Productivity of Australian dairy farms



Source: ABARE (2005), Carlisle (2007b)

The average rate of growth in on-farm total-factor productivity was 1.8% a year in the decade to 1994–95, but it then slowed to 1.0% per year in the decade to 2003–04 (see Table 3). This occurred as a result of dairy farmers increasing their use of inputs to raise production; however, production did not rise as fast as the growth in inputs. For example, increases in grain feeding in 2001–02 were not matched by corresponding increases in milk output.

Table 3 **Productivity — annual growth rates for Australian dairy farms**

	Over two decades 1984–85 to 2003–04 (%)	First decade 1984–85 to 1994–95 (%)	Second decade 1994–95 to 2003–04 (%)
Terms of trade			
Prices received	1.9	4.4	0.3
Prices paid	3.0	4.2	2.3
Terms of trade	–1.1	0.3	–2.3
Productivity growth			
Outputs	5.3	5.3	5.3
Inputs	4.1	3.5	4.4
Total factor productivity	1.2	1.8	1.0

Source: Carlisle (2007b)

Industry productivity has grown through new investment. Between 1998–99 and 2001–02 and because of high farm incomes, there was a steady increase in the proportion of dairy farms acquiring land and expanding the scale of their farm operation. New investment in plant, machinery, vehicles and improvements also increased over this period (ABARE and GRDC 2007).

This pattern of new investment was interrupted by the drought in 2002–03 and subsequent lower incomes. The level of land acquisition and capital investment resumed once dairy farmers recovered from the drought, but both have been impacted again in 2006–07.

The adoption of new technologies by dairy farmers over the past decade has resulted in increased productivity on dairy farms. These technologies particularly apply to shed management, supplementary feeding, improved dairy cattle genetics, pasture management and water management. The impact of two severe droughts in quick succession may constrain new investment, although currently the industry is experiencing a positive international market and high dairy prices.

The environmental contribution

Signposts addresses the environmental contribution or impact of agricultural industries on natural assets and systems. In agricultural terms, the natural assets of primary interest are the atmosphere, climate, land, water and plants. These elements are highly interlinked and, in combination, determine the capacity of farms to produce food, ingredients, fibre, fuel and ecosystem services such as biodiversity conservation and greenhouse gas (GHG) sequestration.

David and Leanne Hank's dairy farm near Harvey, WA. David runs a centre pivot on 10 hectares with moisture probes on his pasture and is comparing flood irrigation with the centre pivot. (Photo by Arthur Mostead 2004)

The Signposts framework for dairy farming maps the industry's environmental contribution in terms of natural assets it holds and manages and its contribution to natural systems extending beyond the dairy industry (particularly the water cycle and atmosphere).

Natural assets to produce food and other products

The components of the industry's natural assets relating to the production of food and other products comprise climate, soil and biota (total animal and plant life in an area):

- Climate — most elements of climate are critically important to dairy farming. Their relationship to seasonal conditions determines the growth and quality of pasture and fodder crops. Rainfall is by far the most significant climatic factor in Australian dairy production, as evidenced by the impact of drought on production and profitability.
- Soil — includes both fertility issues (soil nitrogen and phosphorus) and degradation issues (dryland and irrigation-induced salinity and soil acidity).
- Livestock — the dairy cattle genetic material that is available to the industry for the purpose of breeding.
- Pasture — the plant genetic resources that are available to the industry for the purpose of plant breeding for feed production (pastures and forage plants).
- Pests, weeds and diseases — their presence on land held by the industry that may affect the health and productivity of dairy cattle. The occurrence of pests, weeds and diseases degrades the land and reduces its value by decreasing its capacity to produce food. In a survey of natural resource management (NRM) practices under the Dairying for Tomorrow program, Watson (2006) found that noxious weeds affect more than one-third of dairy farms and are the major land issue currently being faced in all regions.

Signposts addresses water issues in terms of the contributions to natural systems extending beyond the dairy industry. Water is a natural asset used by the dairy industry and is an essential component of the industry's capacity to produce milk and ecosystem services. This report considers water in terms of the capacity of the dairy industry to produce food and other products.

Natural assets to produce ecosystem services

There are many aspects to the capacity of an industry to provide ecosystem services. Determining these is a developing area that requires further research and knowledge. In some cases, markets are starting to be developed which, over time, may be attractive for dairy farmers. At present the compelling issues in the minds of consumers and the general community are the contribution of the dairy industry to the conservation of biodiversity and GHG emissions — or conversely GHG sequestration.

Signposts notes that an increase in the capacity of the land to provide ecosystem services increases the value of the industry's natural capital and is, therefore, a positive contribution to ESD. The current dairy industry profile reports on the provision of biodiversity conservation services.

The Signposts profile also addresses GHG emissions, but in the context of contributions to natural systems extending beyond the industry. This report addresses both dairy-farming GHG emissions and sequestration under the section on ecosystem services.

Dairying for Tomorrow

Dairying for Tomorrow is a national dairy industry scheme with resources and programs that aim to ensure Australian dairy farmers remain viable. The program is led by Dairy Australia. One such program delivered by Dairying for Tomorrow is DairySAT.

DairySAT

Launched in 2005, DairySAT is a self-assessment planning tool used to measure environmental management. It identifies below-standard ecological practices on farm, and enhances farm management in nine key areas — effluent management; irrigation; nutrients; soils; chemicals; farm wastes; pests and weeds; biodiversity; and air and energy.

Funded by state Departments of Primary Industries and Dairy Australia, DairySAT has received industry-wide support from dairy farmer groups and milk companies.

DairySAT offers a detailed checklist on best environmental practice, photographs of environmental issues, legal requirements and references for further information. It develops an individual documented, auditable environmental management system (EMS) for a dairy producer. This document is used to demonstrate credentials and accountability to the wider community.

Since 2005, approximately 17% of dairy-farm businesses have completed DairySAT. Of these, 84% are planning to, or already have, made changes to their management practices to improve environmental and productivity outcomes.

A number of South Australian producers are using DairySAT to lift their profitability, improve their environmental management and benchmark against industry best practice. These producers focus on:

- maintaining natural vegetation for wildlife
- water management
- natural resource efficiency.

DairySAT case studies are presented in relevant sections below.

Natural assets of dairy farming lands to produce food

This section assesses soil and water assets.

Soil

In a survey on NRM for the Dairying for Tomorrow program, Watson (2006) found that inroads have been made in several key land-management issues on dairy farms. These include soil acidity, irrigation-induced salinity, erosion, surface crusting or soil compaction, and acid sulfate soils. The main soil aspects considered in the Signposts framework are fertility (nitrogen and phosphorus levels) and degradation (salinity and acidity) issues.

Soil fertility is the result of the combined effects of three major interacting components: the chemical, physical and biological characteristics of the soil. Australian soils are generally shallow and infertile in terms of chemical and biological components. Therefore dairy farmers need to ameliorate their soils through application of fertiliser, particularly nitrogen and phosphorus.

Apart from the environmental issues of fertiliser use, rapidly rising fertiliser prices are causing cost pressures on farm budgets and profitability (Norton and Srivastava 2007a).

Nitrogen is an important macronutrient in soil and essential to pasture growth and high yield. In the soil it is either part of organic matter and unavailable for plant uptake, or mineralised (as nitrate or ammonium ions) and available to plants. In most soils, more than 95% of the nitrogen is present in organic form.

Soil nitrogen can be measured as total nitrogen and 'available' nitrogen, the latter being the component of total soil nitrogen that can be absorbed by plants. There are few data on available nitrogen, therefore total nitrogen is used by Signposts as the indicator of the nitrogen 'health' of soil for dairy production. Generally, plant yield is positively correlated with total soil nitrogen.

Table 4 shows the area and proportion of dairy-farming land with total soil nitrogen greater than 0.2% for Dairy Australia regions. For all regions, the proportion is 54% and it varies greatly from 97% for DairyTas to only 12% for Murray Dairy. DairySA (26%) and Western Dairy (41%) also have the majority of their dairy area with total soil nitrogen of less than 0.2%.

Summary measure

Signposts uses the proportion of land with total soil nitrogen above 0.2% as a summary measure of the nitrogen status of soils. Dairy production generally takes place in high rainfall or irrigation areas, and moderate to high soil-nitrogen levels are required to ensure nitrogen does not become a limiting production factor. The 0.2% level for total soil nitrogen is considered moderate to high by the Audit (NLWRA 2001).

Table 4 Area of dairy farming land with total soil nitrogen greater than 0.2%, by Dairy Australia region

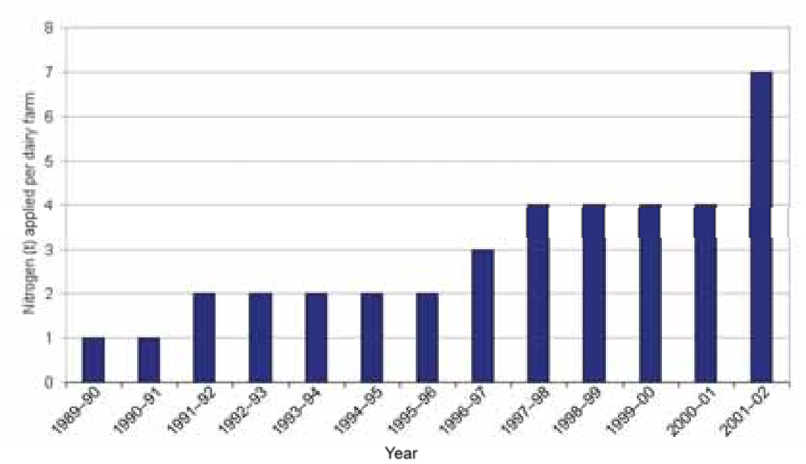
Dairy region	Total area of dairy land (ha)	Area of dairy land with total N > 0.2% (ha)	Proportion of dairy land with total N > 0.2%
DIDCO	400 800	253 100	0.63
DairySA	223 800	58 000	0.26
DairyTas	168 400	163 000	0.97
GippsDairy	397 700	328 000	0.82
Murray Dairy	813 200	95 000	0.12
Subtropical Dairy	597 400	344 200	0.58
WestVic Dairy	404 700	384 400	0.95
Western Dairy	121 800	50 400	0.41
Total	**3 127 800**	**1 676 100**	**0.54**

ha = hectare; N = nitrogen; DIDCO = Dairy Industry Development Company
Source: NLWRA (2001)

Nitrogen fertilisation is a widely used practice in the dairy industry, particularly for pastures based on ryegrass, tall fescue and kikuyu under irrigation or in high rainfall areas. Additional nitrogen enables dairy farmers to maximise the growth potential of these grasses and increase feed-protein levels. This allows farmers to meet feed requirements and achieve higher productivity more easily than if relying solely on nitrogen fixed by pasture legumes or the comparatively low natural fertility of most Australian soils.

Figure 7 shows the estimated total annual amount of nitrogen (tonnes) applied on an annual basis per dairy farm to pastures from 1990 to 2002. This shows a rapid increase in use of nitrogenous fertiliser in 2001–02, a peak year for milk production.

Figure 7 Total annual amount of nitrogen (tonnes) applied per dairy farm from 1990 to 2002



Source: Norton and Srivastava (2007a)

The main environmental risk of nitrogenous fertiliser use is eutrophication. This is an increase in the nutrient levels of natural waters causing accelerated growth of algae or water plants that may kill native aquatic flora and fauna. Nitrogen is highly soluble, particularly in its nitrate form, and can easily be leached into groundwater in sandy soils or carried with runoff into surface water bodies after rain or irrigation. This may occur if the applied nitrogen exceeds plant requirements, but actual losses also depend on factors such as soil type and pH, the crop grown, type of fertiliser applied, temperature and degree of soil cover.

Some nitrogen is lost to the air through volatilisation of ammonia. This is particularly the case with nitrogen from animal manure, surface application of urea or use of urea on alkaline soils. Volatilisation of ammonia is a contributor to acidification, or as nitrous oxide, it is a powerful GHG (NLWRA 2001).

Farmers can manage the risk of nitrogen runoff or leaching through soil testing and nutrient budgeting, pasture management and effective irrigation management. Timing of the fertiliser application and adjusting the amount applied to suit soil-moisture conditions, expected rainfall or scheduled irrigation events are crucial in avoiding negative environmental impacts.

Nutrient budgets that calculate all inflows and outflows of nutrients from each paddock or the whole farm area can help farmers to:

- attain an overview of the nutrient status of their farm
- match fertiliser needs to their production requirements
- together with soil and plant tissue tests, target specific fertiliser needs of different areas of the farm
- reduce the cost of over-fertilisation of some areas and increase returns from areas that need more fertiliser.

Watson (2006) found that urea and superphosphate are the most widely used fertilisers on Australian dairy farms and that more farmers are using ‘prescription blend’ fertilisers designed for the specific requirements of their farms.

The research results from the NRM survey (Watson 2006) show that between 2000 and 2006, dairy farmers became more ‘scientific’ in fertiliser management. A higher proportion of farms now:

- undertake soil testing (83%), tissue test (12%), seek advice from suppliers (44%) or consultants (38%) when determining the type and application of fertiliser
- conduct annual soil tests (39%), particularly on farms with higher stocking rates (53%) and higher rates of supplementary feeding (57%)
- prepare nutrient budgets (30%).

However, the survey found there was little change in the proportion of dairy farmers actively preventing fertiliser loss. On surface (flood) irrigated farms, loss prevention is mainly through reuse systems and avoiding fertiliser application on bottom bays. Spray irrigators tend to fertilise after irrigation to prevent loss. The rapid increase in fertiliser costs in 2007 and 2008 may result in more farmers ensuring loss of fertiliser is minimised.

Like soil nitrogen, phosphorus is also a macronutrient important to crop yields. Phosphorus can be added to the soil through the application of superphosphate fertiliser to maintain the productive capacity of the soil. However, only a small proportion of total phosphorus is accessible to plants (1–4%) and its availability is highly dependent on soil pH (Norton and Srivastava 2007b).

The bulk of soil phosphorus exists in three general groups of compounds: organic phosphorus; calcium-bound inorganic phosphorus; and iron- or aluminium-bound inorganic phosphorus. Most compounds in these groups have very low solubility and are not readily available for plant uptake.

Phosphorus in soil is usually available to plants as inorganic phosphate ions (HPO42 and H2PO42) and sometimes as soluble organic phosphorus. The HPO42 anion dominates in strongly acidic soils, while the H2PO42 anion dominates in alkaline soils. Both anions are important in near-neutral soils.

Summary measure

Signposts uses the level of phosphorus in the topsoil as an indicator of available phosphorus, and the proportion of land with total soil phosphorus above 0.02% as the summary measure of the phosphorus ‘health’ of dairy farming soils. The Audit (NLWRA 2001) defines 0.02% as a medium to high level of total soil phosphorus.

Table 5 shows the area and proportion of total dairy-farming land with total soil phosphorus greater than 0.02% for Dairy Australia regions.

Table 5 Area of dairy farming land with total soil phosphorus greater than 0.02%, by Dairy Australia region

Dairy region	Total area of dairy land (ha)	Area of dairy land with total P > 0.02%	Proportion of dairy land with total P > 0.02%
DIDCO	400 800	250 900	0.63
DairySA	223 800	83 600	0.37
DairyTas	168 400	125 100	0.74
GippsDairy	397 700	169 300	0.43
Murray Dairy	813 200	354 200	0.44
Subtropical Dairy	597 400	554 800	0.93
WestVic Dairy	404 700	255 500	0.63
Western Dairy	121 800	6 700	0.06
Total	**3 127 800**	**1 800 100**	**0.58**

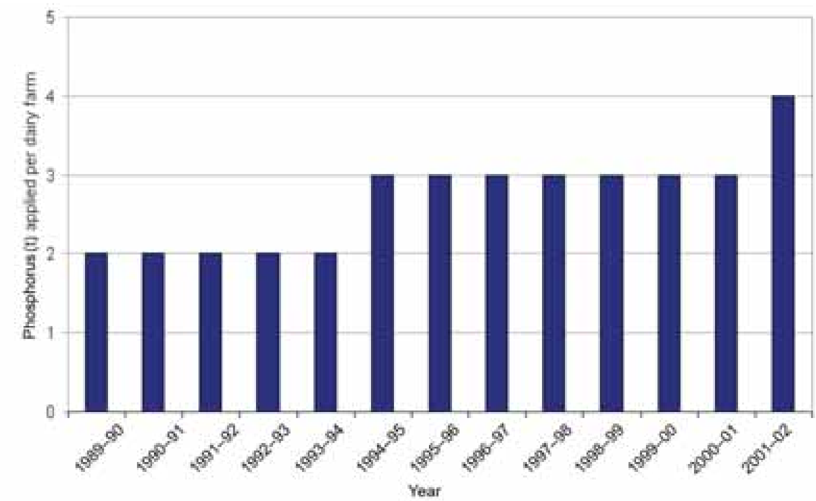
ha = hectare; P = phosphorus; DIDCO = Dairy Industry Development Company
Source: NLWRA (2001)

For all regions, the proportion is 58% and it varies greatly from 93% for Subtropical Dairy to 6% for Western Dairy. DairySA (37%) and Murray Dairy (44%) also have the majority of their dairy areas with total soil phosphorus of less than 0.02%.

Phosphorus fertiliser is used to help increase pasture growth, particularly of clovers. Without the addition of phosphorus to soils, farmers would not be able to maintain high production levels from the natural release of phosphorus from the soil. Best practice requires that feed requirements from pasture production are calculated before applying additional phosphorus.

Figure 8 shows the amount of phosphorus applied per farm from 1990 to 2002. It illustrates the large increase in 2001–02, a year of peak milk production. However, in the NRM survey, Watson (2006) found a significant reduction in the proportion of dairy farmers using superphosphate but an increase in the proportion using prescription blends.

Figure 8 Total annual amount of phosphorus (tonnes) applied per dairy farm from 1989–90 to 2001–02



Source: NLWRA (2001a)

Environmental concerns with phosphorus centre on the risk of eutrophication. This risk is not as high as for nitrogen because phosphorus is bound to clay and organic particles in the soil. Consequently, it is not as soluble as nitrate and does not easily leach. The main risk is through runoff that transports sediment off site. Farmers can manage this risk by annual soil testing and applying the amount of fertiliser that matches plant needs.

Salts are distributed widely across Australian landscapes. However, dryland salinity becomes a problem when soils and vegetation are degraded by the discharge of saline groundwater. This commences when the watertable reaches within two metres of the ground surface (Whitworth et al 2007a).

Australia's natural salinity has been exacerbated by clearing large areas and replacing native vegetation with shallow-rooting crops which do not use as much water. This has meant that water from rainfall has entered the watertable causing it to rise and to mobilise salt, and the salt rises to the land surface. Once watertables are near the surface, salt stored in the soil or groundwater may be concentrated through transpiration by plants and evaporation. If this occurs in the root zone, it can affect plant production.

Case study 1 Resource efficiency

Kym and Kate Bartlett, Jervois, South Australia

Kym and Kate Bartlett are focused on improving irrigation water efficiency, reducing soil degradation and managing effluent to preserve their property for their children.

They joined the Lower Murray Stewardship Program in 2003–04. This program used DairySAT to develop an action plan and monitoring process for NRM.

The Bartlett's short-term aim is to improve irrigation water use by 50% and cut nitrogen and phosphorus losses by 70%. They aim to do this by reducing surface runoff on their 343-hectare dairy farm.

They have graded laneways and the dairy holding yard to direct effluent into the farm catchment system, they have upgraded check banks and built a clay-lined channel for water delivery as part of an irrigation-rehabilitation program. This has substantially reduced water leakage.

The family endorses renewable energy and their highland paddock fencing is solar powered which reduces overheads.

They undertake Dairy Audits and an Environmental Improvement Program Audit in order to license subsurface drainage water returns to the river.

Source: Watson (2006)

Summary measure

Dryland salinity is not a significant issue for the dairy industry according to the Signposts salinity risk indicator (ie the area identified as 'high-salinity risk or hazard'). These areas were determined for the year 2000 using assessments of groundwater levels and trends, groundwater salinity, and salinity outbreaks. Where data were not available, the key drivers of salinity, such as geological features, land use and climate, were used to determine high risk or hazard areas (NLWRA 2001).

It is important to note that the indicator is based on an assessment of risk, rather than an actual measurement of soil salinity. From this, Signposts has derived a summary measure for dryland salinity that is the proportion of dairy farming land **not** assessed as having a high-salinity risk. Table 6 shows the results by Dairy Australia regions.

Table 6 shows that 98% of dairy farming land is not assessed as 'high salinity or hazard risk'. Western Australia is the sole dairy region that has a significant proportion of dairying land (23%) categorised as high-salinity risk. This is due to the low-gradient topography and geology that inhibits groundwater flow and water permeating to a greater depth.

The main options for managing dryland salinity are to reduce water recharge and to manage discharge sites through the conservation of existing vegetation and revegetating appropriate areas.

Table 6 Area of land under dairy farming that was assessed as 'high-salinity risk' in Dairy Australia regions

Dairy region	Total area under dairy assessed as 'high-salinity risk or hazard' (ha)	Total area under dairy (ha)	Summary measure (proportion of dairy land not assessed as 'high-salinity risk')
DIDCO	2 534	408 800	0.99
DairySA	1 300	231 700	0.99
DairyTas	225	180 700	1.00
GippsDairy	1 800	420 700	1.00
Murray Dairy	9 162	861 000	0.99
Subtropical Dairy	14	607 800	1.00
WestVic Dairy	6 000	442 500	0.99
Western Dairy	28 400	125 300	0.77
Total	**49 435**	**3 278 500**	**0.98**

ha = hectare; DIDCO = Dairy Industry Development Company
Source: NLWRA (2001b)

Irrigation-induced salinity

This is a significant issue for the dairy industry. Irrigation-induced salinity can result from both overirrigation and underirrigation. In the case of overirrigation, water percolates beyond the root zone into the watertable. It may also be caused by leakage from earthen distribution channels and water-drainage systems. Norton (2007a) refers to research that shows there have been substantial rises of watertables under most irrigation areas in Australia. Where ground-watertables have reached 1–3 metres below the soil surface, there is a high risk of salinisation of the root zone and detrimental effects on plant production.

In the case of underirrigation, salts accumulate in the upper soil layers over time because insufficient water is applied to leach the salts below the root zone. This effect is considered to be of less importance than salinity due to overirrigation, however it is flagged as a potential problem following an extended drought period and restricted water allocations.

NRM surveys in 2000 and 2006 under the Dairying for Tomorrow program (Pomfret 2000, Watson 2006) measured the proportion of dairy farmers who considered irrigation-induced salinity to be a problem on their farms. Results show there was a reduction in the proportion of respondents identifying it as a problem from 15% in 2000 to 10% in 2006.

Based on the survey results, irrigation-induced salinity remains an issue in northern Victoria, South Australia and Western Australia. However, fewer respondents from Murray Dairy and Western Dairy nominated it as a problem in 2006 compared with 2000. Tasmania was the only region where a small increase was noted.

Dairying for Tomorrow addresses both irrigation-induced and dryland salinity in its strategies to improve NRM in the dairy industry. Improving water use efficiency is a key objective in overcoming irrigation-induced salinity. This can be achieved through improving irrigation infrastructure, converting to more efficient irrigation systems, improving irrigation scheduling and establishing water reuse.

Watson (2006) found that nationally, between 2001 and 2006, there had been a reduction of 7% in dairy farmers using flood irrigation, an increase of 2% using spray irrigation and an increase of 4% using both systems. The majority of survey respondents (62%) stated that their irrigation systems are manual with no automation. Almost one third (31%) of irrigation systems had timers and the remainder were wireless, computer driven or another system. Spray irrigators were significantly more likely than flood irrigators to have some form of automation. A high number of dairy farmers (78%) relied on experience, while 34% followed a regular schedule, particularly with flood irrigation.

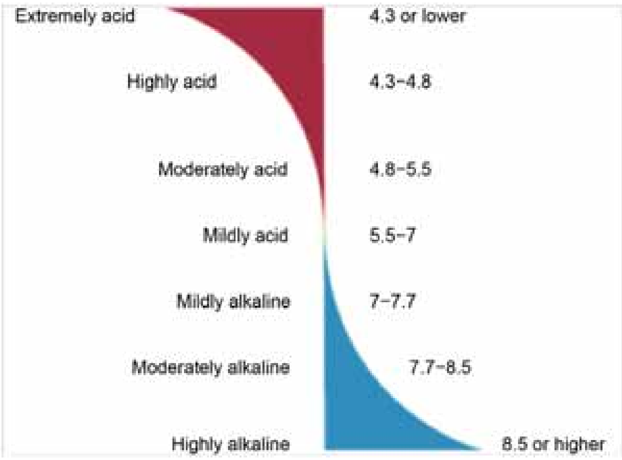
Use of a device to measure soil moisture was higher in Tasmania (33%) and South Australia (29%), and on farms with very large and large herds compared with farms with medium-sized and small herds. In addition, it was higher for farmers who were members of environmental groups (12%) compared with non-members (4%). In 2006, reuse systems were used on 86% of flood-irrigation farms and 14% of spray-irrigation farms. The average percentage of irrigated land draining into a reuse system was 50%.

Soil acidity

Soil acidification (the accumulation of acid in the soil) is a natural process that may be accelerated by farming. Soil acidity affects the availability of nutrients and toxic elements (eg aluminium) in the soil that can limit plant growth and resulting pasture yields (Whitworth et al 2007b).

Acidity is measured by topsoil pH, with soils having a lower pH being more acidic as shown in Figure 9. A neutral pH is 7, and each pH unit below 7 is 10 times more acidic. Conversely, soils with pH values above 7 are progressively more alkaline (NLWRA 2001).

Figure 9 Soil pH range (pH measured in 0.1 M $CaCl_2$)



Source: NLWRA (2001)

While soils with a pH below 7 are considered to be acid, Signposts uses a pH of 5.5 or less as a threshold of acidity — below which there is increased likelihood of soil mineral degradation. This is associated with the loss of basic cations and a reduction in the cation exchange capacity of the soil that may lead to production loss.

A pH below 4.8 may cause significant limitations on plant growth due to increased solubility of toxic aluminium and manganese ions and fixation of phosphorus. Highly alkaline soils (pH above 8.5) are also considered undesirable for plant growth due to reduced solubility of a number of essential cations.

Table 7 shows soil pH for the Dairy Australia regions.

Table 7 Soil pH by Dairy Australia regions

Dariy region	Dairy land with pH ≥ 5.5 (ha)	Total dairy area (ha)	Proportion of dairy land with pH ≥ 5.5
DIDCO	11 200	400 800	0.03
DairySA	222 500	223 800	0.99
DairyTas	0	168 400	0.00
GippsDairy	100	397 700	0.00
Murray Dairy	690 000	813 200	0.85
Subtropical Dairy	171 600	597 400	0.29
WestVic Dairy	10 400	404 700	0.03
Western Dairy	12 600	121 800	0.10
Total	**1 118 400**	**3 127 800**	**0.36**

ha = hectare; DIDCO = Dairy Industry Development Company
Source: NLWRA (2001)

The Audit data suggest that soil acidity is a major issue in most dairy regions, apart from South Australia and to a lesser extent Murray Dairy. As shown by Table 8, the amount of soil affected varies considerably between regions.

Table 8 Area (in ha) in each pH class for dairy land, by dairy region

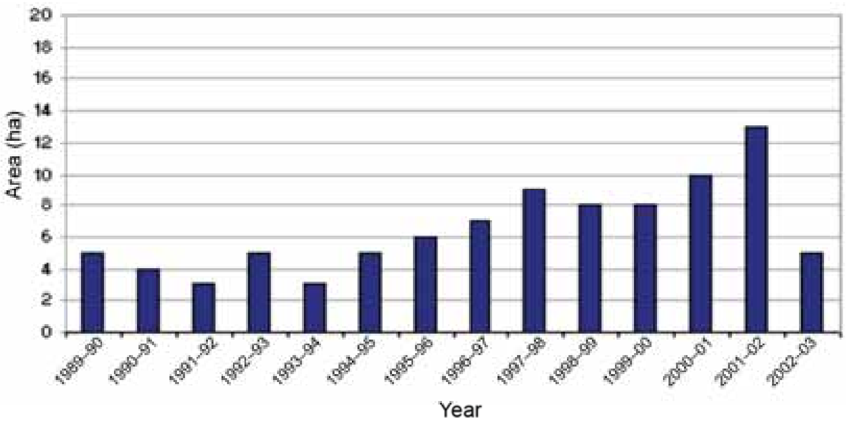
Dairy region	Ph class ≤ 4.3	4.3–4.8	4.8–5.5	5.5–7	7–7.7	7.7–8.5	≥ 8.5	Total dairy area (ha)
DIDCO	13 500	283 100	93 000	11 200	0	0	0	400 800
DairySA	0	200	1 100	71 800	90 800	59 300	600	223 800
DairyTas	7 000	131 700	29 700	0	0	0	0	168 400
GippsDairy	41 100	274 600	81 900	100	0	0	0	397 700
Murray Dairy	300	83 800	39 100	633 500	55 600	900	0	813 200
Subtropical Dairy	24 200	165 400	236 200	170 900	700	0	0	597 400
WestVic Dairy	37 800	347 000	9 500	10 300	100	0	0	404 700
Western Dairy	8 200	43 400	57 600	12 600	0	0	0	121 800
Total	**132 100**	**1 329 200**	**548 100**	**910 400**	**147 200**	**60 200**	**600**	**3 127 800**

ha = hectare; DIDCO = Dairy Industry Development Company
pH ≤4.3 = extremely acid
pH 4.3–4.8 = highly acidic
pH 4.8–5.5 = moderately acidic
pH 5.5–7 = mildly acidic
pH 7–7.7 = mildly alkaline
pH 7.7–8.5 = moderately alkaline
pH ≥8.5 = highly alkaline
Source: NLWRA (2001), Australian Soil Resources Information System

The NRM survey under Dairying for Tomorrow (Watson 2006) shows that the proportion of respondents mentioning soil acidity as a problem has significantly decreased since the 2000 survey. This is consistent across the regions, although acidity remains an important issue for dairy farmers in the northwest Upper Murray region (46% mentioning), South Australia Lakes (30%) and southwest Western Australia (29%).

Soil acidity in dairy pastures can be corrected by applying lime in the form of agricultural lime (calcium carbonate) or dolomite (calcium-magnesium carbonate). Figure 10 shows that the average area of land treated with lime increased substantially from 1989–90 to 2001–02, but declined sharply in 2002–03.

Figure 10 Average area limed per dairy farm, 1989–90 to 2002–03



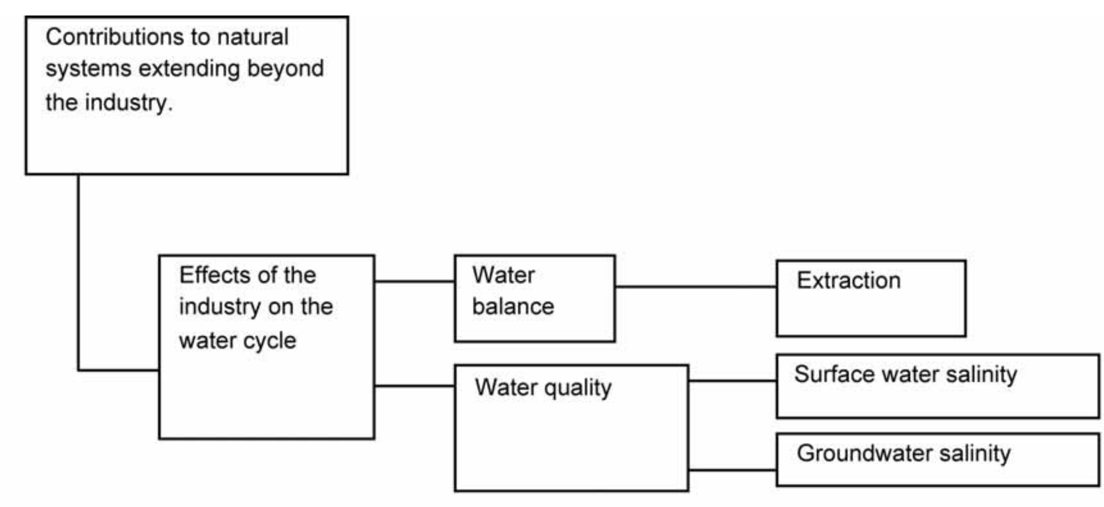
Source: ABARE (2005)

The disparity between data on the distribution of acid soils in Australian dairy regions and the NRM survey results, suggests that farmers are not universally aware of soil acidity problems. In addition, liming may be suspended due to adverse environmental conditions such as drought or due to the costs involved.

Water

Signposts addresses water in terms of the contributions to natural systems extending beyond the industry, as shown in Figure 11.

Figure 11 Effects of the industry on the water cycle



Source: Norton (2007b)

Water extraction from surface-water bodies and groundwater for irrigation is one of the most important factors influencing the national water balance. The Australian Bureau of Statistics' (ABS) National Water Account for 2004–05 (ABS 2006) showed agriculture accounting for 65% of the total national consumption for that year.

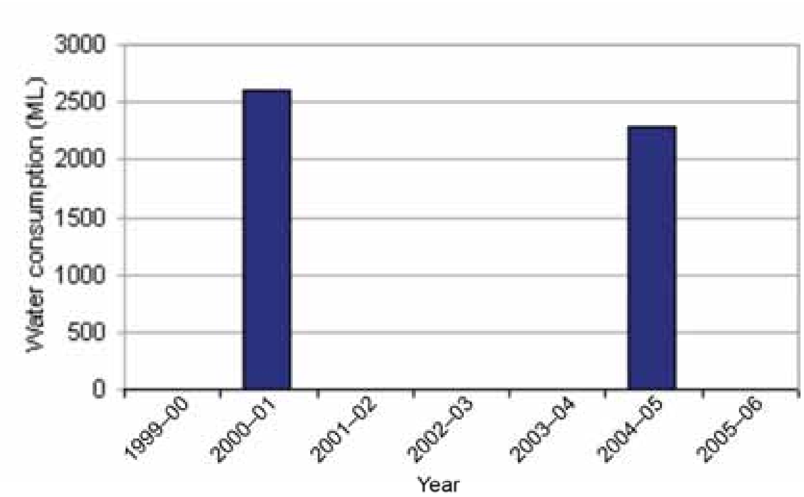
Water is essential to the dairy industry for livestock watering, cleaning and irrigation. In most areas, irrigation is required to supplement rainfall to support dairy's intensive production system and this depends on a secure and reliable irrigation supply.

Fifty-four percent of dairy farms are irrigated and there was a substantial increase in the percentage of dairy land irrigated from 43% to 56% (Watson 2006).

Signposts uses net water consumption as the indicator for water use in the dairy industry. Net water consumption is defined by ABS as water extracted by the industry itself, water extracted and distributed by water suppliers, and water from regional reuse schemes. It is identical to total-water extraction since there is no measured discharge from dairying to other users or back into water bodies.

Figure 12 presents the total estimated net water consumption for dairy farms for 2001–02 and 2004–05. This was 2 592 769 ML in 2000–01 and 2 275 603 ML in 2004–05. For both years, it equated to around 12% of national net water consumption. Within the agricultural sector, the dairy industry increased its share from about 17.3% of total consumption in 2000–01 to 18.7% in 2004–05.

Figure 12 Estimated total net water consumption for the dairy industry in 2000–01 and 2004–05



Source: ABS (2006), Norton (2007b)

At the farm level, Watson (2006) found that in a typical year irrigated dairy farms used an average of 454 ML of water. Some 93% of respondents considered their irrigation systems were efficient, but 25% intended to make changes to their systems over the following two years.

There are a range of management practices for improving water conservation and water-use efficiency in the industry. This includes modernising irrigation technology, such as converting from flood irrigation to centre pivots; installing soil-moisture monitoring and weather stations linked to controllers; improving irrigation scheduling; introducing pasture and fodder species that use less water; improving nutrient and pasture-grazing management; and providing adequate shade in summer to reduce consumption of water by cattle.

Based on the survey results, Watson (2006) concluded that farms using automated irrigation systems and soil-moisture monitoring use less water per hectare than those using manual systems. On 52% of dairy farms using spray irrigation, some form of automation had been adopted, but the percentage is much lower for flood-irrigated pasture.

Only 10% of farmers use a tensiometer to monitor soil moisture and 14% use visual assessment such as a shovel or stick in the ground. The degree of automation and technology applied in scheduling and managing irrigation may be influenced by soil type, the distribution system and whether there is a reuse system in place or not. For example, if a distribution (supply) system cannot respond with precision to orders for water, or if all runoff is captured for later reuse, there is less advantage in having sophisticated approaches to irrigation scheduling.

Most of the land where flood irrigation is used has been laser graded (79%) and water reuse has been adopted (74%).

Native plant regrowth after land clearing near St Lawrence, Queensland (photo by Arthur Mostead 2006)

Case study 2 Water efficiency

The Vivian and Schellen Families, Mannum, South Australia

First-class irrigation infrastructure is reducing water use, improving quality and raising pasture production at the farm trust run by the Vivian and Schellen families. They manage 380 dairy cows across three farms and have endorsed the DairySAT project.

Theirs was the first dairy property to complete the joint federal and state government rehabilitation project to renovate swamps on the Murray River banks.

The families have laser levelled the swamps to distribute water evenly and lift pasture growth. Paddocks that once used 3.5–4 ML per hectare irrigation, now only require 1.6–2.2 ML per hectare, thereby cutting use by 40%.

Reuse pumps have been installed to recycle water around the property and nutrients in runoff entering the Murray have reduced by up to 70%.

With the rehabilitation behind them, the families still conduct annual reviews of their DairySAT Environmental Management Plan, continue to construct fences to prevent animals entering the river and continue revegetation of their highland areas.

Source: Watson (2006)

Water quality refers to the chemical, physical and biological characteristics of water. These determine the suitability of water for particular purposes such as stock watering and irrigation. Water quality also affects the biodiversity of aquatic ecosystems. The quality of Australia's water resources is an issue of increasing importance due to climate variability and change, overextraction of water in some areas and pollution (Norton 2007c).

The dairy industry primarily impacts on water quality through:

- seepage or leaching of effluent to surface and groundwater, respectively
- water extraction from surface and groundwater resources
- return flows associated with irrigation
- erosion by water of dairy-farming land
- runoff, particularly after fertilising
- leaching of nutrients.

Signposts includes data on the effects of effluent and fertiliser on water quality.

Effluent

An environmental issue in the dairy industry is the potential loss of effluent from dairy sheds and feeding pads to waterways. Dairy effluent contains nutrients such as nitrogen and phosphorus, organic compounds, solids and pathogens. In addition, it may contain detergents, disinfectants, pesticides, antibiotics and hormones. All of these may have negative impacts on water quality if dairy effluent is poorly managed. The minimisation of the industry's off-farm environmental impacts is one of the key objectives of the Dairying for Tomorrow program.

Effluent management is usually regulated under state environmental legislation. Dairy farmers must maintain effective systems to contain all dairy effluent within their farm boundaries in order to fulfil obligations under environmental protection policies.

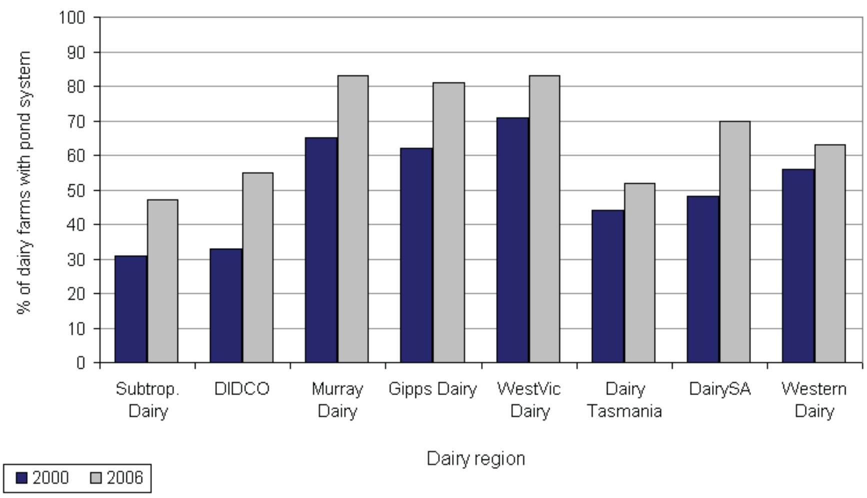
Watson (2006) found that 24% of dairy farms allowed effluent and runoff from feed pads to drain to paddocks. This was down from 56% in 2000 and is the result of increased use on dairy farms of pond systems (43%) and sump and dispersal systems (14%).

The survey also found that compared with 2000, effluent is retained on a higher proportion of farms by applying it to land (88% compared with 79% in 2000). Just under half of these farms apply effluent to the same area, but few test the nutrient composition of the effluent (16%).

Pond systems enable containment within the farm boundaries and permit reuse of effluent. They are the effluent-management system recommended by the Audit in its 'best practice' management principles for the dairy industry (NLWRA 2002).

There has been an increase in farmers reporting the use of a pond system from 54% in 2000 to 73% in 2006. The percentage of farms with pond systems for managing their milking-shed effluent increased for all regions. The Subtropical Dairy region had the lowest percentage, and for all Victorian regions it was greater than 80%.

Figure 13 The percentage of dairy farms with pond systems for management of milking-shed effluent in various dairy regions in 2000 and 2006



Source: Pomfret (2000), Watson (2006), Norton (2007d)

Watson (2006) concluded that while many dairy farmers have upgraded their effluent management systems, most (59%) believed there was room for improvement and 31% indicated an intention to make changes over the following two years.

Accounting for Nutrients

Australia's ability to supply itself with dairy products depends on the availability of water and nutrients. If nutrients leak, this can have an adverse affect on the environment.

Accounting for Nutrients is a new Dairy Australia project that develops a standardised nutrient-accounting framework for the dairy industry.

It will account for nutrient movement of nitrogen, phosphorus, potassium, sulfur, calcium and magnesium (see the following page on the Dairying for Tomorrow website http://www.dairyaustralia.com.au/content/view/214/108).

The purpose of Accounting for Nutrients is to develop a national standard to assist dairy producers to target their use of fertiliser. By reducing fertiliser application, dairy producers will lessen the environmental impact of nutrient imbalances in soils, improve pastures and lower their cost of production.

Presently, this project is undertaking research by measuring inputs, outputs and within-farm transfers of nutrients on 50 dairy farms across Australia. The results will provide a national framework of nutrient accounting for all producers in the Australian dairy industry.

Natural capacity to provide ecosystem services

The current Signposts profile reports on the provision of biodiversity services and impacts of the dairy industry on GHG emissions.

Biodiversity conservation

This relates to the capacity of land held by the industry to conserve native biodiversity. It is an issue of national and state consideration and is reflected in the National Strategy for the Conservation of Australia's Biological Diversity (the 'National Strategy'), and at state level through laws and regulations that include controls on land clearing (Norton 2007e).

The National Strategy has an objective to 'protect and restore native vegetation and terrestrial ecosystems'. A further objective relates directly to agriculture and is to 'achieve the conservation of biological diversity through the adoption of ecologically sustainable agricultural and pastoral management practices'.

Summary measure

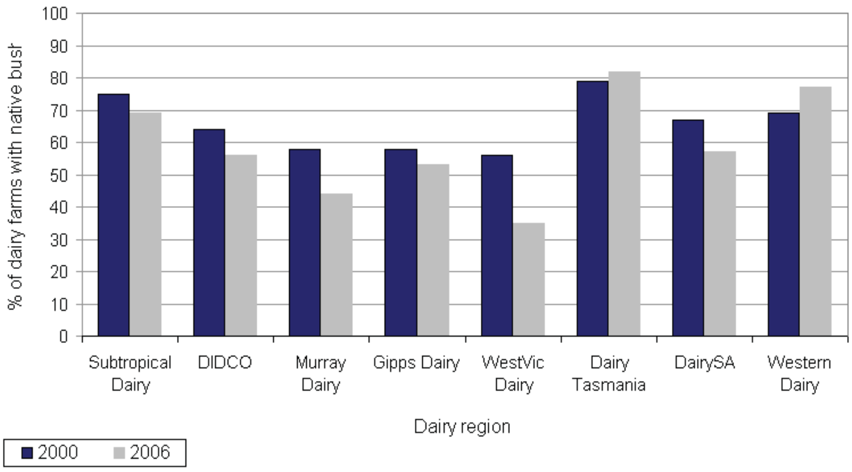
Signposts uses the proportion of dairy farms that have native bush as the indicator and a summary measure of biodiversity conservation, based on the 2000 and 2006 NRM survey results. The proportion of farms with native bush has declined from 64% in 2000 to 52% in 2006.

Figure 14 shows that there was substantial variation among regions. Six of the eight regions recorded reductions in dairy farms with native bush and the greatest decline occurred in the WestVic (21%) and Murray Dairy (14%) regions. The only increases were in the Western Dairy (8%) and Dairy Tasmania (3%) regions.

Significantly higher proportions of the following groups of farmers have remnant native vegetation:

- those with low stocking rates (64% of farms with less than one cow per hectare compared with 43% of farms with more than three cows per hectare)
- environmental group members (53% compared with 46% of non-members)
- dryland farmers (34% compared with 25% for irrigators).

Figure 14 The percentage of dairy farms with native bush by dairy region, 2000 and 2006



Source: Watson (2006)

As clearing of native vegetation is regulated by state governments, Watson (2006) explains that the fall in the percentage of dairy farms with native bush is most likely due to a shift in the type of land or landscapes that remained profitable for dairy production.

The 2006 NRM survey showed that, compared with 2000, where native bush remains on dairy farms it is more likely to be fenced off and stock access to waterways prevented. It was found that over the decade from 1996–2006, 55% of dairy farms implemented a revegetation program. Providing shelter for stock was a key driver for farmers to revegetate, although aesthetics and property value were also important. Most dairy farmers acknowledged that management of native vegetation could be improved (Watson 2006).

Among the 2006 survey respondents, 49% reported they had fenced their vegetation compared with 36% in 2000. A further 23% of 2006 respondents reported they had plans to fence their native vegetation within the following two years.

In the 2006 survey, there were significant differences between categories of dairy farmers who had fenced their native vegetation. These included:

- farmers with very large and large herds (86% compared with 50% with small- and medium-sized herds)
- younger farmers (71% of farmers aged 18–39 years compared with 64% of farmers aged 40–59 and 51% aged 61 years and over)
- dryland farmers (69% compared with 56% of irrigators)
- industry optimists (68% compared with 52% with negative outlooks)
- industry stayers (66% compared with 52% who were planning to leave the industry)
- environmental group members (64% compared with 55% of non-members).

Case study 3 Natural vegetation

Jill, Ian and Amy Williams, Parawa, Fleurieu Peninsula, South Australia

The Williams family, milking 600 dairy cows on two properties, is demonstrating the economic, environmental and social sustainability benefits of its EMS.

Developed five years ago, they trialled an early version with their employees to gather broader consideration on environmental risks and develop viable daily practices.

Since that assessment, the family and employees have improved their farm's appearance, environment and economic sustainability.

They have fenced off 65 hectares of wetlands, swamps and remnant vegetation. They have created a habitat for wildlife such as echidnas, skinks and lizards in these protected areas. This has reduced their erosion risk as stock is excluded from these areas.

They acknowledge three key future challenges for the family farm: ongoing legal compliance including new water regulations; climate risk management; and succession planning. However, the Williams family is confident about a sustainable future through continual reassessment of their EMS program, their awareness of future opportunities to increase the value of the property and increase their contribution to community projects.

Source: Watson (2006)

Greenhouse gas emissions and carbon sequestration

Signposts addresses the issue of the GHG emissions of the dairy industry as an environmental impact extending beyond the industry.

Sources of GHGs in agriculture that are relevant to dairy farming include:

- methane from cows digesting feed (enteric fermentation)
- nitrous oxide from soils, methane emissions from managed manure (when manure is stored in piles)
- carbon dioxide from the operation of fossil fuel machinery.

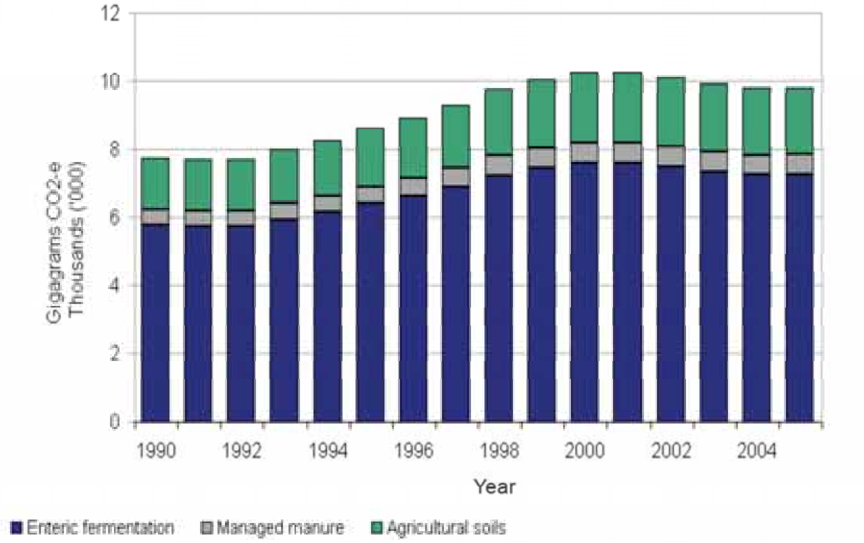
The dairy industry emitted 9824 gigagrams (9.8 million tonnes) of CO_2e in 2005, which was approximately 10% of total agricultural emissions. Around 74% of the industry's emissions are from enteric fermentation, less than 6% from managed manure and the remainder originates from soil (Lizzio and Whitworth 2007).

Indicator

Signposts' indicator of GHG emissions is gigagrams of CO_2e from enteric fermentation, managed manure and agricultural soils. Due to a lack of data or difficulties in attributing the emissions solely to dairy farming, energy consumption and land-use change are excluded from the indicator.

Figure 15 shows that emissions from enteric fermentation declined slightly after 2001, although there was a slight increase in 2005. This may be associated with reduced cattle numbers during the 2002–03 drought.

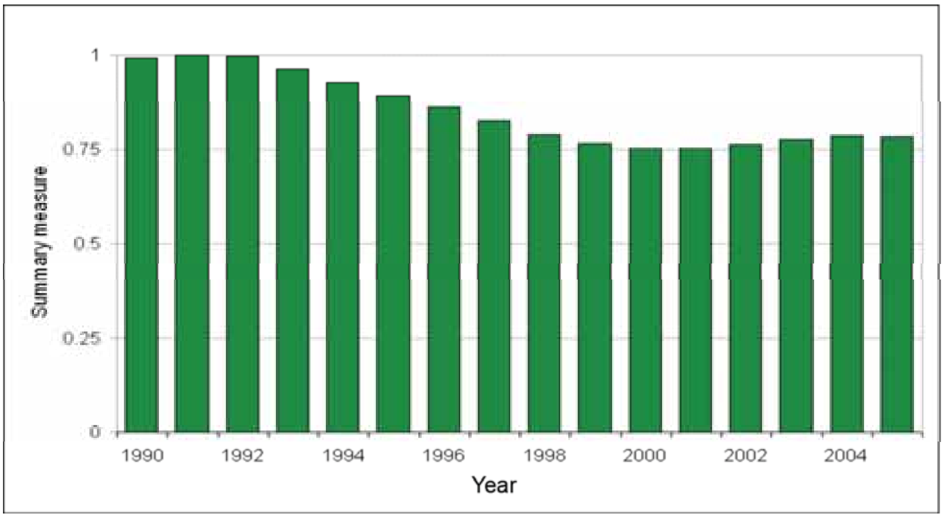
Figure 15 Estimated GHG emissions (gigagrams CO_2e), by source, from the dairy industry



Source: Australian Greenhouse Office (2007)

Dairy GHG emissions in 2005 were 27% higher than in 1990, although there was a decrease of 4% between the years 2000–2004.

Figure 16 Summary measure for GHG emissions from the dairy industry



Source: Source: Australian Greenhouse Office (2007)

Management actions to reduce GHG emissions in the dairy industry include improving the quality of feed for cattle (AGO 2006), improving fertiliser and pasture management, and innovative approaches (such as using genetic selection) to breed more feed-efficient cattle.

Since the main proportion of GHGs from agriculture originates from enteric fermentation, the dairy industry is a key sector in reducing total agricultural emissions. The National Farmers' Federation (NFF) in its submission to the Garnaut report on climate-change policy, states that primary-industry emissions have 'plummeted' by 40% over the past 15 years. They consider that the existing international greenhouse accounting rules fail to adequately recognise the carbon cycle of agricultural systems by taking account of emissions, but not sequestration.

In farming, a natural ‘life cycle’ is at play. While it is true agriculture is responsible for around 17% of Australia’s total carbon emissions, no account has yet been taken of the carbon being sequestered in farm soils, crops and trees in this assessment. It needs to be (NFF 2008).

The social contribution

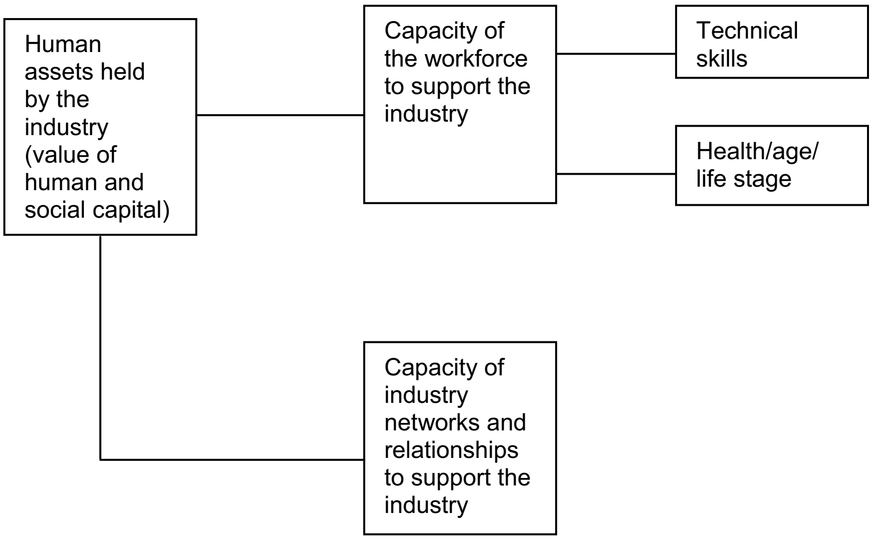
Figures 17 and 18 show in conceptual form the contributions the industry makes to social systems, thereby increasing or decreasing human and social capital or assets (Chesson 2007).

Signposts notes that the industry can contribute in two ways — through changes in the value of its own human and social capital or by changing the value of human and social capital held by others.

The dairy industry gives high priority to human- and social-capital development through programs of Dairy Australia and its partners, such as the Gardiner Foundation, which has a portfolio of around $1 million invested in community development projects.

The industry's own stock of human capital is defined as the capacity of the industry's workforce to support the industry. Attributes of the human-capital component that will be measured by Signposts include technical skills and health, age and life stage.

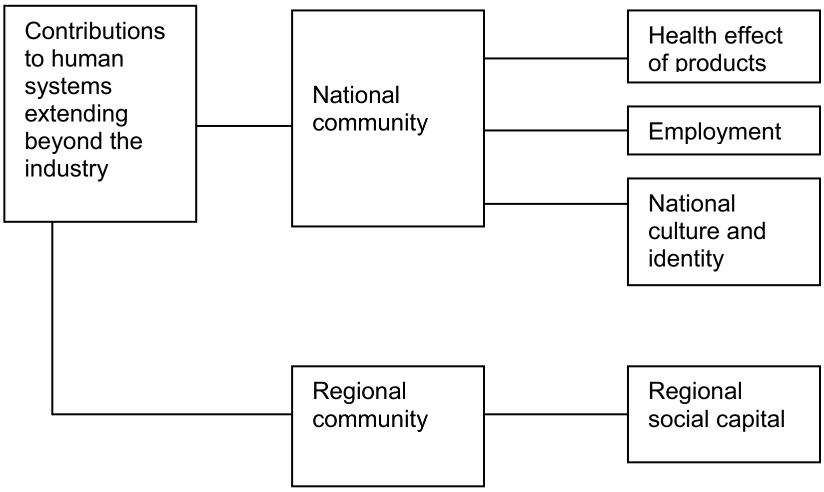
Figure 17 Value of human and social capital held by the industry — Signposts' framework of the social contribution of the dairy industry



Social capital is defined in terms of group relations, partnerships, norms and networks that facilitate diffusion of knowledge and innovation, provide support during structural adjustment, and promote cooperative behaviour.

Other aspects of the social contribution of the Australian dairy industry relate to those extending beyond the industry and include contributions to the national community and to regional communities (Figure 18).

Figure 18 Contributions to human systems extending beyond the industry —Signposts' framework of the social contribution of the dairy industry



Human capital

Education, training and technical skills

National Centre for Dairy Education Australia

The National Centre for Dairy Education Australia (NCDEA) is a major industry initiative and drives provision of technical skills within a dairy-career framework. In addition, it provides for ongoing assessment or audit of skills needs in the dairy industry.

NCDEA was established to provide vocational education and training in the dairy production and processing sectors. It is an initiative of Dairy Australia and Goulburn Ovens Institute of Technical and Further Education that aims to bring dairy education and training under one umbrella.

NCDEA delivers nationally accredited courses in:

- agriculture (specialising in dairy production)
- food technology (dairy)
- food processing.

NCDEA delivers short courses and customised programs for dairy and processing organisations, individual farmers and people in the dairy service industry. It provides standardised systems for competencies, certificates, diplomas and degrees to be recognised by the industry at local, national and international levels.

The People in Dairy program

This program reflects the importance that Dairy Australia places in the industry's human resources (HR). Projects that are currently under way include:

- **The People in Dairy Resource Kit (Industry Resource Kit)** — a comprehensive HR kit designed to provide the tools, guidance and background information to support a step forward in the quality of management of HR in the dairy industry
- **People Focus Discussion Groups** — targeted discussion groups on effective labour management and deployment, particularly as it relates to the farming system under operation
- **Diploma of Business (HR) Dairy** — providing an opportunity for dairy service providers to obtain qualifications at diploma level in the critical field of HR management on dairy farms

- **DairySage Mentoring** — a dairy mentoring program aimed at equipping young dairy people, across the supply chain, with the information, support and enthusiasm to take leadership positions in the dairy industry
- **Workforce Planning** — a model for the farm sector at regional and national levels that allows dairy regions to better understand their workforce requirements, including gaps, demand and development needs.

Health

A 2006 survey of dairy farms for Dairy Australia's Dairying for Tomorrow program found that the average age of dairy farmers participating in the study was 50 years, with farmers in the 40–59 age group comprising 61% of the sample (Watson 2006). The National Dairy Farmer Survey (2005) also found the average age of family members to be 50 years.

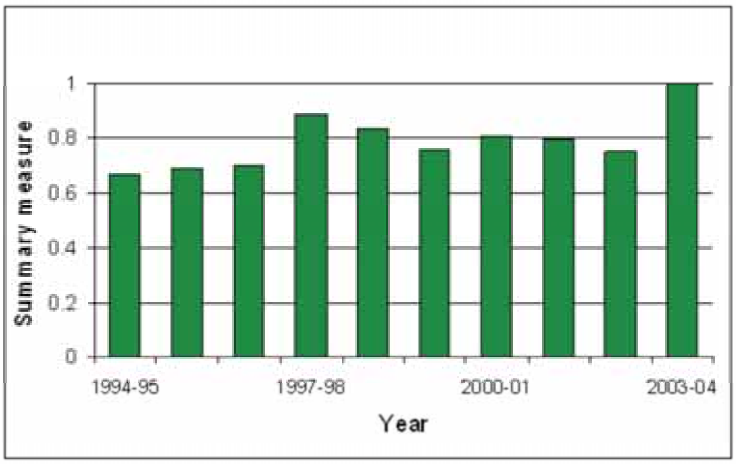
Signposts indicator

Health, age and life stage are considered to be characteristics of the industry's workforce that influence the capacity to make decisions, achieve output, adapt to new situations and adopt new practices. An indicator considered by Signposts is the median age of farmers that, monitored over time, may be indicative of the degree of new recruitment to the industry. At this stage, there are no data provided for this subcomponent.

Another aspect is the industry's impact on the health of its workforce. Signposts states that the most direct impact is through injuries on farms, but there are other potential impacts. These include long-term effects of working with chemicals and exposure to the sun, as well as the beneficial impacts of an active outdoor lifestyle. The desired outcome is that the negative impacts of the industry on the health of its people are reduced.

Figure 19 shows improved performance over the past 10 years. The summary measures are based on the indicator values from compensation statistics shown in Figure 20.

Figure 19 Signposts' summary measure for occupational health, 1994–95 to 2003–04

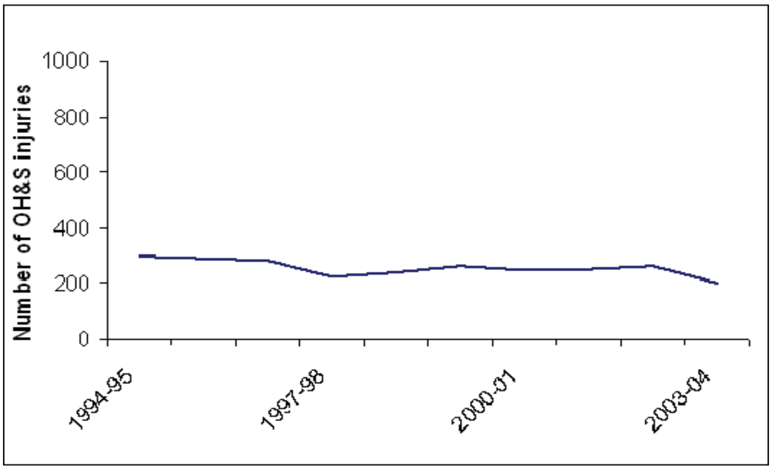


Source: Norton and Whitworth (2007)

Summary measure

Signposts uses a summary measure, on a scale of 0 to 1, which shows the extent to which the desired outcome is being achieved. A score of 1 for the most recent year means that occupational injuries are at their lowest level to date.

Figure 20 Number of reported occupational health and safety injuries on dairy farms



Source: Australian Safety and Compensation Council (ASCC) (2006) National On-line Statistical Database, http://nosi.ascc.gov.au/

Sustainable Farm Families

Sustainable Farm Families (SFF) is an award-winning program first funded by the Gardiner Foundation and WestVic Dairy. The program has significantly contributed to health and safety improvements in the dairy industry. It has subsequently extended to other industries.

SFF has produced many different outcomes for farming families across Australia. In the dairy industry, many have come together to learn about the changes they can make individually and as families to increase health, wellbeing and farm safety. A wide range of health issues have also been covered and include skin cancer, hypertension, cholesterol, body fat, diabetes, farm injuries and motor-cycle safety.

One of the strengths of the SFF program across different agricultural industries is the way farmers have come together to participate, not only to improve their health and wellbeing, but also to support other farm families in this process. Participants have reported that SFF has contributed to the strong community spirit shown by farming families — one of the key social characteristics of Australian farming. The program encourages including concerns for health, wellbeing and farm safety in business discussions, so that farm families may have more fulfilling, productive and successful lives (Western District Health Service 2007).

Social capital

Social capital is defined in terms of group relations, partnerships, norms and networks that facilitate diffusion of knowledge and innovation, provide support during structural adjustment and promote cooperative behaviour. Watson (2006) found that 42% of dairy farmers are involved in NRM groups and that this has increased by 11% since 2000.

National community

The contributions the industry makes to social systems at the national scale include employment, national culture and identity, and the health effects of products. Agricultural produce is consumed by most people in the country, as well as by consumers internationally, and Australian agriculture forms a significant part of the nation's cultural heritage (Schirmer 2006).

Employment

Signposts' indicator of the industry's employment contribution is the number of persons employed in dairy farming as a proportion of the total people employed in agriculture. Employment in dairy farming includes individuals who nominated themselves in the ABS *Census of Population and Housing 2001* as being employed in dairy farming for all ABS occupation types. Relevant data from the 2006 *Census of Population and Housing* are yet to be published.

Table 9 shows that the total number of persons employed in dairy farming in 2001 was 28 649, which represented 10% of employment in agriculture.

Table 9 Total number of persons employed in dairy farming

State or territory	Persons employed (number)	% of total
Victoria	16 418	57
New South Wales	4 275	15
Queensland	3 486	12
South Australia	1 824	6
Tasmania	1 496	5
Western Australia	1 066	4
Northern Territory and Australian Capital Territory	84	less than 1
Total	**28 649**	**100**

Source: Whitworth (2007)

Victoria had the largest proportion of agricultural employees engaged in dairy farming (57% of total industry employment in 2001). At a regional level, dairy farming occupies a much greater proportion of the agricultural workforce. In Victorian regions this was between 30% and 45% in 2001. Farmers and managers constitute the bulk of those employed in the sector. From the 1996 ABS census, the proportion of people employed in dairying declined by around 2%.

Dairy Australia (2008) estimates that more than 40 000 people are directly employed on farms, in dairy manufacturing, related transport services, distribution and research and development (R&D).

Nutrition and health

The industry contributes to the health of Australians through dairy foods such as milk, yoghurt and cheese. These provide essential nutrients such as calcium, protein, carbohydrate, vitamins A, B12 and riboflavin, phosphorus, potassium, magnesium and zinc.

Dairy Australia provides information and educational resources, based on sound science, for consumers and health professionals on the nutritional value of dairy products.

Regional communities

Signposts notes that local and regional communities may receive many social benefits from agricultural industries, via development of unique cultures, businesses, production chains and communities related to an industry (Schirmer 2006).

The business contribution to regional communities is substantial. As an indicator, in 2006 the economic and financial consulting firm, CRA International, estimated that if the industry was able to recover the one billion litres of milk production lost due to the 2006–07 drought, it would produce an extra $300 million in farm-gate receipts, around 8000 dairy farming jobs and almost $1.6 billion in regional income (Dairy Australia 2008).

In the early 1990s, Dairy Australia established regional development programs (RDPs) in the eight major dairying areas of Australia. The objective was, and remains, to drive innovation in research and extension in Australia's dairying areas through the use of regional knowledge and skills. RDPs are independent entities that are coordinated and managed by the regions to improve local and national productivity, prosperity and sustainability.

Subtropical Dairy

The Subtropical Dairy Program was established as an incorporated body in 1995 and is one of eight RDPs under the umbrella of Dairy Australia.

A regional structure was set up for dairy farmers to participate in identifying, selecting and managing R&D and extension activities. Farmers provide information on their needs and issues. This allows projects to be developed which focus on these needs to achieve positive outcomes for the dairy industry.

The Darling Downs Young Farmers Network is managed by Subtropical Dairy. This network focuses on social, economic and environmental issues through facilitated workshops. A primary purpose of these workshops is to help young farmers develop social skills, improve their decision-making power and expand their farm-management skills.

A roadside sign warning about livestock grazing in the area, Dundonnell, Victoria (photo by Alison Pouliot 2008)

Case study 4 Social sustainable contribution

Graham and Theresa Bourke, Warwick, Queensland

Graham and Teresa Bourke manage 200 dairy cows and are actively involved in the Darling Downs Young Farmers Network.

By attending the 'Business Structure' workshop, they were able to develop additional communication skills which have greatly assisted relations with their valued employees.

This network has also provided them with a NRM program in line with their business expansion. Within this, there are numerous environmental projects in progress on their property, including controlling erosion and improving water-use efficiency.

The Bourke's largest project involves improving their riparian zone. Subtropical Dairy assisted in gaining funding through Envirofund to plant trees, fence and install off-stream watering points.

The connection to the Darling Downs Young Farmers Network has strengthened their links to other local dairy producers, as well as building relations with key organisations, like Subtropical Dairy, offering knowledge of economic and environmental sustainability programs.

Source: Watson (2006)

WestVic NRM Focus Farm Project

WestVic Dairy is a regional development board based in southwest Victoria, a pivotal area for the dairy industry in Australia. WestVic Dairy cooperates with the Victorian Department of Primary Industries, Department of Sustainability and Environment and Dairy Australia to develop programs in research and development, NRM and to facilitate use of existing technology.

The vision of WestVic Dairy is to ensure that farming is profitable and rewarding, that cooperation between all regional stakeholders is strong and productive, and that DairyVic producers enjoy an improved quality of life.

The NRM Focus Farm Project is a concept by WestVic Dairy to progress both farm and environmental management.

The project involves a range of focus farms, each with a group of approximately 12 dairy producers who utilise their combined knowledge to help create individual action plans. These action plans combine farm and catchment management and all producers can select subjects related to their personal interest.

Case study 5 Focus Farm Project

Belinda Roche, Warrnambool, Victoria

Belinda Roche runs 270 dairy cows on her property with her son Simon. She has recently purchased a new farm which has resulted in new farm-management systems and environmental challenges.

The new property had an unfenced boundary along a creek, chemical containers containing residues, and extensive rubbish around the farm. These problems resulted in some initial cow losses and cow abortions.

When WestVic Dairy invited local producers to attend a local NRM Focus Farm Group, Belinda joined with dairy farmers who were increasingly concerned about future environmental impacts that may affect their businesses.

The creation of an individual farm plan and prioritising projects for her property focused Belinda's attention on environmental sustainability. Improving effluent management has been a key priority. Belinda and Simon introduced an effluent pump, pipes and spray outfit to spread effluent across a number of paddocks.

The discussions from the focus groups led to sharing ideas on how to best grow native trees for windbreaks, fence off and revegetate waterways and attract more wildlife and birdlife.

Consequently Belinda has fenced off the creek on the new property and planted more than 2000 trees with the assistance of local school students. This experience for the children enhanced their knowledge of food production and animal welfare practices on dairy farms.

Finally, Belinda has made significant contacts within the Landcare network and the regional Catchment Management Authorities. These have provided assistance to help her develop a sustainable environmental and economically viable business enterprise.

Source: Watson (2006)

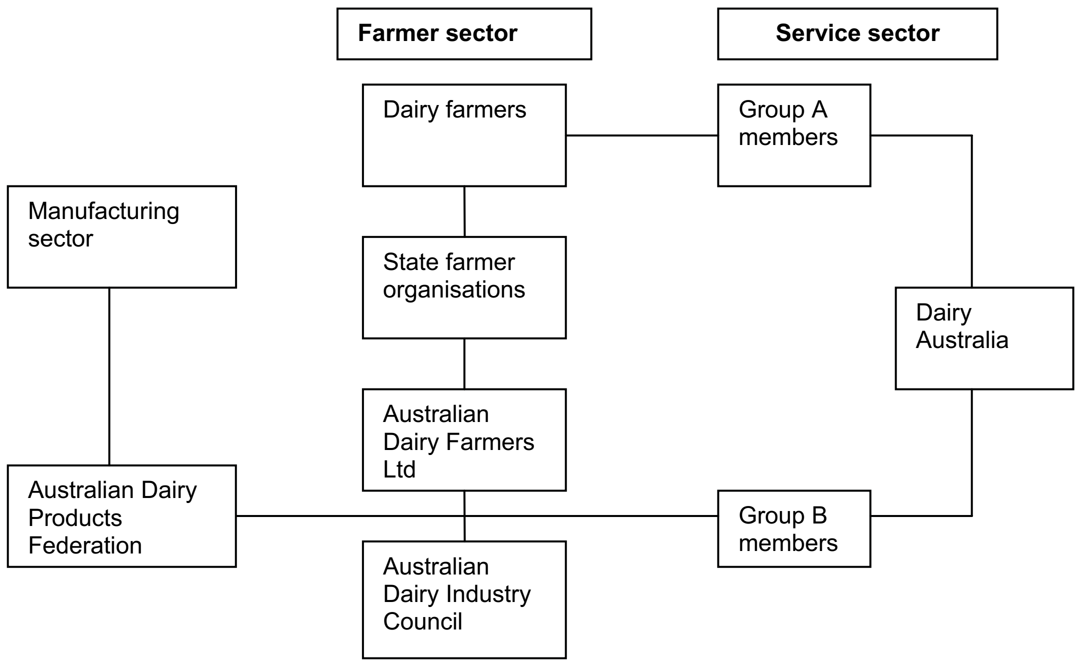
Service provider networks

The industry service organisations are critical to the dairy industry's social capital. This report deals with the on-farm sector, but the whole dairy industry covers manufacturing and marketing as well as primary production. Dairy farming, like other agricultural industries, has led to the creation of an extensive service sector that provides transport, storage, selling, marketing, brokering, financial, information, research, consulting, education and training services. In addition, there is an extensive informal network of social groups associated with the industry at local levels.

There are key industry associations at the formal level and these are shown in Figure 21.

This structure has an important role in policies and innovation through R&D that drive the industry's contribution to ESD. Dairy Australia undertakes key R&D, on-farm adoption and marketing-support roles for the industry. These activities are funded through producer levies and the Australian Government's matching contribution.

Figure 21 Australian dairy industry organisations



Source: Dairy Australia (2007a)

Dairy Australia maintains a rolling Five Year Strategic Plan. The Australian dairy industry's vision is to 'grow an internationally competitive and sustainable dairy industry'. Dairy Australia's six strategic priorities for 2008–2012 are to:

- protect and increase farm business margins, profitability and confidence
- coordinate an integrated industry response to emerging issues, eg climate change and variability, biosecurity and genetic modification technologies
- reduce funding for growing volume milk markets and shift the emphasis to maintaining and growing markets for higher-margin products and components
- accelerate the transfer and commercial application of knowledge and innovation for dairy farming and manufacturing
- maintain and enhance the dairy industry's reputation as a valuable contributor to the Australian economy and wider community, and as a responsible user of valuable resources
- provide foresight and analysis of emerging issues.

The dairy industry is one of the most active of all agricultural industries in ensuring it invests in its future economic, environmental and social contribution to Australia and the many rural communities in dairying regions.

FutureDairy

This is a research and extension program to help Australia's dairy farmers manage the challenges they are likely to face during the next 20 years. Challenges are anticipated regarding the availability and cost of land and water resources; the availability and cost of labour; and associated lifestyle issues.

FutureDairy is based on a unique approach that considers science, systems and people issues. It is exploring opportunities for a 'quantum leap' in production rather than incremental improvements.The program is a strategic investment on the industry's behalf, to improve lifestyle and productivity in the long term.

Through partner farms, FutureDairy explores how its findings work under commercial conditions. It studies how technical issues are affected by 'people' issues, and how these can make a difference between a technology being used on-farm or not.

To get involved in FutureDairy or to find out more about it, visit the website http://www.futuredairy.com.au.

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About the Signposts for Australian Agriculture Report Series

The *Signposts for Australian Agriculture* project is a partnership between the Department of Agriculture, Fisheries and Forestry, Research and Development Corporations, and the National Land & Water Resources Audit.

The Signposts project aims to inform policy development by assessing and reporting on the environmental, economic and social contributions of Australian agricultural industries.

Six industry Signpost reports have been produced covering the following industries:

- Grains
- Beef
- Dairy
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