Organisation for Economic Co-operation and Development
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ENVIRONMENTAL PERFORMANCE OF AGRICULTURE IN OECD COUNTRIES SINCE 1990:

Australia Country Section

This country section is an extract from chapter 3 of the OECD publication (2008) ***Environmental Performance of Agriculture in OECD countries since 1990***, which is available at the OECD website indicated below.

This text should be cited as follows: OECD (2008), *Environmental Performance of Agriculture in OECD countries since 1990*, Paris, France

A summary version of this report is published as ***Environmental Performance of Agriculture: At a Glance***, see the OECD website which also contains the agri-environmental indicator time series database at: http://www.oecd.org/tad/env/indicators

TABLE OF CONTENTS OF THE COMPLETE REPORT

I. HIGHLIGHTS

II. BACKGROUND AND SCOPE OF THE REPORT

1. Objectives and scope
2. Data and information sources
3. Progress made since the OECD 2001 agri-environmental indicator report
4. Structure of the Report

1. OECD TRENDS OF ENVIRONMENTAL CONDITIONS RELATED TO AGRICULTURE SINCE 1990

1.1. Agricultural production and land
1.2. Nutrients *(nitrogen and phosphorus balances)*
1.3. Pesticides *(use and risks)*
1.4. Energy *(direct on-farm energy consumption)*
1.5. Soil *(water and wind soil erosion)*
1.6. Water *(water use and water quality)*
1.7. Air *(ammonia, methyl bromide (ozone depletion) and greenhouse gases)*
1.8. Biodiversity *(genetic, species, habitat)*
1.9. Farm Management *(nutrients, pests, soil, water, biodiversity, organic)*

2. OECD PROGRESS IN DEVELOPING AGRI-ENVIRONMENTAL INDICATORS

2.1. Introduction
2.2. Progress in Developing Agri-Environmental Indicators
2.3. Overall Assessment

3. COUNTRY TRENDS OF ENVIRONMENTAL CONDITIONS RELATED TO AGRICULTURE SINCE 1990

Each of the 30 OECD country reviews (plus a summary for the EU) are structured as follows:

1. Agricultural Sector Trends and Policy Context
2. Environmental Performance of Agriculture
3. Overall Agri-Environmental Performance
4. Bibliography
5. Country figures
6. Website Information*:* Only available on the OECD website covering:
1. *National Agri-environmental Indicators Development*
2. *Key Information Sources: Databases and Websites*

4. USING AGRI-ENVIRONMENTAL INDICATORS AS A POLICY TOOL

4.1. Policy Context
4.2. Tracking agri-environmental performance
4.3. Using agri-environmental indicators for policy analysis
4.4. Knowledge gaps in using agri-environmental indicators

BACKGROUND TO THE COUNTRY SECTIONS

Structure

This chapter provides an analysis of the trends of environmental conditions related to agriculture for each of the 30 OECD member countries since 1990, including an overview of the European Union, and the supporting agri-environmental database can be accessed at *www.oecd.org/tad/env/indicators*. Valuable input for each country section was provided by member countries, in addition to other sources noted below. The country sections are introduced by a figure showing the national agri-environmental and economic profile over the period 2002-04, followed by the text, structured as follows:

- ***Agricultural sector trends and policy context:*** The policy description in this section draws on various OECD policy databases, including the *Inventory of Policy Measures Addressing Environmental Issues in Agriculture* (*www.oecd.org/tad/env*) and the Producer and Consumer Support Estimates (*www.oecd.org/tad.support/pse*).
- ***Environmental performance of agriculture:*** The review of environmental performance draws on the country responses to the OECD agri-environmental questionnaires (unpublished) provided by countries and the OECD agri-environmental database supporting Chapter 1 (see website above).
- ***Overall agri-environmental performance:*** This section gives a summary overview and concluding comments.
- ***Bibliography:*** The OECD Secretariat, with the help of member countries, has made an extensive search of the literature for each country section. While this largely draws on literature available in English and French, in many cases member countries provided translation of relevant literature in other languages.

At the end of each country section a standardised page is provided consisting of three figures. The first figure, which is the same for every country, compares respective national performance against the OECD overall average for the period since 1990. The other two figures focus on specific agri-environmental themes important to each respective country.

Additional information is also provided for each country on the OECD agri-environmental indicator website (see address above) concerning:

- Details of national agri-environmental indicator programmes.
- National databases relevant to agri-environmental indicators.
- Websites relevant to the national agri-environmental indicators (*e.g.* Ministries of Agriculture)
- A translation of the country section into the respective national language, while all 30 countries are available in English and French.

Coverage, caveats and limitations

A number of issues concerning the coverage, caveats and limitations need to be borne in mind when reading the country sections, especially in relation to making comparisons with other countries:

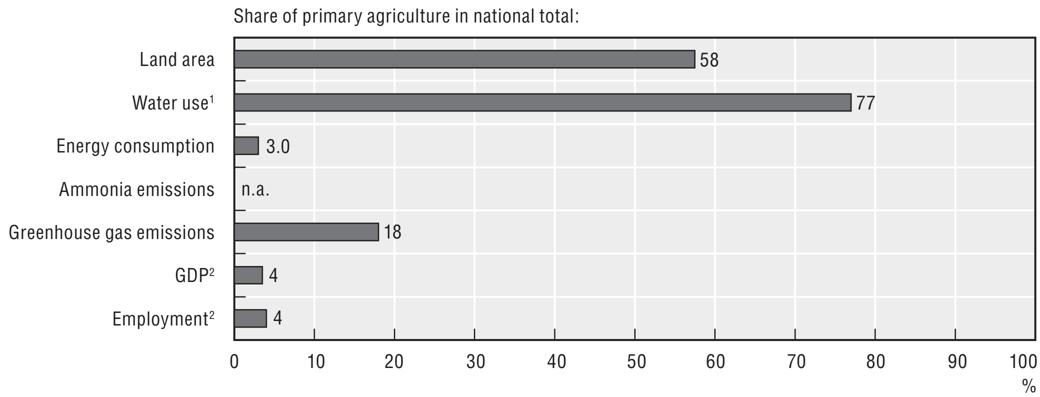
Coverage: The analysis is confined to examination of agri-environmental trends. The influence on these trends of policy and market developments, as well as structural changes in the industry, are outside the scope of these sections. Moreover, the country sections do not examine the impacts of changes in environmental conditions on agriculture (*e.g.* native and non-native wild species, droughts and floods, climate change); the impact of genetically modified organisms on the environment; or human health and welfare consequences of the interaction between agriculture and the environment.

Definitions and methodologies for calculating indicators are standardised in most cases but not all, in particular those for biodiversity and farm management. For some indicators, such as greenhouse gas emissions (GHGs), the OECD and the UNFCCC are working toward further improvement, such as by incorporating agricultural carbon sequestration into a net GHG balance.

- ***Data availability, quality and comparability*** are as far as possible complete, consistent and harmonised across the various indicators and countries. But deficiencies remain such as the absence of data series (*e.g.* biodiversity), variability in coverage (*e.g.* pesticide use), and differences related to data collection methods (*e.g.* the use of surveys, census and models).
- ***Spatial aggregation*** of indicators is given at the national level, but for some indicators (*e.g.* water quality) this can mask significant variations at the regional level, although where available the text provides information on regionally disaggregated data.
- ***Trends and ranges in indicators***, rather than absolute levels, enable comparisons to be made across countries in many cases, especially as local site specific conditions can vary considerably. But absolute levels are of significance where: limits are defined by governments (*e.g.* nitrates in water); targets agreed under national and international agreements (*e.g.* ammonia emissions); or where the contribution to global pollution is important (*e.g.* greenhouse gases).
- ***Agriculture's contribution to specific environmental impacts*** is sometimes difficult to isolate, especially for areas such as soil and water quality, where the impact of other economic activities is important (*e.g.* forestry) or the "natural" state of the environment itself contributes to pollutant loadings (*e.g.* water may contain high levels of naturally occurring salts), or invasive species that may have upset the "natural" state of biodiversity.
- ***Environmental improvement or deterioration*** is in most individual indicator cases clearly revealed by the direction of change in the indicators but is more difficult when considering a set of indicators. For example, the greater uptake of conservation tillage can lower soil erosion rates and energy consumption (from less ploughing), but at the same time may result in an increase in the use of herbicides to combat weeds.
- ***Baselines, threshold levels or targets for indicators*** are generally not appropriate to assess indicator trends as these may vary between countries and regions due to difference in environmental and climatic conditions, as well as national regulations. But for some indicators threshold levels are used to assess indicator change (*e.g.* drinking water standards) or internationally agreed targets compared against indicators trends (*e.g.* ammonia emissions and methyl bromide use).

3.1. AUSTRALIA

Figure 3.1.1. **National agri-environmental and economic profile, 2002-04: Australia**



StatLink http://dx.doi.org/10.1787/288667861547

1. Data refer to the year 2000.
2. Data refer to the year 2004.

Source: OECD Secretariat. For full details of these indicators, see Chapter 1 of the *Main Report*.

3.1.1. Agricultural sector trends and policy context

Growth in agricultural production is among the most rapid across the OECD, with the volume of production growing by 23% between 1990-92 to 2000-04 (Figure 3.1.2). However, partly due to deteriorating terms of trade, agriculture's role in the economy has remained stable over the past 10 years with regard to its contribution to GDP. Agriculture is a vital sector in the Australian economy contributing about 4% to GDP, 4% to employment and accounting for around 25% of merchandise exports (2004) (Figure 3.1.1). Around two-thirds of agricultural production is exported. Australia exports 95% of wool produced, 65-75% of beef, sugar and wheat and 50-60% of sheep meat, wine and dairy [1].

Despite harsh environmental conditions, agriculture is the most extensive form of land use. Fundamentally agriculture is based on extensive pastoral and cropping activities. However in recent years the farming sector has increasingly diversified into intensive livestock and horticultural industries. Agricultural activity occurs on around 60% of the total land area (2002-04). Livestock grazing accounts for 57% of land use in Australia, whilst dryland agriculture accounts for 5% [2]. Recent structural changes, developments in water and natural resource management, access to new biotechnologies and climate, are significantly impacting on agricultural productivity, land use and land use intensity. The average farm size increased by 23% whilst the number of farms fell by 25% since 1990. This has resulted in a –5% decline in area of land under agricultural production, between 1990-92 and 2002-04 [1]. Some 70% of arable farmers have adopted both direct drilling and minimal tillage practices and productivity in the sector has increased annually by 2.3% over the period 1974/75 to 2004/05 [3].

Support to the agriculture sector is among the lowest in the OECD. Producer support fell from 8% in the mid-1980s to 4% by 2002-04 (as measured by the OECD's Producer Support Estimate) compared to the OECD average of 30%. The decrease in producer support was the result of deregulation of several agricultural sectors such as, dairy, wool, pork and egg industries. Most support is provided through budget financed programmes, regulatory arrangements and tax concessions [4].

A range of policies have been implemented to address agri-environmental concerns. Soil salinity, acidity and erosion are key issues being addressed through various programmes including the *National Landcare Programme* (NLP), the *National Action Plan for Salinity and Water Quality* (NAP) and the *National Heritage Trust* (NHT). The NAP encourages regional action to tackle salinity problems and together with the NHT are funding measures to address salinity, amounting to AUD 33 (USD 21) million in 2003-04. The *National Landcare Programme* (NLP), which involves over 40% of landholders (who manage 60% of the land) (Figure 3.1.3), promotes sustainable management practices, and includes undertaking conservation and improving the productivity, profitability and condition of natural resources [5, 6]. The Federal Government has committed AUD 160 (USD 120) million over 2004-08 for the NLP. Funding of AUD 18 (USD 14) million is available under the *Environmental Management Systems* programme to improve farm management [7]. An AUD 50 (USD 38) million *Environmental Stewardship Programme* is helping farmers, among others, to preserve and restore high-end environmental assets under a new long-term stewardship programme on their properties. The NHT, jointly with states and territories, is also funding a range of strategic programmes aimed at the sustainable use of natural resource by agriculture.

The relationship between agricultural production and the environment is recognised in the broader framework of policies aimed at improving environmental outcomes. The *National Strategy for Ecologically Sustainable Development* provides the framework for most environmental and natural resource policies and the funding to states/territories to enact legislation supporting national strategies. The NAP aims to reverse salinity and water quality problems, with funding of AUD 1.4 (USD 1.0) billion over 2000-08, while the NHT focuses on biodiversity and sustainable natural resource management, with funds of AUD 1.3 (USD 0.9) billion over 2004-08 and a further AUD 2 (USD 1.5) billion over five years from 2008-09 [8]. The National Water Initiative (NWI) seeks to increase productivity and efficiency of water use, sustain rural and urban communities, and ensure the health of river and groundwater systems. Under the NWI funding of AUD 2 (USD 1.5) billion is provided for programmes, which include irrigators, to move toward full cost recovery for water, expand trade in water, improve access entitlements, plan for environmental needs, and enhance water management [9].

The Greenhouse in Agriculture and Regional Australia Programme is building capacity in agriculture and land management to reduce greenhouse gas (GHG) emissions. In addition, taxation policies affect energy production and use by agriculture. In 2004, the Federal Government committed AUD 20.5 (USD 15) million over four years to help agriculture and land management sectors to reduce GHG emissions. A further AUD 1 (USD 0.7) million has been contributed, along with AUD 1.25 (USD 0.9) million from livestock industry partners, to a project to reduce agriculture's methane emissions. The ***Greenhouse Challenge Plus for Agriculture*** is a voluntary programme promoting emissions reductions at enterprise level. Farmers are provided rebates for on-farm diesel use, equal to nearly AUD 650 (USD 480) million of budget revenue forgone in 2004-06. The Federal Government has set a production target for fuel ethanol and biodiesel from renewable sources to contribute to about 1% of the consumption of transport fuels by 2010. Biofuels (both domestically produced and imported) are subject to lower excise taxes compared to fossil based fuels, while producers of biofuels are provided tax exemptions and investment grants, such as under the *Biofuels Capital Grants Programme*. Under the 2005 *Renewable Remote Power Generation Program* AUD 206 (USD 151) million is being granted up to 2012 to off-grid energy users, including farmers, covering 50% of the capital cost of installing renewable energy equipment, which could reduce GHGs.

3.1.2. Environmental performance of agriculture

Australia has recognised the need to address a number of land and water management issues in which farming plays a key part [2, 3, 10]. Three issues are important to agriculture's relationship with the natural environment: soil resources, water resources, and biodiversity. Estimates suggest that management of these issues costs AUS 3.5 (USD 2.5) billion annually [11], or 10% of agricultural GDP. Farmers are estimated to have invested in natural resource management and environmental protection (mainly on fencing, earthworks and weed management) AUD 220 (USD 140) million in 1999-2000, or about AUD 2.60 (USD 1.65) for every AUD dollar invested by the government [12]. A large share of farmed soils are naturally shallow, acidic, low in fertility, high in salt, have low water holding capacity and require careful management to avoid degradation.

Soil conservation and management is a major national issue [2]. While soil degradation occurs naturally some farming practices have exacerbated the problem, with, on average across Australia, 20% of farmland showing acute degradation [10]. Evidence over the 1990s, however, suggested some improvement in soil quality [5, 11, 13]. For example, farming practices in certain areas have improved the fertility and health of soils through: the use of fertilisers; lime to reduce soil acidity; and minimum tillage techniques [2]. ***On-farm costs*** of degradation from soil acidity, sodicity and salinity were estimated in 2000 at AUD 2.6 billion (USD 1.5 billion) [14] (about 7% of agricultural GDP), with most farmers reporting these problems as having a significant impact on their businesses [5], especially in Western Australia [15]. Soil degradation is also leading to ***off-farm damage*** on a national scale, from agriculture and non-agricultural sources, especially from dryland salinity and soil erosion, by degrading aquatic environments, raising drinking water treatment costs, and damaging buildings and roads [13].

Soils are naturally predisposed to salinity due to climatic and topographical factors, but past land clearing and management have contributed to increased soil salinity in some regions. Recent estimates suggest that about 2 million hectares of farmland show some signs of salinity [2]. As the problem of salinity evolves slowly with time lags of 50-100 years, the area at high risk may triple between 2000 and 2050 [16]. By 2002 two-thirds of irrigated farms had changed practices to address salinity, including tree planting, fencing and building banks, levees and drains [17]. Accelerated ***soil erosion*** above natural rates is relatively evenly distributed across Australia, but while grazing land has typically erosion rates 2-5 times natural rates, for croplands rates are 5-20 times higher [18, 19]. While erosion rates on cropping lands are in some areas higher, the area of land involved is significantly smaller. About 20% of farmers report that erosion has a major impact on their business [5], but the off-farm impacts can be significant. Some 120 000 km of rivers have degraded riparian vegetation, with the restoration cost estimated at AUD 1.2 (USD 720) billion [18], reinforcing the importance of policies in place to manage impacts on water quality. Also 90% of soil sediment reaching estuaries are derived from 20% of catchments, with the greatest concern for sediment flows into the Great Barrier Reef, a UNESCO World Heritage Site [12, 19]. ***Soil acidity*** is estimated to affect about half of the total agricultural land area, at a level probably affecting crop yields [2]. While the application of lime could remedy the problem and is used in cropping systems, this is financially not viable for many pasture-based industries [2]. Run-off from disturbance of coastal ***acid sulphate soils***, including by agriculture, have had an adverse impact on aquatic ecosystems, in some areas of North New South Wales and Queensland [20]. Enhanced management practices indicate that some improvement in the problem of acid sulphate soils is underway [21].

The expanding demand for water resources, including from agriculture, is an issue of national significance.The growth in use of water by agriculture (24%) was more than double that of other users (9%) over the period 1993-95 to 2000, when annual average rainfall levels have declined in major farming areas (Figure 3.1.2) [16]. Nationally 26% of river basins and 30% of aquifers are close to or exceed sustainable extraction limits [10]. Many irrigators in the Murray-Darling Basin (MDB) have switched from surface water to groundwater since the surface water cap on withdrawals was introduced in 1995. In combination with other groundwater uses and the drought, this has caused groundwater to decline over large areas of the MDB [2]. A key driver in the growth of water demand has been the 17% rise in irrigated area over the period 1990-92 to 2001-03, with farming accounting for three-quarters of total water use in 2000 (about 90% of which is used by irrigators), although data for 2001-02 suggest agriculture's share in total water use was 69% [3]. Irrigators produce about 25% of total agricultural gross value of production [2]. There has been considerable improvement in water use efficiency by irrigators, with water application rates declining from 8.7 megalitres/hectare of irrigated land (ML/ha) in 1996-97 to 4.3 ML/ha in 2002-04, with around 40% of water applied by technically efficient irrigation technologies (Figure 3.1.2) [2, 22]. Almost a third of water used by agriculture is for irrigating pasture, especially for dairy cows, with sugar cane and cotton accounting for a further 25% [22].

Agriculture is one impact, among others, on water quality for some rivers and coastal waters. In river basins in the most populated areas of Australia, nutrients and soil turbidity are the most widespread pollutants from agriculture amongst other sources, followed by salinity, acidity/alkalinity, with pesticides and biological contaminants having a lower occurrence [23]. About two thirds of river basins were found in 2000 to have nutrients in excess of acceptable standards or were excessively turbid, while water quality exceeded salinity standards in over a third of river basins [3, 23]. Salinisation is also affecting drinking and irrigation water quality, with some surface water in Western Australia too saline for domestic use [10], while rising groundwater levels which contain salt are damaging urban infrastructures in parts of New South Wales [16]. Groundwater in intensively farmed areas of north eastern Australia show only 3% of wells with nitrate concentrations above drinking water standards [24].

The quality of water entering the Great Barrier Reef (GBR) is of concern. Water quality entering the GBR has declined affecting about 25% of its area, partly as a result of farm pollutants, although phosphorus run-off from urban sewerage is also a problem [26, 26]. The dry tropical regions in Queensland are the main source of these pollutants, although some farmers are adopting practices to reduce pollution. While evidence of adverse impacts on the GBR from pollutants is not conclusive, research suggests the need for caution for any activities leading to elevated pollution levels [25].

Environmental pressure from agricultural nutrients and pesticides are very low compared to most OECD countries, however, input use has grown with the large increase in the volume of agricultural production over the period 1990-92 to 2002-04 (Figure 3.1.2). With an overall decline in livestock numbers, much of the growth in ***nutrient surpluses*** is from greater use of fertilisers, especially nitrogen. Overall efficiency of nitrogen use (*i.e.* ratio of nitrogen crop uptake to total nitrogen inputs) is low [27] and below the OECD average although higher for phosphorus. Increased soil nutrient testing over the 1990s may improve nutrient efficiency [27], although management of manure ponds on dairy farms is poor [28]. Nearly 19 000 tonnes of total phosphorus and 141 000 tonnes of total nitrogen were estimated to be transported down rivers to the coast from areas of intensive agricultural activity [2].

Pesticide use volume increased by 10-15% annually over the period 1996-99, of which about 40% is accounted for by glyphosate (a herbicide) used in conservation farming and minimum tillage techniques that reduce soil erosion. More recent pesticide use data are unavailable and there is little monitoring of the environmental impacts of pesticides [29]. There was a shift in the late 1990s from broad spectrum, relatively toxic pesticides, to use of targeted and less harmful ones [29]. In the cotton growing areas of Eastern Australia only 10% of samples from surface water exceeded drinking water standards for pesticides [29], and 50% of the land cultivated to cotton is grown under best management practice codes [16]. The cotton industry has also made significant steps to reduce pesticide use through growing genetically modified cotton varieties and using other improved practices (Figure 3.1.4) [2, 29, 30]. An environmental audit of the sugar industry, however, reveals only a small share of farmers using Integrated Pest Management practices [31].

Trends in air emissions from agricultural sources have revealed mixed results over the past decade. Agriculture is the major source of ***ammonia emissions***, but time series emissions data are unavailable [32]. However, given nitrogen surpluses rose slightly over the period 1990-92 to 2002-04 (mainly due to higher fertiliser use, as overall livestock numbers have declined), it is possible ammonia emissions and acidifying air pollutants have also risen slightly. As a signatory to the *Montreal Protocol*, Australia agreed to phase out by 2005 the use of ***methyl bromide*** for purposes other than for quarantine and pre-shipment use, agreed critical uses where no technically or economically viable alternatives are available, and feedstock uses. By 2004 methyl bromide was reduced by over 70% from the 1991 baseline level. "*Critical Use Exemptions*" (CUE) were sought in 2005 and following years, and agreed for certain uses, which under the *Protocol* allows farmers additional time to find substitutes. In 2005, methyl bromide use was reduced a further 10% compared to the 1991 baseline level. With some methyl bromide users ceasing use in 2007, but rice, strawberry growers and cut flower producers have exemptions for use up to, and including 2008. Rice and strawberry growers are currently seeking to continue use under CUE status after 2008 [33]. Both these latter industries are undertaking research, together with the Federal Government, into alternative chemicals and/or application methodologies.

Greenhouse gas emissions (GHGs) from agriculture accounted for 16% of Australia's net GHG emissions in 2004, and 18% of gross emissions over 2002-04 [2]. Projections to 2010 suggest that agricultural GHGs could be 5% above their 1990 level, without taking into account possible savings from soil sequestration and land use changes, although estimates of these savings are still subject to a high degree of uncertainty [34]. ***Soil carbon levels*** vary annually, but results from the Australian Greenhouse Office, based on long term nationally consistent modelling, suggest that as a result of clearing for agriculture soil carbon has declined from slightly above 675 million tonnes in 1990 to about 643 million tonnes in 2004 [2]. The growth in agricultural gross GHG emissions was 6% between 1990-92 and 2002-04, compared to a reduction of 3% across the OECD area, while total Australian gross GHG gross emissions rose by 22% (Figure 3.1.2). The growth in agricultural GHG emissions was largely driven by increases in the application of fertilisers and manure to soils, intensive savannah burning, and clearance of land under native vegetation for agricultural use, although the rate of clearance has decreased [35]. Use of ***agricultural biomass*** for bioenergy is at present contributing, in the case of biofuels, less than 0.1% of transport fuel use [2, 37]. Agriculture's ***direct on-farm consumption of energy*** rose by nearly 50% over the period 1990-92 to 2002-04 (the Australian Bureau of Statistics [3], calculate an increase of 35% over the period 1990 to 2002), almost twice the rate of growth in national energy consumption over this period, although agriculture accounted for only 3% of total energy consumption in 2002-04 [37].

Agriculture is one source of pressure on biodiversity, but there are signs of the pressure easing [2]. Conserving biodiversity is a serious environmental challenge, especially given Australia's world "megadiversity" status [3, 38]. But while farming contributes to pressure on biodiversity other pressures are also important, including invasive species, urbanisation, mining and climate variability. ***Clearing of native vegetation*** for agricultural and other land use purposes has been one of the main threats to terrestrial biodiversity. Over the last 20 years state/territory governments have tightened land clearing controls and in 2004 all Australian governments agreed to phase out broadscale land clearing by the end of 2006 [39]. These changes have seen a reduction in land clearing, with flow on benefits to the environment. The rate of clearance (forest conversion and reclearing of land previously cleared) was nearly 30% between 1990 and 2004, with about 325 000 hectares of conversion and reclearing in 2004 [3]. While from 2007 all land clearing has been prohibited, there can be long time lags between land clearance and future adverse ecological impacts [40].

Agricultural pressures on wild species reductions have been significant in the past but more recently the pressures have eased. Almost 30 mammal and bird species over the past 20 years showed significant reductions in farming areas, especially where land has been cleared [2, 41], or overgrazed [2, 42]. For aquatic biodiversity conditions in rivers and coastal environments have been modified by environmental disturbances, including farming [2]. All sources of environmental disturbances combined, have resulted in over 30% of total river length degraded from reduced riparian vegetation, and nutrient and sediment loadings, while 50% of inland waterbirds are listed as vulnerable or threatened mainly from habitat loss [43]. Nationally nearly 10% of wetlands are affected by salinity [38, 44]. A number of reports have identified agriculture as one of the main sources of pollution threatening some coastal habitats, especially the GBR [25, 26].

3.1.3. Overall agri-environmental performance

Agriculture's environmental footprint remains significant. This can contribute to lowering farm productivity (*e.g.* due to soil degradation, low nutrient efficiency), and also causing much larger off-farm costs. Of particular concern have been the clearing of native vegetation and water use by agriculture, contributing to pressures on the quality and availability of water for environmental purposes. However, there is now a trend in reducing land clearing. Problems of agricultural pollution from nutrients and pesticides and soil erosion are more regional, while methyl bromide use has declined, likely to have increased slightly for agricultural ammonia emissions, but showing a slight rise for agricultural GHG emissions.

Australia has built a natural resource management programme, largely through the Australian Government's *Natural Heritage Trust* and its funding of regional natural resource management groups. Investment plans produced by regional groups require both environmental outcome and environmental performance monitoring and reporting through *State of the Environment* reports and other mechanisms [2, 8, 13, 45, 46]. Addressing information gaps will improve the ability to track environmental performance and evaluate policies, as the paucity of relevant time series data sets has inhibited the development of more effective responses [2, 12]. Key areas where monitoring could be improved are: regular assessment of soil erosion [2]; water pollution, in particular, measuring pesticide and other agricultural discharges into coastal waters [2]; and tracking changes in biodiversity, [43]. The Australian Greenhouse Office is developing a new reporting procedure for on-farm emissions to improve measurement of methane and nitrous oxide emissions from agriculture.

Australian agriculture will continue to face challenges with regards to the environment. But these challenges need to be understood in the context of the difficult "natural environmental" conditions in which Australian farmers operate relative to many OECD countries, in terms of: high levels of risk from natural climatic hazards and climate variability (*e.g.* drought, floods, fire) [3, 47, 48]; domination of soils of "naturally" low fertility, poor water holding capacity, and easily degraded; and existence of invasive non-native species imposing costs on both farmers and the environment.

The ongoing decline of soil quality is a concern, as are inefficiencies in the use of other resources by agriculture. Despite lack of definitive data it is clear that soil acidity, salinity, soil erosion and nutrient loss all remain a major threat to the long term sustainability of agriculture [2]. Also livestock grazing, while providing high economic value for agriculture, continues to place heavy pressure on the environment, especially in some sensitive areas [2]. Taking action to raise the efficiency of nitrogen use in crop and livestock agriculture would bring production, greenhouse and environmental benefits [48]. Moreover, subsidising farm diesel energy costs is a disincentive to improving energy use efficiency and reducing GHGs.

The country also has a major challenge in terms of biodiversity conservation given its world mega-biodiversity status, and agricultural pressures from land clearing and grazing pressures [3]. There has been considerable progress since 1990 in terms of reducing land clearance by agriculture, especially with the prohibition of broad-scale vegetation clearing from 2006 [3]. Nevertheless, past declines in vegetation extent and condition, as well as fragmentation of habitats and continued grazing pressures on some habitats, especially in sensitive areas, are cause for ongoing action and vigilance [2]. Moreover, there are concerns that rivers and associated aquatic ecosystems in tropical Australia could come under increasing pressure as sources of water to support irrigation development in southern Australia are subject to enhanced climate variability [2].

There has been ongoing adaptation in the approach of agricultural and environmental policies over the past 10 years, from a mainly farm focus to a more integrated and long term emphasis operating at water catchment and regional levels [49]. Many farmers are addressing environmental concerns, with Government initiatives, such as the NLP, raising farmer awareness and responses to these issues, with over 40% of farmers in *Landcare* groups (Figure 3.1.3) [49, 50]. Agricultural practices, that have in the past exacerbated natural erosion rates, are improving, with the NLP encouraging more sustainable practices.

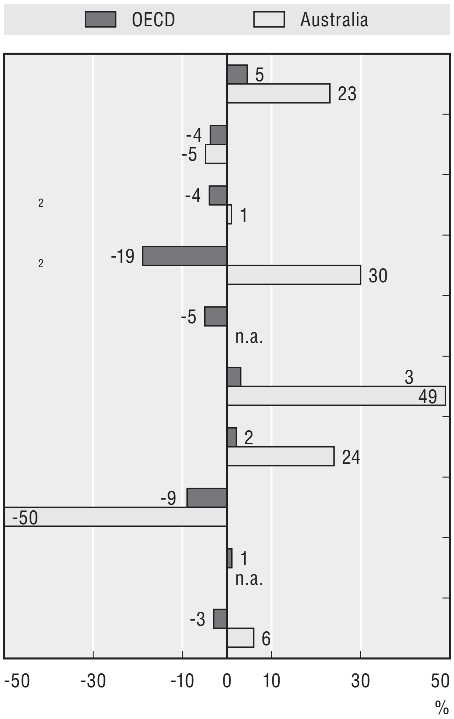
A range of government supported initiatives are being led by industry to address the environmental footprint of agro-chemical use. For example, the NLP is funding delivery of *FertCare*, through the fertiliser industry, to encourage farming practices that manage environmental risks of fertiliser use. Increased funding of the NAP to control soil salinity, such as through revegetation, is leading to secondary beneficial impacts on biodiversity and reducing GHGs [42]. Between 1996-2004 the NHT facilitated nearly 800 000 hectares of land rehabilitation which, together with state/territory government controls on land clearing and the NHT *Bushcare Program*, should help biodiversity conservation.

While increasing attention is being paid to water management, recent droughts have placed additional pressures on an already stressed water system [2]. For water some issues that need addressing include, among others: variation between States in water reforms and securing adequate water for environmental purposes; exploring new opportunities for water recycling; and improving irrigators water use efficiency [4, 9, 51, 52]. Uncontrolled and unsustainable growth in groundwater use in many regions, linked to the stress on surface water systems, is a cause for serious concern [2]. There are, however, some positive signs of more sustainable use of groundwater use by irrigators, for example in the Great Artesian Basin many bore holes have been capped, drainage canals covered and some wetlands restored [2].

Water reform policies are beginning to change farming systems. This is evident with farmers producing products with higher economic returns (*e.g.* from pasture to horticultural crops), increasing efficiency of irrigation and by diverting water for environmental purposes to encourage biodiversity conservation [2]. Further improvements in agricultural water use are needed. Some are being delivered through provision of technical advice to irrigators under initiatives such as the *National Program for Sustainable Irrigation through Land and Water Australia*. In 2007, the Federal Government allocated an additional AUD 10 (USD 7.5) billion under the *National Plan for Water Security*. Improving the efficiency of agricultural water use is a key objective of the Plan through reforms in the management of water access and trading, and improved irrigation practices, in the industry.

Figure 3.1.2. **National agri-environmental performance compared to the OECD average**

Percentage change 1990-92 to 2002-04[1]



Absolute and economy-wide change/level

Variable	Unit		Australia	OECD
Agricultural production volume	Index (1999-01 = 100)	1990-92 to 2002-04	123	105
Agricultural land area	000 hectares	1990-92 to 2002-04	–22 364	–48 901
Agricultural nitrogen (N) balance	Kg N/hectare	2002-04	17	74
Agricultural phosphorus (P) balance	Kg P/hectare	2002-04	1	10
Agricultural pesticide use	Tonnes	1990-92 to 2001-03	n.a.	–46 762
Direct on-farm energy consumption	000 tonnes of oil equivalent	1990-92 to 2002-04	+659	+1 997
Agricultural water use	Million m^3	1990-92 to 2001-03	+3 276	+8 102
Irrigation water application rates	Megalitres/ha of irrigated land	2001-03	4.3	8.4
Agricultural ammonia emissions	000 tonnes	1990-92 to 2001-03	n.a.	+115
Agricultural greenhouse gas emissions	000 tonnes CO_2 equivalent	1990-92 to 2002-04	+5 374	–30 462

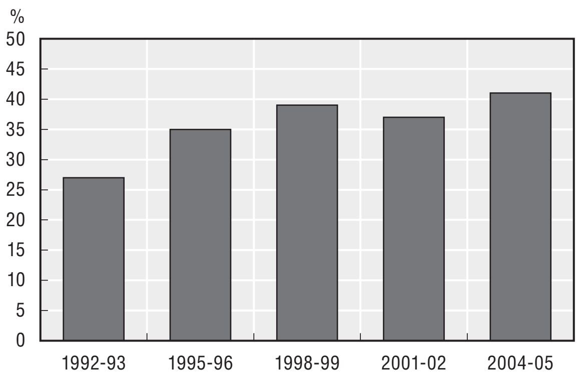
n.a.: Data not available. Zero equals value between –0.5% to < +0.5%.

1. For agricultural water use, pesticide use, irrigation water application rates, and agricultural ammonia emissions the % change is over the period 1990-92 to 2001-03.
2. Percentage change in nitrogen and phosphorus balances in tonnes.

Source: OECD Secretariat. For full details of these indicators, see Chapter 1 of the *Main Report*.

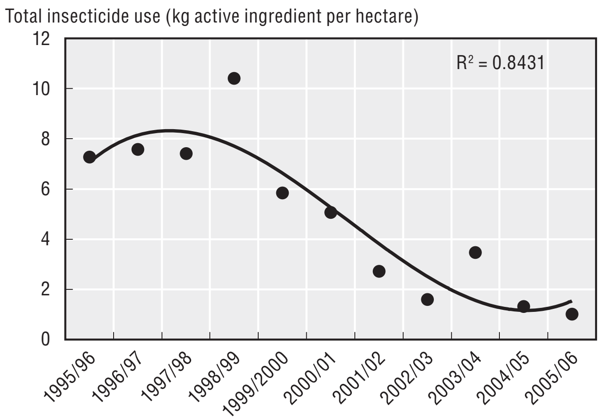
Figure 3.1.3. **National Landcare membership**

% of total number of farmers



Source: Australian Bureau of Agricultural and Resource Economics.

Figure 3.1.4. **Annual quantities of insecticide and acaricide applied to the cotton crop**



Source: Cotton Research and Development Corporation, Australian Government.

StatLink http://dx.doi.org/10.1787/288687778216

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