6
AGRICULTURE AND ENVIRONMENT*

Features

- Voluntary approaches: landcare and EMS
- Preventing salinity
- Improving the efficiency of water use
- Combating weeds and pests
- Agriculture and climate change

* The present chapter reviews progress in the last ten years, and particularly since the previous OECD Environmental Performance Review of 1998. It also reviews progress with respect to the objectives of the 2001 OECD Environmental Strategy.

Recommendations

The following recommendations are part of the overall conclusions and recommendations of the environmental performance review of Australia:

- ensure that the 56 new regional *catchment management bodies develop the capacity* (good governance, funding, know-how, training, institutional support) to achieve the outcomes they are expected to deliver, in partnership with the agricultural industry;
- further develop and operationalise the *economic framework for sustainable agriculture*, using *market-based instruments* (taxes, charges, trading) and economic analysis;
- assure independent evaluation of the *effectiveness of voluntary approaches* (e.g. landcare, promotion of EMS); and ensure that the *lessons learned* with good land and environmental management practices are shared across the country;
- strengthen measures to reduce *irrigation water losses* and the runoff of *excess fertilisers and pesticides* to the environment;
- develop *information* on agrochemicals use and residues and more broadly on the environmental impacts of agriculture;
- evaluate the economic risks to agriculture associated with projected climate change, and take cost-effective measures to enhance the sector's capacity to *adjust to expected effects of climate change*, and continue to develop and expand the capability of the agricultural sector to reduce greenhouse gas emissions;
- where agriculture can no longer be sustainable, assist affected landholders and communities in the *transition to other land uses.*

Conclusions

During the review period, Australia made considerable efforts to reduce the environmental footprint of its agricultural sector. These efforts included a fundamental *reform of the water sector*, support for the states and territories to implement a regional approach to natural resource management, and Commonwealth and state/territory funding made available through various channels. The extensive reforms being introduced under the *National Water Initiative*, notably water markets and full cost pricing, can be expected to considerably improve the *efficiency of irrigated agriculture* and also return water to the environment. The unflagging continuation of these efforts should be given a high priority. Almost all regional plans and investment programmes have been accredited by the Commonwealth and relevant

state/territory governments; if well implemented, they will do much to make agriculture more sustainable. At the farm level, the *Landcare programme* has contributed to fostering a *stewardship ethos* and promoting more environmentally friendly land management practices, with almost 40% of landholders involved. In 2004, all Australian governments agreed to stop loss of native vegetation through *land clearing*. Governments are also developing and pilot-testing market-based instruments to protect and expand native vegetation on private land. The range of strategic programmes funded by the Commonwealth and state/territories, was and continues to be a catalyst for progress.

Despite these gains, there is much more to be done to improve the sustainability of the agriculture sector in Australia. This will require dealing with a number of *legacy issues*, including the accumulated negative effects of some agricultural practices (e.g. over-grazing, land clearing, inefficient irrigation), which have aggravated soil salinity and acidity, erosion and pests damage. Doing so will be made even more difficult by the projected impacts of climate change. The success of the plans and programmes underway will rely very heavily on the performance of the natural resource management bodies, some of which are relatively new and untested, as well as the introduction of proper *economic incentives and prices* concerning water, land and ecosystem resources. The problems of *salinity* and *acidity* might become more widespread if the ambitious measures underway are not fully pursued. The use of *nitrogenous fertilisers* has risen during the review period, and in intensively farmed regions, fertilisers cause eutrophication of both fresh and marine waters. There is a dearth of policy-relevant information about trends in the use of *pesticides* and about the levels of pesticide residues in food, organisms and ecosystems. Despite recent improvements in some regions, the efficiency of irrigation water use could be improved by reducing *leakage and evaporation* from channels and reservoirs. With severe droughts affecting the country since 2000, there have been recurrent and large drought compensation payments. The difficult economic question for some of the farmland is whether it may be more cost-effective to induce farmers to retire from farming entirely in order to capture the benefits of the biodiversity, natural heritage and tourism potentials of restored land.

1. Agricultural Policy Objectives Related to the Environment

Agriculture, notably extensive pastoralism on the country's rangelands, has long been emblematic of Australia's history and identity. While it now represents a relatively modest part of the country's economy (Box 6.1), *agriculture's environmental footprint remains significant.* More than 60% of the country's land area (460 million ha) is devoted to agriculture (Table 6.1) and irrigation represents two-thirds of total extracted water use (Box 2.2). The cost of land and water degradation due to the growing problem of dryland salinity is estimated at AUD 3.5 billion per year (Auditor General, 2004). The legacy of overgrazing and land clearing presents severe challenges to agricultural sustainability and indigenous biodiversity. Conversely, the fragility of the natural resource base and ambient environmental conditions (e.g. frequent droughts, naturally saline soils) seriously constrain the sustainability of agricultural production. In the long run, climate change may also strongly affect the shape of Australian agriculture.

Since the 1990s, Australia has *moved away from the traditional farm-focused and services-cum-subsidies approach*. Its agri-environmental policies are now framed under the rubric of sustainable natural resource management, and the focus has widened to the landscape scale. Through the policies of the Natural Heritage Trust (NHT), there is now a high degree of integration among land management policies, for both agriculture and forestry, and the protection of nature and biodiversity. The new approach appears full of promise, but the *transition to sustainable agriculture* will take time and it will be important not to lose heart when results initially prove modest. Even so, problems such as water scarcity also affect cities and urban areas. The onus will be on the agriculture sector as well as governments to show that the large continual investment of public funds in rural Australia is producing results.

Sustainability and the commercial dimensions of farming are integrated in the Australian Government's *overarching policy objective for the agriculture sector* through references to sustainability and maintaining the natural resource base, at the same time as increasing profitability and competitiveness and achieving greater national wealth and stronger regional communities.[1] Under this generic objective, a host of multi-faceted national programmes[2] (in co-operation with the States and Territories and regional natural resource management bodies) directly or indirectly address matters related to agriculture and the environment.

The major national initiatives addressing *agro-environmental* issues include:

– the National Landcare Programme (NLP), administered through the Department of Agriculture, Fisheries and Forestry (DAFF) since its inception in 1992, encourages landholders to adopt sustainable management practices, undertake

Box 6.1 **Agriculture**

Agriculture in Australia generates less than 3% of GDP and accounts for around *25% of merchandise exports* and 4% of the workforce (2004-05). A much greater proportion of GDP comes from secondary industries that add value to agricultural commodities; the farm output sector accounts for 8% of GDP. Agriculture grew by more than 50% between the early 1980s and 2004-05, but owing to the more rapid growth of other sectors (e.g. services, mining and manufacturing) its share of GDP declined from around 3.6 to 2.7% over the same period (ABARE, 2006a). Support for agriculture is among the lowest in the OECD area. Producer support, as measured by the OECD Producer Support Estimate, continued to fall through the review period, from 7% in 1998 to 5% in 2005 (Figure 6.1).

The *deregulation* of several agricultural sectors proceeded during the review period. For instance, in the dairy sector farm gate prices were deregulated in 2000 in all the States and Territories. Structural adjustment assistance for farmers (part of an industry recovery plan) will terminate by 2008. In the wool sector, industry bodies were privatised in 1999 and are now controlled by the woolgrowers themselves. Similar developments took place in the pork and egg industries.

Australia is a significant player in *world trade* for several commodities, and the agriculture sector has become increasingly export-oriented over the past two decades. Around two-thirds of agricultural production is exported, including wool (95%), beef, sugar and wheat (65-75%), sheep meat, wine and dairy (50-60%). The production of biofuel (e.g. from sugar cane) is being developed. Australia has the second largest livestock population among OECD countries (after the US), with 283 million head of sheep-equivalent. This includes some 28 million cattle, 106 million sheep and 3 million pigs (Figure 6.2).

The agriculture sector has experienced considerable *structural change in recent decades*. In the two decades to 2005-06, across the entire sector, average farm size increased by 23% and the number of farms fell by 25%, leading to a decline of 9% in the area of land under agricultural production (ABARE, 2006a). Over the same period in the cropping industry, the number of farm businesses fell from 39 000 to 30 500, a decline of 22%; the average area cropped per farm rose from 450 to 710 ha, an increase of 58%.

Small *family-owned and -operated farms* typify the sector: 63% of farms are under 500 ha and 99% remain family-owned, despite a continuing trend towards larger farms. Off-farm employment has become increasingly important to maintain family farm incomes. Around 45% of farm families now derive income from off-farm salaries and wages (up from 30% in 1990), with average earnings of AUD 33 500 in 2003/04.

Broadacre farming[a] has remained internationally competitive through *productivity growth*, most notably in the grains and cropping industry but significantly less for sheep, beef and dairy. In the cropping industry, total factor productivity (the value of output relative to the value of inputs used) rose on average

Box 6.1 **Agriculture** *(cont.)*

2.7% a year from 1977-78 to 2003-04; the good relative performance of cropping can be attributed to a range of factors, such as increased mechanisation, improved herbicides and pesticides, better rotations, higher yielding varieties (e.g. GM cotton dominates the Australian cotton crop), and better farm management and marketing strategies (ABARE, 2006a).

a) Broadacre farming comprises grain growing, sheep and beef production, and beef cattle feedlot operations.

Table 6.1 **Agricultural land use**

Land use	% of total land area
Grazing natural vegetation (rangeland)	56.0
Dryland grazing (improved pastures)	2.5
Cropping	2.8
Horticulture	< 1.0
Irrigation	< 1.0
Total agricultural land	61.5

Source: SoE, 2006.

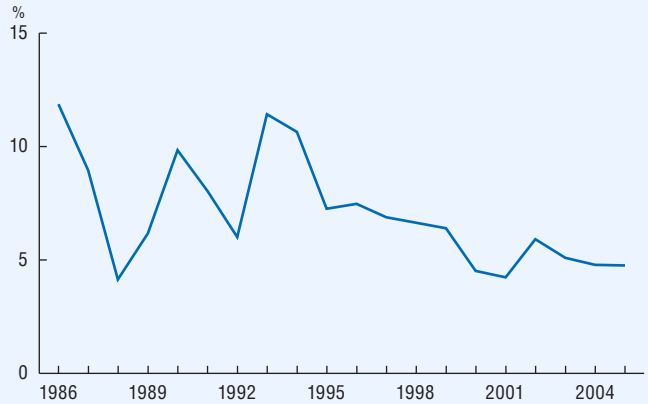
conservation, and improve their productivity, profitability and the condition of natural resources, both on and off farms; it emphasises community and industry engagement and natural resource management (NRM) planning (Box 6.2);

– the sustainable use of natural resources by agriculture is a key objective of the Natural Heritage Trust. Set up in 1997, the NHT delivers programmes jointly with the States and Territories through 56 regional natural resource management bodies responsible for preparing and implementing natural resource management plans and investment strategies (Chapters 2 and 3);[3]

– the National Action Plan for Salinity and Water Quality (NAP) encourages regionally co-ordinated action to tackle salinity problems. Since 2001, the States and Territories have signed bilateral agreements with the Australian

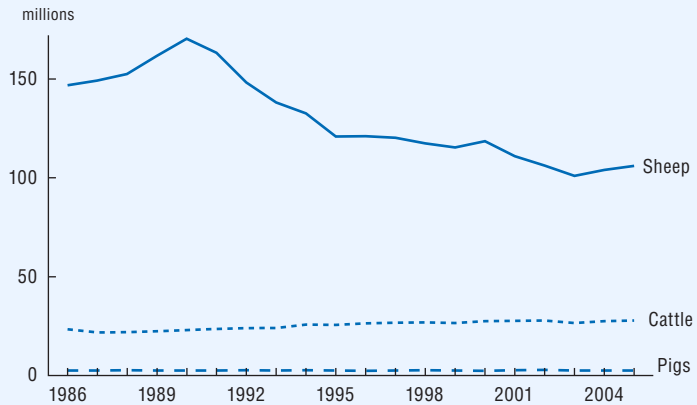
Figure 6.1 **Agricultural subsidies**

Producer Support Estimate,[a] 1986-2005



a) PSE (total producer support estimate): transfers to farmers as a percentage of their gross receipts.
Source: OECD PSE/CSE database, 2006.

Figure 6.2 **Livestock,**[a] 1986-2005



a) Totalling 283 million head of sheep equivalent (including goats, chickens, horses, mules and asses) in 2005; based on equivalent coefficients in terms of manure: 1 horse = 4.8 sheep; 1 pig = 1 goat = 1 sheep; 1 hen = 0.1 sheep; 1 cow = 6 sheep.
Source: FAO (2006), FAOSTAT data.

Box 6.2 **The Landcare voluntary approach**

The Australian Government's National Landcare Program (NLP) was established in 1992 as one of the mechanisms to make progress towards sustainable ecosystems, with a primary focus on sustainable agriculture and improved management of the natural resource base (i.e. soil, water and vegetation) at farm level. Administered by the Department of Agriculture, Fisheries and Forestry, the programme includes support for the *voluntary landcare movement*.

The landcare movement began in the mid-1980s. It has become a *community-based movement* now comprising around 4 500 groups across the country. Participation in the landcare groups stands at around *40% of farmers nationally, compared with 32% at the time* of the previous OECD review. Landcare has very high public recognition and support: 85% of the public recognises and supports it as important for natural resource management and environmental care.

A 2003 review of the National Landcare Program showed that funding of landcare groups, and other support through the programme, have been highly effective in building awareness and skills, transferring knowledge and stimulating adoption of better farming practices. The review found that *75% of broadacre and dairy farmers and 50% of all farmers* use landcare groups as a source of information on farm management. Landcare participants were found to perform better than non-participants in adopting a wide range of sustainable production and improved natural resource management practices, such as adopting minimum tillage, fencing off degraded land, monitoring vegetation, and controlling pests and non-crop weeds.

The landcare movement has been described as a powerful and capable *force for landscape change* in Australia. However, a *majority of farmers are not involved* in the NLP and the *efficiency of voluntary approaches* has to be compared with the efficiency of regulatory and economic instruments. In addition, given the extent and scale of the natural resource management challenges facing Australia, the benefits of changing farming practices on the property and local scales are not necessarily reflected in resource condition improvements on the regional scale. For example, it is likely that landcare type programmes can make only a marginal contribution to dealing with regional scale issues such as dryland salinity.

Government; AUD 1.4 billion has been committed over seven years, of which half by the Australian Government and the other half by the States and Territories (Chapters 2 and 3);

– the National Water Initiative (NWI) aims to increase the productivity and efficiency of water use, sustain rural and urban communities, and ensure the health of river and groundwater systems (Chapter 2);

– the Environmental Stewardship Programme, announced in 2007, will focus on the long-term protection, rehabilitation and improvement of targeted environmental assets.

Other initiatives have been the National Framework for Management and Monitoring of Australia's Native Vegetation (2000), the National Weeds Strategy (Chapter 3) and the National Feral Animal Control Program.

2. Management of Impacts on Land and Soil Quality

2.1 Erosion

Much of Australia's *agricultural land faces degradation problems*. Overall, it is the driest permanently inhabited continent. Few of its soils are naturally suited to intensive agriculture, as they are shallow, high in salt or low in nutrients. Annual rainfall is less than 600 mm per year over 80% of the continent, and evaporation rates are high. Drought is a regular feature of the climate (Chapter 2).

Past overgrazing and land clearing have led to substantial vegetation loss and accelerated *erosion, leaving landscapes permanently degraded*. Studies have shown that over 70% of the Intensive Land Use Zone[4] has erosion rates ten times greater than the estimated average natural rate of erosion. Generally, erosion rates also far exceed those at which soil is replaced by organic decomposition. While the rate of loss is higher on the more erodible cropping lands, about three-quarters of all soil losses occur on extensively grazed native pasture due to the large areas involved (Gleeson and Dalley, 2006).

The main attempt over the past two decades to halt soil erosion and maintain the natural resource base has been to *commit landholders to adopt sustainable land management practices* on a voluntary basis. The landcare campaign has become a community-based movement, now comprising around 4 500 groups or about 40% of farmers across the country. Given the extent and scale of the natural resource management challenges facing Australia, however, the benefits of changed farming practices at property and local scale are not automatically reflected in resource condition improvements on a regional scale (e.g. regarding salinity). The most significant result of the landcare movement's activities to date may be an attitude change on the part of the farmers (Box 6.2).

Following a 2003 review of the NLP, the Australian Government *renewed its commitment to landcare*. NLP funding is around AUD 40 million per year.

2.2 Salinity

Land use changes have exacerbated natural salinity problems. Australia is geologically and climatically prone to salt concentrations in the landscape, as it combines a generally flat terrain with low rainfall, high evaporation and very limited sub-surface drainage to the sea. Extensive land clearing for agricultural purposes and irrigation have altered groundwater balances, mobilising salts. This has had significant adverse effects on soil and water quality and on ecosystems. The cost of salinity[5] includes the loss of productive land for agriculture, reduced yields, and damage to infrastructure such as roads and buildings.

The cost of land and water degradation alone, due to the growing problem of dryland salinity, is *estimated at AUD 3.5 billion* per year (Auditor General, 2004). Around 20 000 farms and 2 million ha of agricultural land are reported to show signs of salinity (ABS, 2002). The state most affected is Western Australia, with 7 000 farms and 1.2 million ha showing these signs. Of the agricultural land on which there is evidence of salinity, 800 000 ha cannot be used for agricultural production. Around 5.7 million ha of agricultural land is estimated to have high potential for developing dryland salinity; this figure could rise to 17 million ha (almost 4% of all agricultural land) by 2050 if effective controls are not implemented.

In order to *halt the further spread of the problem*, in 2000 the Australian Government launched the National Action Plan for Salinity and Water Quality (NAP), the first national strategy to address the salinity problem. The NAP targets the 21 regions most affected by salinity and water quality problems through regional NRM plans (rather than individual projects) developed by local communities (Chapter 3). The aim is for all levels of government, community groups, individual land managers and local businesses to work together to manage water quality and address salinity problems. Much NAP funding is used for catchment planning, capacity building for a change in management practices, and information dissemination activities. Some is also spent on activities such as replanting and stream stabilisation.

Ultimately, landscape-scale adaptation of land use practices will be needed. It is as yet *too early to assess the effectiveness of the NAP in terms of on-the-ground outcomes*. Bringing dryland salinity to a standstill will require long-term efforts well beyond the current seven-year term of the NAP. Salinisation involves complex spatial and temporal processes. There is still much to learn about the precise links between land management actions and their effect on salinity. Given that success ultimately depends on landholder actions and practices, it is vital that the agriculture sector remain fully engaged with the regional NRM approach.

The *National Market-based Instruments Pilot Program*, a sub-programme of the NAP, is intended to explore the potential, and experiment with the use, of market-based

instruments (MBIs) in managing natural resource issues, particularly in addressing the problems of salinity and water quality (Chapter 3). Other NHT programmes promote the use of environmental management systems (EMS) on farms (Box 6.3).

Box 6.3 **Persuading farmers to adopt Environmental Management Systems**

Australian governments operate a plethora of programmes that are at least partially aimed at raising farmer awareness of, and knowledge about, environmental and natural resource management issues. One way to translate better knowledge into improved farm management practices is through *farm-level environmental management systems (EMS*). The benefits of EMS in agriculture can include: improved management of the environmental impacts of farming; better natural resource outcomes and sustainable agriculture; the potential to respond to market access issues; improved community perceptions of farming; adaptive management processes to build on and streamline a range of complementary processes, e.g. property management planning, quality assurance, best management practices; and improved business efficiency. Independently audited EMS, in combination with some kind of labelling scheme (e.g. sustainable produce), can confer a price advantage on domestic or international markets.

In 2002, the National Resource Management Ministerial Council endorsed the document "Australia's National Framework for Environmental Management Systems in Agriculture: Partnerships for Sustainable Agriculture" and adopted an associated five-year national implementation plan. Funding (AUD 20.2 million) through the Natural Heritage Trust is therefore promoting the use of EMS in the agriculture sector. First, the *EMS National Pilot Program* (AUD 8.5 million) was launched in 2003 with 16 pilot projects across Australia. The programme was aimed at developing and assessing the value of EMS from an enterprise level up to a catchment scale. Secondly, the *Pathways to Industry EMS* (AUD 11.7 million) involves 19 industry bodies, research and development corporations and farming organisations.

Both programmes have recently been subject to *mid-term reviews*. While there are general indications that satisfactory progress is being made, tangible environmental benefits have yet to emerge. Furthermore, an apparent surplus of EMS tools risks creating confusion about the terminology used and the linkages to other systems. An evaluation of pilot projects in Queensland found that although initial farmer interest was higher than expected, relatively few farmers, once they had completed the first round of the process, continued to use EMS as a tool for continuous improvement.

Source: Environmental Management Systems Implementation Working Group, 2003; Pahl *et al.*, 2006.

2.3 Acidity

Soil acidification is a major soil degradation issue in many parts of Australia. The National Land and Water Resources Audit (NLWRA) estimates that *approximately 50 million ha, or about 11% of all agricultural land, has a soil pH value of less than 5.5*. Moreover, without corrective action the area of land affected could increase to 99 million ha over the next decade. Although the continent's soils are generally acidic because they are geologically old and have been leached of most of their minerals, farming practices (notably the use of acidifying fertilisers) can exacerbate the problem.[6] Soil acidity often affects low-lying coastal regions, especially in areas where mangrove swamps have been cleared for agriculture or urban development. The exposure of coastal *acid sulphate soils* (pH less than 3.5) to the atmosphere results in the release of sulphuric acid, which reduces water quality in rivers and estuaries and often results in fish kills.

Although soil salinity problems have a higher profile in the public mind, *soil acidity currently affects eight to nine times more land than dryland salinity*. To put the scale of the issue in perspective, the NLWRA estimates that to raise the pH of all soils in Australia to 5.5, a one-off application of 66 million tonnes of lime would be required. The NLWRA estimates current agricultural lime use at nearly 2 million tonnes per year, which is insufficient to deal with existing acidity problems, let alone continuing soil acidification.

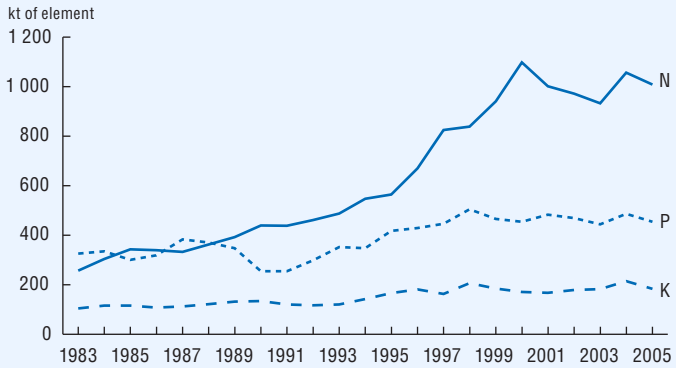
2.4 Agrochemicals

Australia's vast area of unimproved grazing lands, made up of native grasslands and woodlands that receive no agrochemicals (i.e. commercial fertilisers, pesticides and other agrochemicals), cause the country's *footprint for agrochemical use* to be very low compared to that of most other countries. The estimated nitrogen and phosphorus surpluses (calculated following the OECD methodology) are also among the lowest in the OECD area.

Commercial fertilisers

Nonetheless, productivity improvements in areas of more intensive use have to a large extent been achieved through greater use of agrochemicals. Total consumption of commercial fertilisers (nitrogen, phosphorus and potassium) has increased over the past 20 years by 126% (from 730 000 tonnes to 1 647 900 tonnes) (Figure 6.3). While there has been some growth in phosphorus and potassium consumption during the review period, a nearly five-fold increase in nitrogen use accounts for most of the trend. The upward trend in nitrogen use continued throughout the review period,

Figure 6.3 **Trends in fertiliser sales,**1983-2005



Source: FAO (2004), FAOSTAT data; FIFA; OECD Environment Directorate.

albeit at a lower rate due to the drought conditions prevailing in recent years (FIFA, 2006). These trends are in stark contrast to those observed in most other OECD countries.

Nutrients generated by the large livestock population (283 million head of sheep-equivalent), together with poor management of manure, contribute to pollution of both water and air. The levels of *commercial fertiliser use also cause significant nutrient problems* in fresh and marine waters (Chapter 2). There is particular public concern about the effects on the Great Barrier Reef and adjacent coastal environments (Box 2.5); the issue has also received public attention throughout the Murray-Darling Basin. While agriculture is not the only cause of eutrophication, there can be little doubt that inefficient fertiliser use, poor storage and handling practices, and inappropriate farm management practices are significant contributors. These problems are being addressed by industry programmes and, in some States, by legislation intended to make fertiliser practices both more efficient and more environmentally responsible.

Pesticides and other agrochemicals

Pesticides used in Australia (i.e. insecticides, herbicides and fungicides) and *growth promotants* represent more than 35 000 tonnes of active ingredients per year. The most extensively used *herbicide* is glyphosate (about 15 000 tonnes per year), a broad-spectrum, non-selective post-emergence product. Use of herbicides has

allowed the adoption of conservation farming and minimum cultivation techniques, which reduce soil erosion. A recent report found that around 70% of arable farmers have adopted both direct drilling and minimum tillage practices[7] (ABARE, 2006b). The main chemical used for *pest animal management* is "1080" (sodium monofluoroacetate). The use of this controversial chemical was recently reviewed by the Australian Pesticides and Veterinary Medicines Authority, which found that adverse environmental impacts were minimal relative to the agricultural and environmental benefits (reduced pest animal damage to native flora and fauna).

The use of *methyl bromide* has been phased out under the *Montreal Protocol* since 2005 in developed countries, except for agreed exemptions. In Australia, its use fell from a high of 652 ODP[8] tonnes in 1993 to 70 ODP tonnes in 2005. While strawberry fruit growers have largely substituted Telone C35 for methyl bromide as a preferred fumigant, strawberry runner growers still use it in the apparent absence of a technically feasible alternative. Australia is continuing to seek critical use exemptions under the Montreal Protocol, at the request of industry, while research continues on alternatives (Chapter 8).

Sugar and cotton producers are some of the largest pesticide users. An environmental audit of the sugar industry reveals that only a small share of farmers use Integrated Pest Management practices (DAFF, 2004). However, in the cotton growing areas of Eastern Australia only 10% of samples from surface water exceeded drinking water standards for pesticides (AATSE, 2002); best management practice codes are in effect on 50% of the land where cotton is grown.

Intentions and actions

Several *government-supported and industry-led voluntary initiatives* are being implemented to manage the impacts of excess agrochemicals on the environment. These initiatives include: National Landcare Program funding for the delivery of FertCare, through fertiliser industry associations, to facilitate the development of farming practices that, among other objectives, "effectively manage environmental risks associated with nutrient use"; a collaborative partnership (known as Dairying for Tomorrow) between the dairy industry and catchment managers to set on-farm targets that will contribute to healthy catchments and communities; and initiatives under the Pathways to Industry Environmental Management Program to assist farmers and growers in the dairy, cotton, rice, wine, horticulture and organics industries to improve farming practices (including the use of fertilisers and pesticides) and soil condition.

It is hard to assess the performance of such voluntary programmes in terms of their impact on chemicals use, as there is a *dearth of good information about consumption trends*. The National Pollutant Inventory does not report on agricultural

or veterinary chemicals. In addition, little systematic information is available about the presence of, and risks posed by, pesticide residues in soils, water and biota. A 2002 study on pesticide use in Australia i) recommended the establishment of a comprehensive integrated national environmental monitoring programme and ii) requested more emphasis on monitoring the biological effects of pesticides on organisms and ecosystems, rather than just testing for concentration effects in individual species (AATSE, 2002).

3. Management of Impacts on Water

Irrigated agriculture

The agriculture sector is by far the *major water consumer in the Australian economy*, accounting on average for almost 70% of the country's annual use of extracted water by rural, industry and domestic sectors (Government of Australia, 2007). In 2003-04, about 10 000 gigalitres[9] (GL) of water was used for irrigated agriculture.[10]

Although it occupies only 0.5% of all agricultural land (2.4 million ha in 2003-04), *irrigated agriculture generates around 23% of the gross value of all agricultural production*, or AUD 9 billion in 2003-04. Irrigated horticulture contributes 52% to this total (using 19% of irrigation water), with irrigated pastures and irrigated broadacre crops together contributing around 48% (using 81% of irrigation water) (Chapter 2). The area of land under irrigation grew by 22%, and total water use by 7.5%, in the five-year period to 2000-01, with most of the growth occurring in Queensland. The Murray-Darling Basin is the dominant irrigation region (accounting for an estimated 70-72% of total irrigation water use) (Chapter 2); its catchment covers over 1 million km^2, or 14% of Australia's total landmass, across parts of New South Wales, Victoria, Queensland and South Australia. Broken down according to States, most of the water used by Australian agriculture is consumed in New South Wales (44%), followed by Victoria (22%) and Queensland (21%).

Countrywide, about *one-third of irrigators irrigate pasture for grazing*. In 2003-04, irrigation for this purpose accounted for 32.6% of the total area of irrigated crops and 29.5% of the total volume of irrigation water applied. Irrigating pasture for grazing is the dominant use of irrigation water in several States and Territories (e.g. in Victoria and Tasmania 68.0% and 52.7%, respectively, of water used).

Other sectors dependent on irrigation include *dairying and the production of commodities* such as rice, cotton, grapes and other fruit, vegetables and sugar. *Dairy production* occurs in all the States but is concentrated in Victoria, where 60% of

Australian dairy farms are located. More than 50% of dairy farmers irrigate. About 6.4% of all irrigators irrigate *sugar cane*, which is the predominant crop irrigated in Queensland (1 110 GL). Sugar cane accounted for 42.5% of total irrigation water applied in that State in 2004-05, a decrease from the 47.2% reported in 2003-04. About 1.9% of irrigators irrigate *cotton*, which consumes 18% of overall water used in agriculture. Irrigation of cotton increased significantly during 2004-05, with both the area irrigated and volume of water used increasing by 46% on the previous year. The most intensive use of irrigation water is for cotton and rice production (with average application rates of 6.7 and 12.4 ML[11] per irrigated hectare, respectively). Around 70% of Australia's cotton and almost all of its rice is produced in New South Wales.

Improving the efficiency of water use

There are signs of improvements in *water use efficiency in agriculture*, with application rates declining from 7.5 to 4.3 ML/hectare irrigated between 1996-97 to 2003-04, although only around 40% of water is applied using more technically efficient irrigation technologies (ABS, 2005). However, water is still not used as efficiently as it could be in agriculture. Between 10-30% of the water diverted from rivers into irrigation systems is lost through leakage and evaporation before it reaches the farm gate. Up to 20% of water delivered to the farm may be lost in on-farm distribution channels, and around 60% of water used for irrigation on farms is applied using high-volume, ineffective gravity (e.g. flood) irrigation methods. More than 10-15% of water applied to crops is lost through overwatering. Better measurements and scheduling could more precisely match water application to crop water requirements. Inaccurate metering of water diversions from rivers and water use on farms is leading to both unintentional and intentional overuse.

To increase on-farm water efficiency, irrigators have access to *technical advice*, for example through the National Program for Sustainable Irrigation delivered by Land and Water Australia, a government agency. Rising *water charges* (i.e. for the operational cost of delivering water to the farm gate) have also provided an incentive; charges on average doubled in real terms during 1996-2004 as a result of the drought, which curbed the volumes of water available to irrigators and forced irrigation water providers to increase unit costs in order to achieve the full cost recovery required of them.

Improving the productivity and efficiency of Australia's water use is also one of the key objectives of the 2004 *National Water Initiative* (NWI), which proposes to achieve this objective through, *inter alia*, creating more secure *water access entitlements*, expanding permanent *water trading* and increasing the confidence of water industry investors (Chapter 2). A 2006 review of progress on the National Water Initiative concluded that there is now significant momentum behind the reform,

but that there is still a considerable distance to go to achieve sustainable water management in practice (National Water Commission, 2006).

In January 2007, the Australian Government proposed a further AUD 10 billion *National Plan for Water Security*, which provides for the Murray-Darling Basin Commission to be reconstituted as an Australian Government agency to take over governance of the water resources of the Murray-Darling Basin. To be implemented, the plan needs the prior agreement of the State/Territory governments affected. The new plan, which will be implemented over ten years starting from the date of the final agreement, also proposes large investments to achieve water savings.

As for the *reform of property rights to water*, all Murray-Darling Basin States are moving beyond the simple separation of land ownership from water entitlements, which have been split into three separate rights: water allocation (defined as a share of the resource available after the needs of the environment have been satisfied), delivery capacity rights and site use licences. The aim of this "unbundling" is to further enhance the capacity of markets to operate efficiently.

Certainty over water entitlements is being used by some States and Territories as a means to promote competitive advantage in attracting and maintaining investment in primary industries, related processing industries and infrastructure. For example, according to the Victorian Government, its approach to security of water entitlements results in irrigated agriculture in the State earning approximately twice the value per ML as that in New South Wales (DPI, 2005). In Victoria and South Australia, high security entitlements and high levels of supply reliability attract industries requiring larger initial investment for the production of perennial crops (e.g. wine grapes, citrus, almonds) and for dairying. In New South Wales, where the majority of irrigators have general security entitlements, a higher proportion of annual crops (rice and other cereals) is grown. Annual cropping tends to allow more flexibility because rice farmers, for example, can adapt more easily to changing conditions (such as water shortages and price changes). They may choose not to plant, to sell their temporary water allocation or to plant an alternative crop.

Australia's *water markets* are still young, but the measures taken thus far are already stimulating trade (Box 2.4). Around 43% of irrigated pasture farms, 36% of irrigated broadacre farms and 27% of irrigated horticulture establishments have participated in some form of trade since 2000-01. Water traded on a temporary basis entitles the purchaser to the use of the water allocation associated with a water entitlement for a period of typically one (but it can be up to five) irrigation seasons. Water traded on a permanent basis involves the one-off transfer of an entitlement from one entitlement holder to another.

Under the National Water Initiative, State/Territory governments are committed to establish *compatible institutional and regulatory arrangements* to facilitate intra- and inter-state trade, and to manage differences in entitlement reliability, supply losses, supply source constraints, trading between systems and cap requirements by 2007. However, agricultural producers in New South Wales, Victoria and South Australia face differing arrangements with respect to obtaining water for irrigation purposes, including varying reliability of supply.

4. Management of Impacts on Biodiversity

Agriculture confers economic and social benefits on Australia, but also exerts considerable *pressures on terrestrial and aquatic biodiversity* (Chapter 3). Although 87% of the country's original native vegetation cover remains, its condition varies due to the decline of many ecological communities. Some ecological communities occupy less than 1% of their original area as a result of clearing for agriculture, and many others are highly fragmented. In addition, the components of many ecosystems, especially the understorey of forests and woodlands, have been severely disrupted (Beeton *et al.,* 2006). A number of reports have identified agriculture as the main source of pollution threatening coastal habitats, especially the Great Barrier Reef (Productivity Commission, 2003).

Native vegetation

The *clearing of native vegetation* for agriculture and other land uses (i.e. forestry, urban development, roads) has long been recognised as the main threat to indigenous biodiversity (Chapter 3). Over the past 20 years or so, the State/Territory governments have progressively strengthened legislation to control the clearing of native vegetation on private freehold and leasehold land, although the legacy of massive vegetation clearance for agriculture remains. In 2004, all Australian governments agreed to stop the loss of native vegetation through land clearing. Under the NHT Bushcare Program, farmers are encouraged to conserve and restore native vegetation, threatened ecological communities and migratory birds. On a landscape scale, the regional NRM plans guide investment to reverse the long-term decline in the quality and extent of Australia's indigenous vegetation cover, and to remediate salinity and other land degradation problems. At present, however, such efforts are not always backed up by appropriate rules in local authority land use plans.

A 2004 review of the *impact on agriculture of native vegetation and biodiversity regulations* found that the design and implementation of regulations led, in many cases, to inefficient, ineffective and inequitable outcomes, mainly in terms of forgone production and missed development opportunities (Productivity Commission, 2004).

The review also noted evidence of non-compliance (enforcement is difficult in thinly populated areas) and pre-emptive clearing as insurance against possible future policy changes. Such findings added force to the creation of market-based instruments (MBIs) providing landholders with incentives to protect indigenous vegetation on private land; in this way, native biodiversity is turned into an asset rather than a liability. MBI experiments are being carried out under a sub-programme of the NAP, the National Market-Based Instruments Pilot Program (Table 5.5). Examples are the BushTender and BushBroker Programs now being implemented across Victoria (Box 3.4).

Invasive species

Invasive species, or weeds and pests, also present a significant threat to Australia's agriculture sector and biodiversity. All but five of the 17 threatening processes listed under the Environment Protection and Biodiversity Conservation (EPBC) Act involve invasive species (Chapter 3). Many introduced animals, including rabbits, foxes, feral goats and feral pigs, have established large and widespread populations across Australia;[12] vertebrate pests make up about *10% of mammal fauna*. Exotic pest plant species account for about 15% of flora; weeds are estimated to cost agricultural industries about *AUD 4 billion a year*. Of more than AUD 3.3 billion spent by farmers in 2004-05 on managing land, soil, indigenous vegetation and water problems, more than AUD 1.1 billion was spent on preventing or managing weeds (ABS, 2006).

Weeds are controlled in a variety of ways and at all levels of government. States and Territories operate weed strategies. In 1997, the Australian Government developed a *National Weeds Strategy* for species listed as Weeds of National Significance; 20 species have been so designated and AUD 44.4 million (over four years, from 2004/05 to 2007/08) was allocated from the federal budget to control the listed weeds. All regional NRM plans have identified weed and pest control as a significant preoccupation, but the relative priority and share of resources vary across the country, depending on regional circumstances., There are also some doubts about whether the current species-focused approach is the most effective; many threats come from outside the agriculture sector (landscaping, fodder, earth moving) and greater effort should go into prevention and biosecurity.

The impact of nationally significant pest animals is being managed through the *National Feral Animal Control Program*. The programme is funded through the NHT and aims to develop and implement, in co-operation with the State/Territory and local governments, strategic programmes to reduce the damage to agriculture caused by pest animals. The fight against rabbits, one of the most damaging pests, was greatly helped by the spread of rabbit calicivirus disease (RCD) in the mid-1990s. RCD had a dramatic initial effect in reducing rabbit populations in arid rangeland areas, although

it had less impact in higher rainfall areas. While its impact is now less marked in some areas, the virus still controls numbers sufficiently to make conventional control techniques viable and effective.

Maintaining *biosecurity* is a critical ingredient of the fight against invasive species. Australia has well-established and effective arrangements in place for managing biosecurity, notably in the agriculture sector. A dedicated federal agency (Biosecurity Australia) was established in 2001 to set quarantine policies for imports to minimise the risk of exotic pests and diseases entering Australia. In 2004, the agency's institutional arrangements were amended to give it greater independence and to establish it as an independent agency within the agriculture, fisheries and forestry portfolio.

The Australian Government, in a collaborative effort with the State/Territory governments, has recently initiated a programme to improve the integration of and enhance arrangements for species that have predominantly social and environmental impacts. The programme, established in late 2005, is known as the *Australian Biosecurity System for Primary Production and the Environment*. The outcomes of the programme and an implementation plan are yet to be agreed.

GMOs

The *Gene Technology Act of 2000*, which came into force on 21 June 2001, introduced a national scheme for the regulation of genetically modified organisms. A recent review of the Act found that its objective, to protect the health and safety of people and the environment, is being achieved (Attorney General, 2006). The review observed, however, that all States and Territories except Queensland and the Northern Territory have imposed moratoria regarding GMOs and recommended that all jurisdictions should reaffirm their commitment to a nationally consistent scheme.

The moratoria differ among the States and Territories. Some prohibit the commercial production of all GM crops (not just GM food crops) and one prohibits any dealings with GMOs except under a permit. Some moratoria, however, include provisions for limited and controlled trials of declared GM food crops for research purposes. Non-food GM crops, such as GM cotton, are largely unaffected by the moratoria.

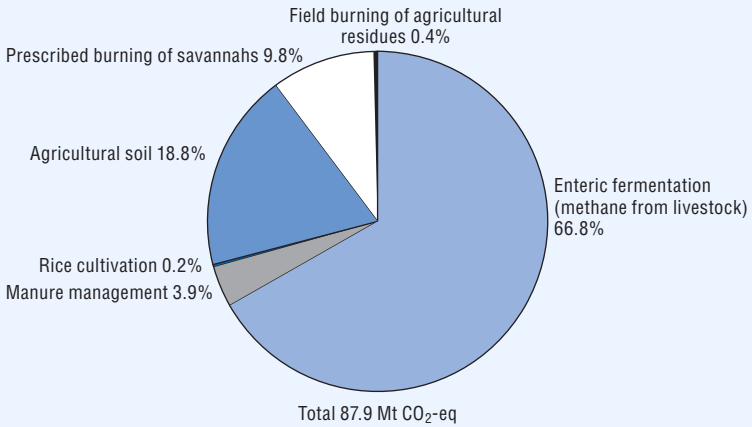
5. Agriculture and Climate Change

The *agriculture sector is the second largest source of greenhouse gas emissions* after electricity production. Australia's National Greenhouse Gas Inventory estimates that on-farm activities (excluding energy use) produce around 15.7% of overall

national emissions (more than total transport-based emissions) (AGO, 2007). Agriculture's direct use of fossil fuel energy rose by more than 35% over the period 1990-2002, more rapid than growth in farm production, leading to a 25% rise in GHGs from farm fuel use.

Agriculture is Australia's *largest source of methane and nitrous oxide emissions*. Methane emissions from livestock represent 11% of national greenhouse gas emissions; nitrous oxide from agriculture represents around 4% of overall greenhouse gas emissions. About 68% of nitrous oxide emissions come from agricultural soils, particularly following the application of nitrogenous fertilisers (Figures 6.4 and 8.2). The halting of land clearing has reduced emissions of nitrous oxides.

Figure 6.4 **Greenhouse gas emissions from agriculture,** 2005



Source: National Greenhouse Gas Inventory 2005, May 2007.

In 2004, the Australian Government initiated an effort to *build the capacity of the agriculture and land management sectors to reduce greenhouse gas emissions*, committing AUD 20.5 million over four years. Agricultural enterprises in the cropping, horticulture, viticulture and livestock sectors are among 700 firms participating in the voluntary Greenhouse Challenge Plus programme (launched in 2005), a voluntary initiative between the private sector and the Australian Government to abate greenhouse gas emissions. It remains difficult to make accurate

and reliable estimates of emissions from livestock and soils at the farm level as these greatly depend on management practices and farming systems, which vary considerably. The Australian Greenhouse Office reports, however, that it is developing a new and more appropriate reporting procedure for on-farm emissions and is investigating technologies to improve the measurement of methane and nitrous oxide emissions from agricultural systems. Taking actions to raise the efficiency of nitrogen use in crop and livestock production, and to increase feed conversion efficiency in livestock production, would bring production, greenhouse and other environmental benefits (DEH, 2005), while diesel fuel tax credits reduce the incentives provided by the broader fuel taxation regime to improve energy use efficiency. The Natural Resource Management (NRM) Ministerial Council has also endorsed the *National Agriculture and Climate Change Action Plan 2006-09*, a strategic framework to develop a co-ordinated response to climate change impacts on agriculture. The Action Plan identifies four key areas: adaptation strategies; mitigation strategies; research and development; and communication and awareness raising.

Actions have been taken with the aim of making agriculture a source of renewable energy. The Australian Government's objective, set in 2001, that *fuel ethanol and biodiesel* produced in Australia from renewable sources should contribute at least 350 million litres to the fuel supply by 2010 is expected to be met in advance. In 2006, biodiesel blended fuel (made up of regular diesel mixed with biodiesel) became available at some Western Australian service stations.

Agriculture is *highly vulnerable to the potential impact of climate change*, including the risk of exacerbating other land degradation problems such as drought-induced soil erosion. The sustained drought conditions prevailing in recent years have heightened awareness of the need to adapt to predicted changes. The severity of the impact of climate change and the capacity to adapt will vary from sector to sector (e.g. extensive grazing, intensive livestock production, cropping, horticulture) but are still very uncertain (Allen Consulting Group, 2005). Where the effects are particularly harsh, and the ability to adjust farming practices is limited, agriculture may no longer be viable; retiring land, however, would have social repercussions and would also pose environmental problems (e.g. weeds and pests).

Notes

1. For example, the Australian Government's Agriculture Advancing Australia (AAA) programme is described as an integrated package of programmes to help primary producers in agriculture be more competitive, sustainable and profitable.
2. This chapter only discusses initiatives with a national scope.
3. The delivery of the programme through regional bodies is a new and evolving process for agencies. A review of the programme by the Australian National Audit Office (ANAO) in 2004 concluded that, at the regional level, strong and concerted action by all stakeholders is required (Auditor General, 2004).
4. The Intensive Land Use Zone represents areas in the east, south-east and south-west of the continent and in Tasmania, where vegetation cover has been subject to land clearing or a potential threat of clearing. The Extensive Land Use Zone broadly corresponds to the area known as Australia's rangelands.
5. There are two types of salinity: *dryland* and *irrigation*. Water imbalances are the fundamental cause of both. Dryland salinity, which is far more widespread, is created by the removal of deep-rooted and perennial native vegetation and its replacement with shallow-rooted crops and pastures. The latter use less water and increase groundwater recharge. This results in elevated water tables, bringing salt in groundwater and the soil to the surface (where it concentrates by evaporation) and also increasing discharges of saline groundwater to streams. Irrigation salinity results from the application of large additional quantities of water, raising water tables. In many cases the two types of salinity have combined to compound the problem and increase salinity both on land and in water.
6. Acid soil conditions restrict the availability of nutrients and trace elements for plant growth, including in the case of valuable deep-rooted perennials (e.g. lucerne) with the potential to assist in addressing dryland salinity problems.
7. However, while conservation tillage helps reduce soil erosion it usually involves higher pesticide use.
8. ODP = Ozone-depleting potential.
9. 1 gigalitre = 1 million cubic metres.
10. Extracted water used for agriculture reached a peak of 16 600 GL in 2000-01. Much of the significant decline to 2003-04 is attributed to the recent drought conditions (ABS, 2006).
11. 1 ML = 1 000 m^3.
12. Including an estimated 300 000 feral horses, up to 5 million feral donkeys and more than 500 000 feral camels.

Selected Sources

The government documents, OECD documents and other documents used as sources for this chapter included the following. Also see list of websites at the end of this report.

AATSE (Australian Academy of Technological Sciences and Engineering) (2002), *Pesticide Use in Australia*, AATSE, Victoria.

ABARE (Australian Bureau of Agriculture and Resource Economics) and New Zealand Ministry of Agriculture and Forestry (2006a), *Agricultural Economies of Australia and New Zealand: Past, Present, Future*, ABARE, Canberra, www.abareconomics.com/interactive/ausnz_ag/pdf/ ausNZ_au_n.pdf.

ABARE, A. Hodges and T. Goesch (2006b), *Australian Farms: Natural Resource Management in 2004-05*, ABARE Research Report 06.12, Prepared for DAFF, Canberra.

ABS (Australian Bureau of Statistics) (2002), *Salinity on Australian Farms*, Commonwealth of Australia, Canberra.

ABS (2005), *Water Use on Australian Farms 2003-04*, Canberra, Australia.

ABS (2006), *Natural Resource Management on Australian Farms 2004-05*, Commonwealth of Australia, Canberra, Australia.

ABS and the Productivity Commission (2006), *Characteristics of Australia's Irrigated Farms 2000-01 to 2003-04*, Commonwealth of Australia, Canberra.

AGO (Australian Greenhouse Office) (2006a), *Agriculture Industry Partnerships – Climate Change Action for Multiple Benefits*, DEH, Canberra, www.greenhouse.gov.au/agriculture/publications/industry-partnerships.pdf.

AGO (2006b), *Tracking to the Kyoto Target: Australia's Greenhouse Emissions Trends 1990 to 2008-12 and 2020*, Canberra.

AGO (2007), *National Greenhouse Gas Inventory 2005*, Canberra.

Allen Consulting Group (2005), *Climate Change Risk and Vulnerability, Promoting an efficient adaptation response in Australia*, report to the Australian Greenhouse Office, Department of Environment and Heritage, Canberra.

Attorney General, The (2006), *Statutory Review of the Gene Technology Act 2000 and the Gene Technology Agreement*, Commonwealth of Australia.

Auditor General, The (2004), Audit Report No. 17 2004-05: *The Administration of the National Action Plan for Salinity and Water Quality: Performance Audit Brochure*, Australian National Audit Office (ANAO), Canberra.

Australian State of the Environment Committee (2006), *Australia State of the Environment 2006*, independent report to the Australian Government Minister for the Environment and Heritage, DEH, Canberra, www.environment.gov.au/soe/2006/publications/report/pubs/soe-2006 report.pdf.

Beeton *et al.* (2006), *Australia State of the Environment 2006: Vegetation*, Independent Report to the Australian Government Minister for the Environment and Heritage, Canberra.

Bellamy, J., D. Metcalfe, N. Weston and S. Dawson (2005), *Evaluation of Invasive Species (Weeds) Outcomes of Regional Investment*, final report to the DEH and DAFF, www.nrm.gov.au/monitoring/national-evaluations/pubs/weeds.pdf.

DAFF (Department of Agriculture, Fisheries, and Forestry) (2004), *Report of the Independent Assessment of the Sugar Industry,* Canberra, Australia.

DEH (Department of the Environment and Heritage) (2001), *Australia State of the Environment Report 2001*, CSIRO Publishing on behalf of the DEH, Commonwealth of Australia, Canberra.

DEH (2005), *Landcare Australia: Meeting the Greenhouse Challenge,* Australia Greenhouse Gas Office, Canberra, Australia.

DPI (Department of Primary Industries) (2005), *Water Growing Sustainable Primary Industries: Defining DPI's Role in Water*, Victorian Government, Melbourne.

Environmental Management Systems Implementation Working Group (2003), *National Environmental Management Systems Implementation Plan: A plan to implement Australia's National Framework for Environmental Management Systems (EMS) in Agriculture*, Natural Resource Management Ministerial Council (NRMMC), www.daffa.gov.au/__data/assets/pdf_file/29227/ems_national_implementation_plan.pdf.

FIFA (Fertiliser Industry of Australia Inc) (2006), *Fertiliser Industry Environment Report 2005*, FIFA, Canberra, www.fifa.asn.au/files/pdf/environment/ecoefficiency/2005%20Fertiliser%20Industry%20Public%20Environment%20Report.pdf.

Gleeson, T. and A. Dalley (2006), "*Land*"*, theme commentary prepared for the 2006 Australia State of the Environment Committee*, DEWR, Canberra, www.environment.gov.au/soe/2006/publications/commentaries/index.html.

Government of Australia (2007), *A National Plan for Water Security*, 25 January 2007, www.pm.gov.au/docs/national_plan_water_security.pdf.

NWC (National Water Commission) (2006), *Progress on the National Water Initiative: A Report to the Council of Australian Governments*, www.nwc.gov.au/publications/index.cfm#COAG_report.

OECD (1998), *Environmental Performance Reviews: Australia*, OECD, Paris.

OECD (2004), *OECD Economic Surveys: Australia*, OECD, Paris.

OECD (2006), *Agricultural Policies in OECD Countries: At a Glance 2006*, OECD, Paris.

Pahl, L., N. Sallur, L. Weier and A. Bull (2006), *On-Farm EMS and Environmental Labelling in the Pastoral Industries*, final report prepared for the National EMS Pilot Program, DPI, Brisbane, Queensland.

Productivity Commission (2003), *Industries, Land Use and Water Quality in the Great Barrier Reef Catchment*, Research Report, Canberra, Australia.

Productivity Commission (2004), *Impacts of Native Vegetation and Biodiversity Regulations, Report No. 29*, Commonwealth of Australia, Melbourne.

RM Consulting Group (2006), *Evaluation of Sustainable Agriculture Outcomes from Regional Investment (NAP and NHT)*, prepared for the DEH and DAFF, Canberra, www.nrm.gov.au/monitoring/national-evaluations/pubs/sustainable-agriculture.pdf.

Sinclair Knight Merz (2006), *Evaluation of Salinity Outcomes of Regional Investment,* prepared for the DEH and DAFF, Canberra, www.nrm.gov.au/monitoring/national-evaluations/pubs/salinity.pdf.

REFERENCES

I.A Selected environmental data

I.B Selected economic data

I.C Selected social data

II.A Selected multilateral agreements (worldwide)

II.B Selected multilateral agreements (regional)

III. Abbreviations

IV. Physical context

V. Selected environmental websites

I.A: SELECTED ENVIRONMENTAL DATA (1)

		CAN	MEX	USA	JPN	KOR	**AUS**	NZL	AUT	BEL	CZE	DNK	FIN
LAND													
Total area (1000 km^2)		9971	1958	9629	378	100	**7713**	270	84	31	79	43	338
Major protected areas (% of total area)	*2*	8.7	9.2	25.1	17.0	9.6	**18.5**	32.4	28.0	3.4	15.8	11.1	9.1
Nitrogenous fertiliser use (t/km^2 of agricultural land)		2.5	1.2	2.7	9.0	20.1	**0.2**	2.6	2.9	10.7	6.9	7.8	5.9
Pesticide use (t/km^2 of agricultural land)		0.06	0.04	0.08	1.24	1.20	**-**	0.02	0.09	0.69	0.10	0.11	0.06
Livestock densities (head of sheep eq./km^2 of agr. land)		192	256	191	1011	1560	**62**	685	492	1790	287	912	290
FOREST													
Forest area (% of land area)		45.3	33.9	32.6	68.9	63.8	**21.4**	34.7	41.6	22.4	34.1	12.7	75.5
Use of forest resources (harvest/growth)		0.4	0.2	0.6	0.4	0.1	**0.6**	..	0.7	0.9	0.7	0.7	0.7
Tropical wood imports (USD/cap.)	*3*	1.6	0.2	2.1	10.7	6.1	**4.0**	3.4	0.4	24.2	0.3	3.8	1.4
THREATENED SPECIES													
Mammals (% of species known)		31.6	34.0	18.8	24.0	17.9	**24.7**	18.0	22.0	30.5	18.9	22.0	11.9
Birds (% of species known)		12.9	17.0	11.6	12.9	13.3	**12.5**	21.0	27.3	28.1	49.5	13.2	13.3
Fish (% of species known)		7.3	34.4	14.4	25.3	9.2	**0.8**	10.0	41.7	23.8	40.0	15.8	11.8
WATER													
Water withdrawal (% of gross annual availability)		1.5	15.9	19.2	20.4	36.2	**4.8**	1.7	5.0	32.5	12.7	4.1	2.1
Public waste water treatment (% of population served)		72	35	71	67	79	**..**	80	86	46	71	88	81
Fish catches (% of world catches)		1.2	1.4	5.3	4.7	1.7	**0.2**	0.6	-	-	-	1.1	0.1
AIR													
Emissions of sulphur oxides (kg/cap.)		76.3	12.2	49.4	6.7	10.4	**123.6**	18.6	4.4	14.5	22.2	4.0	16.4
(kg/1000 USD GDP)	*4*	2.6	1.4	1.4	0.3	0.6	**4.2**	0.8	0.2	0.5	1.4	0.1	0.6
% change (1990-2005)		-27	..	-31	-14	-46	**58**	39	-55	-58	-88	-88	-64
Emissions of nitrogen oxides (kg/cap.)		78.4	12.0	63.9	15.8	24.4	**78.0**	39.0	24.7	26.3	32.3	34.3	40.5
(kg/1000 USD GDP)	*4*	2.7	1.4	1.8	0.6	1.3	**2.7**	1.7	0.9	0.9	2.0	1.1	1.5
% change (1990-2005)		-6	18	-19	-2	47	**25**	16	-3	-24	-40	-32	-32
Emissions of carbon dioxide (t./cap.)	*5*	17.2	3.6	19.8	9.5	9.6	**17.6**	8.1	9.2	11.1	11.6	9.4	13.2
(t./1000 USD GDP)	*4*	0.57	0.39	0.54	0.36	0.50	**0.61**	0.36	0.31	0.40	0.69	0.32	0.47
% change (1990-2004)		29	27	20	15	105	**36**	49	31	7	-23	1	25
WASTE GENERATED													
Industrial waste (kg/1000 USD GDP)	*4, 6*	..	..	..	40	40	**20**	10	..	50	30	10	110
Municipal waste (kg/cap.)	*7*	420	340	750	400	380	**690**	400	560	460	290	740	470
Nuclear waste (t./Mtoe of TPES)	*8*	6.2	0.1	1.0	1.5	3.2	**-**	-	-	2.2	1.7	-	1.9

.. not available. - nil or negligible.

1) Data refer to the latest available year. They include provisional figures and Secretariat estimates.
Partial totals are underlined. Varying definitions can limit comparability across countries.

2) IUCN management categories I-VI and protected areas without IUCN category assignment; national classifications may differ.

3) Total imports of cork and wood from non-OECD tropical countries.

4) GDP at 2000 prices and purchasing power parities.

Source: OECD Environmental Data Compendium.

OECD EPR / SECOND CYCLE

FRA	DEU	GRC	HUN	ISL	IRL	ITA	LUX	NLD	NOR	POL	PRT	SLO	ESP	SWE	CHE	TUR	UKD*	OECD*
549	357	132	93	103	70	301	3	42	324	313	92	49	506	450	41	779	245	35042
13.3	31.5	5.2	8.9	9.5	1.2	19.0	17.1	18.9	6.4	29.0	8.5	25.2	9.5	9.5	28.7	4.3	30.1	16.4
7.6	10.4	2.9	5.8	0.7	7.9	5.2	-	13.8	10.1	4.8	2.3	3.7	3.5	5.2	3.6	3.6	6.3	2.2
0.27	0.17	0.14	0.17	-	0.05	0.58	0.33	0.41	0.08	0.06	0.40	0.16	0.14	0.05	0.10	0.06	*0.21*	*0.07*
514	689	245	207	65	1139	488	4351	2142	845	315	498	226	339	409	794	290	*674*	208
31.6	30.2	22.8	19.5	1.3	9.4	23.3	34.5	9.5	39.2	30.0	36.9	41.6	33.3	73.5	30.8	27.0	11.6	34.4
0.6	0.5	0.6	0.5	-	0.7	0.5	0.5	0.6	0.5	0.6	0.8	0.5	0.5	0.7	0.8	0.5	0.6	0.6
6.8	1.8	2.7	0.1	2.8	11.2	7.2	-	15.6	3.6	0.3	17.6	0.1	6.2	2.2	0.6	0.5	2.7	4.0
19.0	41.8	37.8	71.1	-	1.8	40.7	51.6	18.6	3.4	14.1	17.7	22.2	26.3	22.4	32.9	22.2	*6.3*	..
19.2	27.3	1.9	18.8	44.0	5.4	18.4	50.0	21.5	7.7	8.6	13.7	14.4	25.5	19.1	36.4	30.8	*15.4*	..
31.9	68.2	26.2	32.1	-	23.1	29.0	27.9	48.9	-	7.0	22.9	24.1	52.9	16.4	38.9	9.9	*11.1*	..
17.5	18.9	12.1	4.7	0.1	2.3	44.0	3.3	10.0	0.9	18.3	12.0	1.3	33.3	1.5	4.7	17.0	*22.4*	*11.4*
79	93	56	57	50	70	69	95	99	76	59	60	52	55	85	97	35	*98*	*68*
0.7	0.3	0.1	-	1.9	0.3	0.3	-	0.6	2.7	0.2	0.2	-	0.9	0.3	-	0.5	0.7	26.2
9.0	7.4	46.3	24.5	35.0	24.5	11.6	6.7	5.3	4.9	38.1	28.4	19.0	37.3	6.5	2.3	25.2	16.9	27.5
0.3	0.3	2.6	1.7	1.2	0.8	0.4	0.1	0.2	0.1	3.5	1.5	1.6	1.7	0.2	0.1	3.4	0.6	1.1
-60	-89	4	-76	22	-48	-63	-80	-58	-58	-55	-9	-81	-29	-45	-60	18	-73	-41
22.6	17.2	28.9	17.9	90.4	31.0	22.2	38.1	26.6	46.9	20.8	27.8	19.0	34.7	27.1	11.4	13.1	26.8	34.2
0.8	0.7	1.6	1.2	3.1	1.0	0.8	0.7	0.9	1.3	1.9	1.5	1.6	1.6	1.0	0.4	1.8	1.0	1.4
-29	-48	11	-24	-2	5	-34	-27	-28	-5	-38	13	-53	14	-25	-46	35	-43	-18
6.4	10.3	8.5	5.6	7.7	10.2	7.9	24.9	11.4	7.9	7.8	5.7	7.0	7.7	5.8	6.0	2.9	9.0	11.1
0.23	0.40	0.43	0.38	0.24	0.31	0.30	0.45	0.39	0.21	0.65	0.31	0.55	0.34	0.20	0.20	0.40	0.32	0.44
9	-12	33	-19	19	37	16	7	18	26	-15	52	-34	59	1	8	63	-4	17
50	20	..	30	10	40	20	30	40	20	120	50	130	30	110	-	30	30	50
540	600	440	460	520	740	540	710	620	760	250	470	270	650	480	650	440	580	560
4.2	1.2	-	1.7	-	-	-	-	0.1	-	-	-	3.0	1.2	4.1	1.9	-	1.0	1.5

UKD: pesticides and threatened species: Great Britain; water withdrawal and public waste water treatment plants: England and Wales.

5) CO_2 from energy use only; sectoral approach; international marine and aviation bunkers are excluded.

6) Waste from manufacturing industries.

7) CAN, NZL: household waste only.

8) Waste from spent fuel arising in nuclear power plants, in tonnes of heavy metal, per million tonnes of oil equivalent of total primary energy supply.

I.B: SELECTED ECONOMIC DATA (1)

		CAN	MEX	USA	JPN	KOR	**AUS**	NZL	AUT	BEL	CZE	DNK
GROSS DOMESTIC PRODUCT												
GDP, 2005 (billion USD at 2000 prices and PPPs)		990	983	11049	3477	958	**596**	94	246	294	182	164
% change (1990-2005)		51.3	53.8	55.3	21.6	125.0	**64.5**	58.2	38.2	33.2	22.7	38.1
per capita, 2005 (1000 USD/cap.)		30.6	9.3	37.3	27.2	19.9	**29.3**	22.9	29.9	28.2	17.8	30.3
Exports, 2005 (% of GDP)		37.9	29.9	10.5	14.3	42.5	**19.1**	27.9	54.4	86.3	71.6	48.5
INDUSTRY	*2*											
Value added in industry (% of GDP)		32	27	23	31	43	**26**	25	32	27	40	27
Industrial production: % change (1990-2005)		46.7	51.3	55.9	3.2	210.9	**30.5**	29.5	70.1	21.0	11.8	38.3
AGRICULTURE												
Value added in agriculture (% of GDP)	*3*	3	4	2	1	4	**4**	7	2	1	4	3
Agricultural production: % change (1990-2005)		25.6	41.5	27.6	-12.3	19.3	**25.4**	47.9	9.9	13.0	..	0.7
Livestock population, 2005 (million head of sheep eq.)		118	275	787	53	30	**283**	99	17	25	12	24
ENERGY												
Total supply, 2005 (Mtoe)		272	177	2340	530	214	**122**	17	34	57	45	20
% change (1990-2005)		29.9	42.0	21.4	19.3	128.9	**39.3**	22.9	37.1	15.2	-7.7	9.6
Energy intensity, 2005 (toe/1000 USD GDP)		0.27	0.18	0.21	0.15	0.22	**0.20**	0.18	0.14	0.19	0.25	0.12
% change (1990-2005)		-14.2	-7.7	-21.8	-1.8	1.7	**-15.3**	-22.3	-0.8	-13.5	-24.8	-20.6
Structure of energy supply, 2005 (%)	*4*											
Solid fuels		10.2	4.9	23.8	21.1	23.1	**44.5**	11.9	11.9	9.1	43.6	19.1
Oil		35.5	58.8	40.8	47.4	45.0	**31.1**	40.4	42.5	40.7	21.6	42.1
Gas		29.4	25.0	21.8	13.3	12.8	**18.9**	18.9	24.2	25.2	16.6	22.6
Nuclear		8.8	1.6	9.0	15.0	17.9	**-**	-	-	22.1	14.0	-
Hydro, etc.		16.1	9.7	4.7	3.2	1.2	**5.5**	28.9	21.4	2.9	4.2	16.3
ROAD TRANSPORT	*5*											
Road traffic volumes per capita, 2004 (1000 veh.-km/cap.)		9.8	0.7	16.2	6.5	3.2	**9.8**	12.3	9.3	9.0	4.6	7.8
Road vehicle stock, 2005 (10 000 vehicles)		1883	2205	24119	7404	1540	**1348**	271	502	559	439	245
% change (1990-2005)		13.8	129.3	27.8	31.1	353.5	**37.9**	47.0	36.0	31.2	69.4	29.5
per capita (veh./100 inh.)		58	21	81	58	32	**66**	66	61	54	43	45

.. not available. - nil or negligible.

1) Data may include provisional figures and Secretariat estimates. Partial totals are underlined.

2) Value added: includes mining and quarrying, manufacturing, gas, electricity and water and construction; production: excludes construction.

Source: OECD Environmental Data Compendium.

OECD EPR / SECOND CYCLE

FIN	FRA	DEU	GRC	HUN	ISL	IRL	ITA	LUX	NLD	NOR	POL	PRT	SLO	ESP	SWE	CHE	TUR	UKD	OECD
153	1693	2165	225	156	10	141	1521	26	478	180	475	194	73	995	269	231	568	1699	30283
37.4	29.5	26.6	56.3	33.3	57.2	156.5	20.9	90.8	40.4	59.6	68.2	37.2	35.9	54.5	35.2	17.1	75.6	43.3	44.3
29.1	27.8	26.2	20.3	15.4	33.8	34.2	26.0	56.8	29.3	39.0	12.4	18.4	13.6	22.9	29.7	31.0	7.9	28.3	25.9
41.8	26.0	40.7	20.8	66.4	32.0	81.2	26.3	159.3	69.9	45.3	37.2	28.6	77.3	25.5	48.6	47.9	27.4	26.4	24.3
32	25	30	23	31	27	42	29	20	26	38	30	29	32	30	28	27	31	26	29
75.6	18.2	16.9	19.5	92.2	..	312.8	10.5	57.6	20.8	35.5	113.0	15.1	19.5	27.0	55.3	27.6	78.3	8.6	34.6
4	3	1	7	4	9	3	3	1	3	2	3	4	5	3	2	1	12	1	3
-3.9	0.9	-4.7	10.1	-10.5	5.4	2.6	10.7	13	-9.2	-9.4	-15.8	1.1	..	7.4	-10.2	-4.3	18.2	-8.0	..
8	156	117	21	12	1	50	64	6	42	9	58	19	6	100	13	12	111	113	2639
35	276	345	31	28	4	15	185	5	82	32	93	27	19	145	52	27	85	234	5548
19.8	21.1	-3.2	39.7	-2.8	66.9	47.5	25.2	33.7	22.6	49.3	-6.9	53.1	-11.7	59.4	9.7	8.6	60.9	10.3	22.6
0.23	0.16	0.16	0.14	0.18	0.36	0.11	0.12	0.18	0.17	0.18	0.20	0.14	0.26	0.15	0.19	0.12	0.15	0.14	0.18
-12.8	-6.5	-23.6	-10.7	-27.1	6.2	-42.5	3.5	-29.9	-12.7	-6.4	-44.7	11.5	-35.0	3.2	-18.9	-7.2	-8.4	-23.1	-15.1
14.8	5.1	23.7	29.2	11.3	2.7	17.8	9.1	1.8	10.2	2.3	58.1	12.6	22.2	14.1	5.0	0.6	26.3	16.2	20.4
32.0	32.5	35.8	57.7	26.5	24.5	56.7	45.2	70.3	41.0	42.8	23.6	59.8	18.1	49.1	28.3	48.1	35.0	36.3	40.6
10.8	14.6	23.4	7.7	44.4	-	23.0	39.0	26.2	44.0	15.6	13.0	14.1	30.8	20.5	1.6	10.5	26.7	36.4	21.8
18.1	41.9	12.3	-	13.3	-	-	-	-	1.3	-	-	-	24.4	10.3	35.9	23.0	-	9.1	11.0
24.3	5.9	4.8	5.4	4.5	72.7	2.6	6.7	1.7	3.6	39.3	5.3	13.5	4.5	6.0	29.2	17.9	11.9	2.0	6.2
9.7	8.6	7.1	8.7	2.3	10.2	9.5	8.9	8.9	8.0	7.8	3.9	7.4	2.7	4.8	8.2	8.0	0.8	8.2	8.4
282	3617	4803	552	333	21	198	3894	34	806	252	1472	552	150	2516	463	419	843	3217	64939
26.2	27.1	28.8	118.7	49.4	59.8	108.5	30.2	68.0	40.7	29.9	126.8	151.3	44.4	74.2	17.9	28.9	257.1	35.0	38.7
54	59	58	50	33	72	48	66	74	49	55	39	52	28	58	51	56	12	54	56

3) Agriculture, forestry, hunting, fishery, etc.

4) Breakdown excludes electricity trade.

5) Refers to motor vehicles with four or more wheels, except for Italy, which include three-wheeled goods vehicles.

I.C: SELECTED SOCIAL DATA (1)

		CAN	MEX	USA	JPN	KOR	**AUS**	NZL	AUT	BEL	CZE	DNK
POPULATION												
Total population, 2005 (100 000 inh.)		323	1053	2965	1278	481	**203**	41	82	104	102	54
% change (1990-2005)		16.6	25.4	18.8	3.5	12.3	**19.2**	21.9	6.7	4.7	-1.4	5.3
Population density, 2005 (inh./km^2)		3.2	53.8	30.8	338.2	483.3	**2.6**	15.2	98.2	341.9	129.6	125.7
Ageing index, 2004 (over 64/under 15)		72.3	18.6	59.7	140.3	44.4	**65.4**	54.9	97.1	97.2	91.6	79.5
HEALTH												
Women life expectancy at birth, 2004 (years)		82.4	77.6	80.1	85.6	80.8	**83.0**	81.3	82.1	82.4	79.0	79.9
Infant mortality, 2004 (deaths /1 000 live births)		5.3	19.7	6.9	2.8	5.3	**4.7**	6.2	4.5	4.3	3.7	4.4
Expenditure, 2004 (% of GDP)		9.9	6.5	15.3	8.0	5.6	**9.6**	8.4	9.6	10.1	7.3	8.9
INCOME AND POVERTY												
GDP per capita, 2005 (1000 USD/cap.)		30.6	9.3	37.3	27.2	19.9	**29.3**	22.9	29.9	28.2	17.8	30.3
Poverty (% pop. < 50% median income)		10.3	20.3	17.0	15.3	..	**11.2**	10.4	9.3	7.8	4.4	4.3
Inequality (Gini levels)	*2*	30.1	48.0	35.7	31.4	..	**30.5**	33.7	26.0	26.0	25.0	24.0
Minimum to median wages, 2000	*3*	42.5	21.1	36.4	32.7	25.2	**57.7**	46.3	x	49.2	32.3	x
EMPLOYMENT												
Unemployment rate, 2005 (% of civilian labour force)	*4*	6.8	3.5	5.1	4.4	3.7	**5.1**	3.7	5.2	8.4	7.9	4.8
Labour force participation rate, 2005 (% 15-64 years)		79.2	58.6	66.0	78.0	68.5	**77.1**	67.8	78.4	67.7	71.1	81.0
Employment in agriculture, 2004 (%)	*5*	2.6	15.9	1.6	4.5	8.1	**3.7**	7.5	5.0	2.0	4.3	3.1
EDUCATION												
Education, 2004 (% 25-64 years)	*6*	84.3	22.6	87.9	84.0	74.4	**64.1**	77.6	80.2	63.6	89.1	81.4
Expenditure, 2003 (% of GDP)	*7*	6.1	6.8	7.5	4.8	7.5	**5.8**	6.8	5.5	6.1	4.7	7.0
OFFICIAL DEVELOPMENT ASSISTANCE	*8*											
ODA, 2006 (% of GNI)		0.30	..	0.17	0.25	..	**0.30**	0.27	0.48	0.50	..	0.80
ODA, 2006 (USD/cap.)		114	..	76	91	..	**103**	62	183	187	..	411

.. not available. - nil or negligible. x not applicable.

1) Data may include provisional figures and Secretariat estimates. Partial totals are underlined.

2) Ranging from 0 (equal) to 100 (inequal) income distribution; figures relate to total disposable income (including all incomes, taxes and benefits) for the entire population.

3) Minimum wage as a percentage of median earnings including overtime pay and bonuses.

Source: OECD.

OECD EPR / SECOND CYCLE

FIN	FRA	DEU	GRC	HUN	ISL	IRL	ITA	LUX	NLD	NOR	POL	PRT	SLO	ESP	SWE	CHE	TUR	UKD	OECD
52	609	825	111	101	3	41	586	5	163	46	382	106	54	434	90	74	721	600	11690
5.2	7.3	3.9	10.0	-2.8	16.1	17.9	3.3	18.5	9.2	9.0	0.3	7.0	1.7	11.7	5.5	10.8	28.3	4.8	12.0
15.5	110.8	231.0	84.1	108.4	2.9	58.8	194.5	175.9	393.0	14.3	122.0	114.8	109.9	85.8	20.1	180.2	92.5	245.0	33.4
89.6	88.5	134.5	121.5	98.7	52.2	53.5	133.1	75.3	74.2	74.3	76.9	107.8	66.8	116.0	97.3	100.8	19.4	87.1	70.2
82.3	83.8	81.4	81.4	76.9	82.7	80.7	82.5	81.0	81.4	82.3	79.4	80.5	77.8	83.8	82.7	83.7	73.8	80.7	..
3.3	3.9	4.1	4.1	6.6	2.8	4.9	4.1	3.9	4.1	3.2	6.8	4.0	6.8	3.5	3.1	4.2	23.6	5.1	..
7.5	10.5	10.6	10.0	8.0	10.2	7.1	8.8	8.0	9.2	9.2	6.5	10.1	5.9	8.1	9.1	11.6	7.7	8.4	..
29.1	27.8	26.2	20.3	15.4	33.8	34.2	26.0	56.8	29.3	39.0	12.4	18.4	13.6	22.9	29.7	31.0	7.9	28.3	25.9
6.4	7.0	9.8	13.5	8.2	..	15.4	12.9	5.5	6.0	6.3	9.8	13.7	..	11.5	5.3	6.7	15.9	11.4	10.2
25.0	28.0	28.0	33.0	27.0	35.0	32.0	33.0	26.0	27.0	25.0	31.0	38.0	33.0	31.0	23.0	26.7	45.0	34.0	30.7
x	60.8	x	51.3	37.2	x	55.8	x	48.9	47.1	x	35.5	38.2	..	31.8	x	x	..	41.7	..
8.4	9.9	9.6	9.8	7.2	2.6	4.4	7.7	4.5	4.7	4.6	17.7	7.6	16.3	9.2	6.4	4.5	10.0	4.8	6.6
74.6	69.3	78.2	64.9	60.0	84.6	72.5	62.6	69.1	77.9	79.1	63.9	77.5	68.7	71.3	78.3	86.3	53.0	76.0	68.7
4.9	3.5	2.4	12.6	5.3	6.3	6.4	4.5	1.3	3.0	3.5	18.0	12.1	5.1	5.5	2.1	3.7	34.0	1.3	6.1
77.6	65.3	83.9	56.2	75.4	60.0	62.9	48.2	62.3	70.7	88.3	50.1	25.2	84.7	45.0	82.9	84.5	26.1	65.1	67.5
6.1	6.3	5.3	4.2	6.1	8.0	4.4	5.1	3.6	5.0	6.6	6.4	5.9	4.7	4.7	6.7	6.5	3.7	6.1	5.8
0.39	0.47	0.36	0.16	..	..	0.53	0.20	0.89	0.81	0.89	..	0.21	..	0.32	1.03	0.39	..	0.52	0.30
157	171	126	35	..	..	235	62	633	334	631	..	37	..	86	437	220	..	209	63

4) Standardised unemployment rates; MEX, ISL, TUR: commonly used definitions.

5) Civil employment in agriculture, forestry and fishing.

6) Upper secondary or higher education; OECD: average of rates.

7) Public and private expenditure on educational institutions; OECD: average of rates.

8) Official Development Assistance by Member countries of the OECD Development Assistance Committee.

II.A: SELECTED MULTILATERAL AGREEMENTS (WORLDWIDE)

Y = in force S = signed R = ratified D = denounced

			CAN	MEX	USA
1946	Washington	Conv. - Regulation of whaling	Y D	R	R
1956	Washington	Protocol	Y D	R	R
1949	Geneva	Conv. - Road traffic	Y R		R
1957	Brussels	Conv. - Limitation of the liability of owners of sea-going ships	Y S		
1979	Brussels	Protocol	Y		
1958	Geneva	Conv. - Fishing and conservation of the living resources of the high seas	Y S	R	R
1959	Washington	Treaty - Antarctic	Y R		R
1991	Madrid	Protocol to the Antarctic treaty (environmental protection)	Y R		R
1960	Geneva	Conv. - Protection of workers against ionising radiations (ILO 115)	Y	R	
1962	Brussels	Conv. - Liability of operators of nuclear ships			
1963	Vienna	Conv. - Civil liability for nuclear damage	Y	R	
1988	Vienna	Joint protocol relating to the application of the Vienna Convention and the Paris Convention	Y		
1997	Vienna	Protocol to amend the Vienna convention	Y		
1963	Moscow	Treaty - Banning nuclear weapon tests in the atmosphere, in outer space and under water	Y R	R	R
1964	Copenhagen	Conv. - International council for the exploration of the sea	Y R		R
1970	Copenhagen	Protocol	Y R		R
1969	Brussels	Conv. - Intervention on the high seas in cases of oil pollution casualties (INTERVENTION)	Y	R	R
1973	London	Protocol (pollution by substances other than oil)	Y	R	R
1969	Brussels	Conv. - Civil liability for oil pollution damage (CLC)	Y D	D	S
1976	London	Protocol	Y R	R	
1992	London	Protocol	Y R	R	
1970	Bern	Conv. - Transport of goods by rail (CIM)	Y		
1971	Brussels	Conv. - International fund for compensation for oil pollution damage (FUND)	Y D	D	S
1976	London	Protocol	Y R	R	
1992	London	Protocol (replaces the 1971 Convention)	Y R	R	
2000	London	Amendment to protocol (limits of compensation)	Y R	R	
2003	London	Protocol (supplementary fund)			
1971	Brussels	Conv. - Civil liability in maritime carriage of nuclear material	Y		
1971	London, Moscow, Washington	Conv. - Prohib. emplacement of nuclear and mass destruct. weapons on sea-bed, ocean floor and subsoil	Y R	R	R
1971	Ramsar	Conv. - Wetlands of international importance especially as waterfowl habitat	Y R	R	R
1982	Paris	Protocol	Y R	R	R
1987	Regina	Regina amendment	Y R	R	
1971	Geneva	Conv. - Protection against hazards of poisoning arising from benzene (ILO 136)	Y		
1972	London, Mexico, Moscow, Washington	Conv. - Prevention of marine pollution by dumping of wastes and other matter (LC)	Y R	R	R
1996	London	Protocol to the Conv. - Prevention of marine poll. by dumping of wastes and other matter	R		S
1972	Geneva	Conv. - Protection of new varieties of plants (revised)	Y R	R	R

OECD EPR / SECOND CYCLE

Y = in force S = signed R = ratified D = denounced

JPN	KOR	**AUS**	NZL	AUT	BEL	CZE	DNK	FIN	FRA	DEU	GRC	HUN	ISL	IRL	ITA	LUX	NLD	NOR	POL	PRT	SVK	ESP	SWE	CHE	TUR	UKD	EU
R	R	**R**	R	R	R	R	R	R	R	R		R	R	R	R		R	R		R	R	R	R	R		R	
R	R	**R**	R	R	R	R	R	R	R	R		R	R	R	R		R	R		R	R	R	R	R		R	
R	R	**R**	R	R	R	R	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	
D		**D**			D		D	D	D	D			R		S		D	D	R	R		R	D	R		D	
		R			R			S		S						R			R	R		R		R		D	
		R	S		R		R	R	R				S	S			R			R		R		R		R	
R	R	**R**	R	R	R	R	R	R	R	R	R	R			R		R	R	R		R	R	R	R	R	R	
R	R	**R**	R	S	R	R	S	R	R	R	R	S			R		R	R	R		S	R	R	S		R	
R					R	R	R	R	R	R	R	R			R		R	R	R	R	R	R	R	R	R	R	
	S				S					S				S			R			R							
						R						R							R		R	S				S	
					S	R	R	R	S	R	R	R			R		R	R	R	S	R	S	R	S	S	S	
						S						S			S				S								
R	R	**R**	R	R	R	R	R	R		R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	
					R		R	R	R	R			R	R			R	R	R	R		R	R			R	
					R		R	R	R	R			R	R			R	R	R	R		R	R			R	
R	S	**R**	R		R		R	R	R	R	S		R	R	R		R	R	R	R		R	R	R		R	
		R	S		R		R	R	R	R				R	R		R	R	R	R		R	R	R		R	
D	D	**D**	D		D		D	D	D	D	D		D	D	D	R	D	D	D	D		D	D	D			
R	R	**R**			R		R	R	R	R	R		R	D	R	R	R	R	R	R		R	R	R			
R	R	**R**	R		R		R	R	R	R	R		R	R	R	R	R	R	R	R		R	R	R	R	R	
				R	R	R	R	R	R	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	R	R	
D	D	**D**	D		R		D	D	D	D	D		D	D	D		D	D	D	R		D	D	D		D	
R		**R**	R		R		R	R	R	R	R		R	D	R		R	R	R	R		R	R			D	
R	R	**R**	R		R		R	R	R	R	R		R	R	R	R	R	R	R	R		R	R	R	R	R	
R	R	**R**	R		R		R	R	R	R	R		R	R	R		R	R	R	R		R	R		R	R	
R			R		R		R	R	R	R				R	R		R	R		R		R	R				
					R		R	R	R	R					R		R	R		S		R	R			S	
R	R	**R**	R	R	R	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
R	R	**R**	R	R	R		R	R	R	R	R	R	R	R		R	R	R	R				R	R	R	R	
						R		R	R	R	R	R			R						R	R		R			
R	R	**R**	R		R		R	R	R	R	R	R	R	R	R	R	R	R	R	R		R	R	R		R	
		R	R		R		R	S	R	R			R	R			S	R				R	R	R		R	
R	R	**R**	R	R	R	R	R	R	R	R		R		R	R		R	R	R	R	R	R	R	R		R	

II.A: SELECTED MULTILATERAL AGREEMENTS (WORLDWIDE) (cont.)

Y = in force S = signed R = ratified D = denounced

			CAN	MEX	USA
1978 Geneva	Amendments	Y	R	R	R
1991 Geneva	Amendments	Y			R
1972 Geneva	Conv. - Safe container (CSC)	Y	R	R	R
1972 London, Moscow, Washington	Conv. - International liability for damage caused by space objects	Y	R	R	R
1972 Paris	Conv. - Protection of the world cultural and natural heritage	Y	R	R	R
1973 Washington	Conv. - International trade in endangered species of wild fauna and flora (CITES)	Y	R	R	R
1974 Geneva	Conv. - Prev. and control of occup. hazards caused by carcinog. subst. and agents (ILO 139)	Y			
1976 London	Conv. - Limitation of liability for maritime claims (LLMC)	Y		R	
1996 London	Amendment to convention	Y	S		
1977 Geneva	Conv. - Protection of workers against occupational hazards in the working environment due to air pollution, noise and vibration (ILO 148)	Y			
1978 London	Protocol - Prevention of pollution from ships (MARPOL PROT)	Y	R	R	R
1978 London	Annex III	Y	R		R
1978 London	Annex IV	Y			
1978 London	Annex V	Y		R	R
1997 London	Annex VI	Y			S
1979 Bonn	Conv. - Conservation of migratory species of wild animals	Y			
1991 London	Agreem. - Conservation of bats in Europe	Y			
1992 New York	Agreem. - Conservation of small cetaceans of the Baltic and the North Seas (ASCOBANS)	Y			
1996 Monaco	Agreem. - Conservation of cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area	Y			
1996 The Hague	Agreem. - Conservation of African-Eurasian migratory waterbirds	Y			
2001 Canberra	Agreem. - Conservation of albatrosses and petrels (ACAP)	Y			
1982 Montego Bay	Conv. - Law of the sea	Y	R	R	
1994 New York	Agreem. - relating to the implementation of part XI of the convention	Y	R	R	S
1995 New York	Agreem. - Implementation of the provisions of the convention relating to the conservation and management of straddling fish stocks and highly migratory fish stocks	Y	R		R
1983 Geneva	Agreem. - Tropical timber	Y	R		R
1994 New York	Revised agreem. - Tropical timber	Y	R	R	R
1985 Vienna	Conv. - Protection of the ozone layer	Y	R	R	R
1987 Montreal	Protocol (substances that deplete the ozone layer)	Y	R	R	R
1990 London	Amendment to protocol	Y	R	R	R
1992 Copenhagen	Amendment to protocol	Y	R	R	R
1997 Montreal	Amendment to protocol	Y	R		R
1999 Beijing	Amendment to protocol	Y	R		R
1986 Vienna	Conv. - Early notification of a nuclear accident	Y	R	R	R
1986 Vienna	Conv. - Assistance in the case of a nuclear accident or radiological emergency	Y	R	R	R
1989 Basel	Conv. - Control of transboundary movements of hazardous wastes and their disposal	Y	R	R	S

OECD EPR / SECOND CYCLE

Y = in force S = signed R = ratified D = denounced

JPN	KOR	**AUS**	NZL	AUT	BEL	CZE	DNK	FIN	FRA	DEU	GRC	HUN	ISL	IRL	ITA	LUX	NLD	NOR	POL	PRT	SVK	ESP	SWE	CHE	TUR	UKD	EU
R	R	**R**	R	R		R	R	R	R	R		R		R	R		R	R	R	R	R		R	R		R	
R	R	**R**		R		R	R	R		R		R					R		R		R	R	R			R	
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R		R	R	R	R	R	R	R	R	R	R	S	R	
R	R	**R**	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R		R	R	R	R		R	
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
R					R	R	R	R	R	R		R	R	R	R			R		R	R		R	R			
R		**R**	R		R		D	D	R	D	R			R		R	R	R	R			R	R	R	R	R	
		R					R	R	S	R						R	S	R				R	R	R		R	
					R	R	R	R	R	R		R			R			R		R	R	R	R			R	
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R		R	
R	R	**R**		R	R	R	R	R	R	R	R	R			R	R	R	R	R	R	R	R	R	R		R	
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
R					R		R	R	R	R	R					R		R	R			R	R			R	
		R	R	R	R	R	R	R	R	R	R	R		R	R	R	R	R	R	R	R	R	R	R		R	R
				R	R	R	R	R	R	R		R		R		R	R	R	R	R	R		R			R	
					R		R	R	R	R							R		R				R			R	S
									R		R				R					R		R					
					R		R	R	R	R	S	R		R	R	R	R			R	R	R	R	R		R	R
		R	R						S													R				R	
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S		R	R
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S		R	R
S	S	**R**	R	R	R		R	R	R	R	R		R	R	R	R	R	R	R	R		R	R			R	R
R	R	**R**	R	R	R		R	R	R	R	R			R	R	R	R	R		R		R	R	R		R	R
R	R	**R**	R	R	R		R	R	R	R	R			R	R	R	R	R		R		R	R	R		R	R
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
R	R	**R**	R	R	R	R	S	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

II.A: SELECTED MULTILATERAL AGREEMENTS (WORLDWIDE) (cont.)

Y = in force S = signed R = ratified D = denounced

		CAN	MEX	USA
1995 Geneva	Amendment			
1999 Basel	Prot. - Liability and compensation for damage			
1989 London	Conv. - Salvage	Y R	R	R
1990 Geneva	Conv. - Safety in the use of chemicals at work (ILO 170)	Y	R	
1990 London	Conv. - Oil pollution preparedness, response and co-operation (OPRC)	Y R	R	R
2000 London	Protocol - Pollution incidents by hazardous and noxious substances (OPRC-HNS)			
1992 Rio de Janeiro	Conv. - Biological diversity	Y R	R	S
2000 Montreal	Prot. - Biosafety (Cartagena)	Y S	R	
1992 New York	Conv. - Framework convention on climate change	Y R	R	R
1997 Kyoto	Protocol	Y R	R	S
1993 Paris	Conv. - Prohibition of the development, production, stockpiling and use of chemical weapons and their destruction	Y R	R	R
1993 Geneva	Conv. - Prevention of major industrial accidents (ILO 174)	Y		
1993	Agreem. - Promote compliance with international conservation and management measures by fishing vessels on the high seas	Y R	R	R
1994 Vienna	Conv. - Nuclear safety	Y R	R	R
1994 Paris	Conv. - Combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa	Y R	R	R
1996 London	Conv. - Liability and compensation for damage in connection with the carriage of hazardous and noxious substances by sea (HNS)	S		
1997 Vienna	Conv. - Supplementary compensation for nuclear damage			S
1997 Vienna	Conv. - Joint convention on the safety of spent fuel management and on the safety of radioactive waste management	Y R		R
1997 New York	Conv. - Law of the non-navigational uses of international watercourses			
1998 Rotterdam	Conv. - Prior informed consent procedure for hazardous chemicals and pesticides (PIC)	Y R	R	S
2001 London	Conv. - Civil liability for bunker oil pollution damage			
2001 London	Conv. - Control of harmful anti-fouling systems on ships			S
2001 Stockholm	Conv. - Persistent organic pollutants	Y R	R	S

Source: IUCN; OECD.

OECD EPR / SECOND CYCLE

Y = in force S = signed R = ratified D = denounced

JPN	KOR	**AUS**	NZL	AUT	BEL	CZE	DNK	FIN	FRA	DEU	GRC	HUN	ISL	IRL	ITA	LUX	NLD	NOR	POL	PRT	SVK	ESP	SWE	CHE	TUR	UKD	EU
			R	R	R	R	R	R	R	R		R				R	R	R	R	R	R	R	R	R	R	R	R
							S	S	S			S				S								S	S		S	
		R	R		R		R	S	R	R	R		R	R	R		R	R	S			R	R	R		R	
	R														R			R	R				R				
R	R	**R**	R				R	R	R	R	R		R	R	R		R	R	R	R		R	R	R	R	R	
		R					S	S	S	S	R						R		R	R		R	R				
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
R	R		R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
R	R	**S**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R		R	R
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
					R												R						R				
R	R	**R**																R					R				R
R	R	**R**		R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R
R	R	**R**	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
							S	S		S							S	S					S			S	
		S				S									S												
R	R	**R**		R	R	R	R	R	R	R	R	R		R	R	R	R	R	R	R	R	R	R	R		R	
								R		S		R				S	R	R		R			R				
R	R	**R**	R	R	R	R	R	R	R	R	R	R		R	R	R	R	R	R	R		R	R	R	R	R	R
											R				S	R						R	S				
R		**S**					R	S			R					R		R	R			R	R				
R	S	**R**	R	R	R	R	R	R	R	R	R	S	R	S	S	R	R	R	S	R	R	R	R	R	S	R	R

II.B: SELECTED MULTILATERAL AGREEMENTS (REGIONAL)

		CAN	MEX	USA
1948 Baguio	Agreem. - Establishment of the Asia-Pacific fishery commission	Y		R
1956 Rome	Agreem. - Plant protection for the Asia and Pacific region	Y		
1958 Geneva	Agreem. - Adoption of uniform conditions of approval and reciprocal recognition of approval for motor vehicle equipments and parts	Y		
1964 Brussels	Agreem. - Measures for the conservation of Antarctic Fauna and Flora	Y		R
1968 Paris	Conv. - Protection of animals during international transport	Y		
1979 Strasbourg	Protocol	Y		
1969 London	Conv. - Protection of the archaeological heritage	Y		
1972 London	Conv. - Conservation of Antarctic seals	Y	R	R
1976 Apia	Conv. - Conservation of nature in the South Pacific	Y		
1979 Honiara	Conv. - South Pacific Forum Fisheries Agency	Y		
1980 Canberra	Conv. - Conservation of Antarctic marine living resources	Y	R	R
1985 Rarotonga	Conv. - South Pacific nuclear free zone treaty	Y		
1986 Noumea	Conv. - Protection of the natural resources and environment of the South Pacific region	Y		R
1986 Noumea	Protocol (prevention of pollution by dumping)	Y		R
1986 Noumea	Protocol (co-operation in combating pollution emergencies)	Y		R
1993 Apia	Agreem. - South Pacific Regional Environment Programme (SPREP)	Y		S
1987 Port Moresby	Treaty - South Pacific fisheries	Y		R
1989 Wellington	Conv. - Prohibition of fishing with long driftnets in the South Pacific	Y		R
1990 Noumea	Protocol	Y		R
1990 Noumea	Protocol	Y	S	
1992 Honiara	Treaty - Cooperation in fisheries surveillance and law enforcement in the South Pacific region	Y		
1993 Tokyo	Memorandum of understanding on port state control in the Asia-Pacific region	Y	R	
1993 Canberra	Conv. - Conservation of Southern Pacific bluefin tuna	Y		
1993 Rome	Agreem. - Establishment of the Indian Ocean Tuna Commission	Y		
1994 Lisbon	Treaty - Energy Charter	Y		
1994 Lisbon	Protocol (energy efficiency and related environmental aspects)	Y		
1995 Port Moresby	Conv. - Regional convention on hazardous and radioactive wastes (Waigani Convention)	Y		
2000 Santiago	Agreem. - Conservation of living marine resources on the high seas of the south Pacific (the Galapagos agreement)			

Source: IUCN; OECD.

OECD EPR / SECOND CYCLE

JPN	KOR	**AUS**	NZL	AUT	BEL	CZE	DNK	FIN	FRA	DEU	GRC	HUN	ISL	IRL	ITA	LUX	NLD	NOR	POL	PRT	SVK	ESP	SWE	CHE	TUR	UKD	EU
R	R	**R**	R						R																	R	
	R	**R**	R						R								R			R						R	
R		**R**	R	R	R	R	R	R	R	R	R	R			R	R	R	R	R	R	R	R	R	R	R	R	R
R		**R**	R		R				R						R			R	R							R	
				R	R	R	R	R	R	R	R		R	R	R	R	R	D		R		R	D	R	R	R	
				R	R	R	R	R	R	R	R		R	R	R	R	R	D		R		R	D	R	R	R	
				R	R		R		D	R	R		R		R	R				D		R	D	D		D	
R		**R**	S		R				R	R					R			R	R							R	
		R	R						R																		
		R	R																								
R	R	**R**	R		R			R	R	R	R				R		R	R	R			R	R			R	R
		R	R																								
		R	R						R																	S	
		R	R						R																	R	
		R	R						R																	S	
		R	R						R																		
		R	R																								
		R	R						S																		
		R	S																								
R	R	**R**	R																								
R	R	**R**	R																								
R	R	**R**							R																	R	R
R		**S**		R	R	R	R	R	R	R	R	R	S	R	R	R	R	S	R	R	R	R	R	R	R	R	R
R		**S**		R	R	R	R	R	R	R	R	R	S	R	R	R	R	S	R	R	R	R	R	R	R	R	R
		R	R																								

Reference III
ABBREVIATIONS

AAA	Agriculture Advancing Australia
AADC	Australia Antarctic Data Centre
AAQ	Ambient air quality
ACT	Australian Capital Territory
ADRs	Australian Design Rules
AFCS	Australian Forest Certification Scheme
AGEIS	Australian Greenhouse Emissions Information System
AHC	Australian Heritage Council
ALGA	Australian Local Government Association
AMSA	Australian Maritime Safety Authority
ANCA	Australian Nature Conservation Agency
ANZECC	Australian and New Zealand Environment and Conservation Council
APEC	Asia-Pacific Economic Co-operation
AQIS	Australian Quarantine and Inspection Service
ARIES	Australian Research Institute in Education for Sustainability
AusAID	Australian Agency for International Development
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CDM	Clean development mechanism
CFCs	Chlorofluorocarbons
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNG	Compressed natural gas
CO_2	Carbon dioxide
COAG	Council of Australian Governments
CRC	Co-operative research centre
DAC	Development Assistance Committee of the OECD
DAFF	Department of Agriculture, Fisheries and Forestry
DEC	Department of Environment and Conservation (NSW)
DECC	Department of Environment and Climate Change (NSW)
EEZ	Exclusive economic zone
DEH	Department of Environment and Heritage

DEW	Department of Environment and Water Resources
DFAT	Department of Foreign Affairs and Trade
DITR	Department of Industry, Tourism and Resources
DTRS	Department of Transport and Regional Services
DVE	Diesel vehicle emissions
EEBP	Energy Efficiency Best Practice
e-ELF	Electronic Environment Licensing Form
EIA	Environmental impact assessment
EIS	Environmental impact statement
EPA	Environment Protection Authority
EPBC	Environment Protection and Biodiversity Conservation
ESD	Ecologically sustainable development
FAO	Food and Agriculture Organization of the United Nations
FSC	Forest Stewardship Council
FSM	Federated States of Micronesia
GDP	Gross domestic product
GM	Genetically modified
GNI	Gross national income
GVG	Green Vehicle Guide
HAFC	Harmful anti-fouling compound
HBFCs	Hydrobromofluorocarbons
HC	Hydrocarbon
HCFCs	Hydrochlorofluorocarbons
HDPE	High-density polyethylene
IBRA	Interim Biogeographic Regionalisation for Australia
ICESD	Intergovernmental Committee on Ecologically Sustainable Development
ICLEI	International Council on Local Environment Initiatives
IEA	International Energy Agency
IGAE	Intergovernmental Agreement on the Environment
IMO	International Maritime Organization
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
IUU	Illegal, unregulated and unreported (fishing)
LA21	Local Agenda 21
LBL	Load-based licensing
LETDF	Low Emissions Technology Demonstration Fund
LPG	Liquefied petroleum gas
LRA	Load reduction agreement
LULUCF	Land use, land use change and forestry

MARPOL	London Convention on Prevention of Pollution from Ships
MBI	Market-based instrument
MDBC	Murray-Darling Basin Commission
MCE	Ministerial Council on Energy
MEPS	Minimum energy performance standards
MRET	Mandatory renewable energy target
N_2O	Nitrous oxide
NAP	National Action Plan for Salinity and Water Quality
NEHS	National Environmental Health Strategy
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NFEE	National Framework for Energy Efficiency
NGO	Non-governmental organisation
NHandMRC	National Health and Medical Research Council
NHT	Natural Heritage Trust
NLP	National Landcare Program
NLWRA	National Land and Water Resources Audit
NO_X	Nitrogen oxide
NRM	Natural Resources Management
NRMMC	Natural Resource Management Ministerial Council
NRS	National Reserve System
NRSMPA	National Representative System of Marine Protected Areas
NSW	New South Wales
NWI	National Water Initiative
OCPs	Organochlorine pesticides
ODA	Official development assistance
ODP	Ozone-depleting potential
ODS	Ozone-depleting substance(s)
OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation
PAHs	Polycyclic aromatic hydrocarbons
PAN	Pollution abatement notice
PCBs	Polychlorinated biphenyls
PEFC	Program for the Endorsement of Forest Certification
PFCs	Perfluorocarbons
PIMC	Primary Industries Ministerial Council
PIN	Pollution infringement notice
PM_{10}	Particulate matter less than ten microns in diameter
PNG	Papua New Guinea
PPA	Purchasing power parity

PPP	Polluter-pays principle
PRP	Pollution reduction programme
RCD	Rabbit calicivirus disease
RFA	Regional Forest Agreement
SF_6	Sulphur hexafluoride
SO_2	Sulphur dioxide
SPP	Specific purpose payment
SPREP	(South) Pacific Regional Environmental Programme
TBT	Tributyltin
TDM	Travel demand management
TPES	Total primary energy supply
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
VOCs	Volatile organic compounds
WA	Western Australia
WEEE	Waste electrical and electronic equipment

Reference IV
PHYSICAL CONTEXT

Australia occupies an entire continent and adjacent islands, covering 7.68 million km^2 between the Pacific and Indian Oceans. Its closest neighbours are New Zealand, Papua New Guinea and Indonesia. Mainland Australia extends about 3 500 kilometres from the tip of Cape York in the north to the southernmost point of the State of Tasmania, and about 4 000 kilometres from east to west. Apart from the eastern uplands, most of the country is a broad flat platform, broken by low hills and basins. Average elevation is 330 metres, and uplands rarely exceed 1 200 metres.

Australia has a tropical monsoon climate in the north, a Mediterranean climate in the south and west, a temperate climate in the south-east, and a vast arid or semi-arid interior. Nearly a third of Australia lies in the tropics and over 80% in arid or semi-arid climatic zones. Drought is a recurring feature over most of the continent. Annual rainfall averages 465 mm and is highly variable, partly because Australia lies close to the El Niño Southern Oscillation. Australia has few permanent freshwater lakes and little river water. The largest river system, the Murray-Darling in the south-east, has an average flow volume of only 0.5 million litres per second.

The dry climate, combined with shallow, often infertile soil, strongly influences Australia's land use patterns. Only 12% of the country can sustain dense vegetation or intensive agriculture. Overall, agriculture occupies about 60% of the land surface, mostly as grassland and shrublands; forests and other wooded land account for 20%, settlements 1% and other areas 19%.

Reference V
SELECTED ENVIRONMENTAL WEBSITES

Website	Host institution
Government	
www.abare.gov.au	Australian Bureau of Agriculture and Resource Economics
www.abs.gov.au	Australian Bureau of Statistics
www.daff.gov.au	Department of Agriculture, Fisheries and Forestry
www.greenhouse.gov.au	Australian Greenhouse Office
www.environment.gov.au	Department of Environment and Water Resources
www.greenvehicleguide.gov.au	Department of Transport and Regional Services
enhealth.nphp.gov.au	Environmental Health Council
www.ephc.gov.au	Environmental Protection and Heritage Council
www.gbrmpa.gov.au	Great Barrier Reef Marine Park Authority
www.ilc.gov.au	Indigenous Land Corporation
www.lwa.gov.au	Land and Water Australia
www.mdbc.gov.au	Murray-Darling Basin Commission
www.nht.gov.au/index.html	Natural Heritage Trust
www.nlwra.gov.au	National Land and Water Resources Audit
www.nwc.gov.au	National Water Commission
www.npi.gov.au/	National Pollutant Inventory

State/Territory

www.environment.nsw.gov.au	Department of Environment and Conservation (New South Wales)
www.dnr.nsw.gov.au	Department of Natural Resources (New South Wales)
www.dse.vic.gov.au/dse/index.htm	Department of Environment and Sustainability (Victoria)
www.epa.vic.gov.au	Environment Protection Authority (Victoria)
www.epa.qld.gov.au	Environmental Protection Agency/Parks and Wildlife Service (Queensland)
www.nrw.qld.gov.au	Department of Natural Resources and Water (Queensland)
www.environment.sa.gov.au	Department of Environment and Heritage (South Australia)
www.epa.sa.gov.au	Environment Protection Authority (South Australia)
www.dec.wa.gov.au	Department of Environment and Conservation (Western Australia)
www.dtae.tas.gov.au	Department of Tourism, Arts and the Environment (Tasmania)
www.dpiw.tas.gov.au	Department of Primary Industries and Water (Tasmania)
www.nt.gov.au/nreta	Department of Natural Resources, Environment and The Arts (Northern Territory)
www.environment.act.gov.au	Environment and Recreation (Australian Capital Territory)

Non-government

www.ancid.org.au	Australian National Committee on Irrigation and Drainage
www.iclei.org/index.php?id=home	ICLEI Local Governments for Sustainability Oceania

www.ittis.org	International Tropical Timber Information System
www.tai.org.au	Australia Institute
www.travelsmart.gov.au	Travel Smart Australia

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Signs

The following signs are used in Figures and Tables:

. .: not available

– : nil or negligible

. : decimal point

The sign * indicates that not all countries are included.

Country Aggregates

OECD Europe: All European member countries of the OECD (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey and United Kingdom).

OECD: The countries of OECD Europe plus Australia, Canada, Japan, the Republic of Korea, Mexico, New Zealand and the United States.

Country aggregates may include Secretariat estimates.

Currency

Monetary unit: Australian dollar (AUD)

In 2006, AUD 1.332 = USD 1.

Cut-off Date

This report is based on information and data available up to May 2007.

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