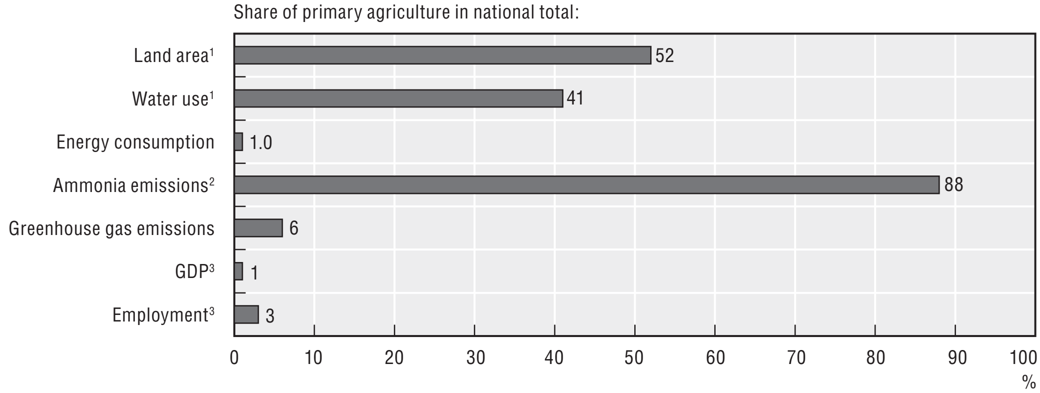
3.30. UNITED STATES

Figure 3.30.1. **National agri-environmental and economic profile, 2002-04: United States**



StatLink http://dx.doi.org/10.1787/301268408146

1. Data refer to the period 2005.
2. Data refer to the period 2000.
3. Data refer to the year 2004.

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

3.30.1. Agricultural sector trends and policy context

Agricultural growth has been amongst the most rapid across OECD countries since 1990 (Figure 3.30.2). Nevertheless, agriculture's contribution to the economy has been declining and currently accounts for less than 1% of GDP and under 3% of employment (Figure 3.30.1). Steady global economic growth and gains in population, particularly in developing countries, have strengthened demand for food and agricultural products, and provided a foundation for gains in world agricultural trade, including US agricultural exports. In addition, large growth of US bioenergy industries is increasing demand in the agricultural sector [1].

About 8% of the 2 million US farms account for 70% of the value of farm production on 30% of agricultural land [2, 3]. However, smaller farms (*e.g.* retirement, residential and farms where sales are a small share of household income) are important in terms of agri-environmental performance as they operate on 60% of farmland and account for around 60% of agri-environmental payments [4].

Agricultural support is currently below the OECD average but above the levels of the mid-1990s. Producer support declined from 22% of farm receipts in the mid-1980s to 13% in 1995-97 but rose to 17% by 2002-04 (as measured by the OECD's Producer Support Estimate) compared to the OECD average of 30% [5]. The share of support that is most production and trade distorting has declined from 69% of support in the mid-1980s to 66% in 2002-04. The basic legislation governing farm policy for 2002-07 is the *Farm Security and Rural Investment Act of 2002* (the *2002 Farm Act*). Support is provided through budgetary payments, loans and interest concessions, minimum prices with government purchases, as well as some import restrictions and export subsidies. Border protection with Canada and Mexico is being reduced under the *North American Free Trade Agreement* (NAFTA).

Agri-environmental programmes form a growing dimension of agricultural policy. The Conservation Reserve Program (CRP) aims to remove from production highly erodible (HEL) and other environmentally sensitive cropland, while the Wetlands Reserve Program (WRP) seeks to re-convert farmland to wetlands. In exchange for annual payments, land is generally enrolled in the CRP for a period of 10-15 years, but contracts can be renewed. Wetlands restored through WRP may be subject to 30 year or permanent easements. Under the Environmental Quality Incentives Program (EQIP) and the Wildlife Habitat Incentives Program (WHIP) payments defray costs for respectively adopting sustainable farming practices, such as for soil and water quality conservation, and providing wildlife habitat. The Farm and Ranch Lands Protection Program (FRPP) aims to avoid productive farm and ranch land being converted into urban use by purchasing the development rights of farm properties. Cross-compliance provisions also require that to receive payments under commodity programmes farmers must not cultivate HEL (sodbuster) without using a suitable soil conservation system or drain wetlands (swampbuster).

The 2002 Farm Act substantially increased funding for agri-environmental policies. For the period 2002-07 funding was USD 3.5 billion annually, a 75% increase over the annual spending for 2000-02 of USD 2 billion annually which was 8% of budgetary payments. The *Farm Act* expanded the CRP and WRP but its emphasis shifted to supporting conservation practices on working farmland, especially under EQIP [6]. In addition, two measures, the *Conservation Security Program (CSP)* and the *Grassland Reserve Program* (GRP), implemented in 2002 and 2003 respectively, further strengthened these efforts. The CSP pays farmers who have met a high standard for environmental performance to adopt or maintain practices to further enhance environmental performance, such as improving soil and water quality or wildlife habitat; while the GRP aims to preserve and improve native grass species. The *Farm Act* also supports technical advice and research to promote sustainable farming.

Economy-wide environmental and taxation policies also impact on agriculture. Between 1994 and 1998, seven agencies provided USD 3 billion annually to address nonpoint source pollution [7, 8]. The *Clean Water Act* (CWA) has responsibility for reducing water pollution, but nonpoint sources of pollution such as agriculture are not directly covered by the CWA [7, 9], although large confined animal feeding operations require pollution permits and implementation of comprehensive nutrient management plans [10]. Policies affecting agricultural water pollution are mainly implemented at the State level, using a mix of measures that vary across States, such as restrictions and taxes on fertiliser and pesticide use, and payments for the adoption of best management practices [4, 11]. However, financial assistance in the form of agri-environmental payments comes primarily from the Federal government, affecting water quality both directly (*e.g.* EQIP) and indirectly (*e.g.* CRP, WRP), as adoption of soil and water conservation practices can help to reduce off-farm flows of soils, nutrients and pesticides into water bodies [4, 10, 12, 13]. Also the *Great Lakes Water Quality Agreement*, between the US and Canada [14] addresses concerns related to agricultural water pollution.

The Federal Energy Policy Act of 2005 mandates that by 2012 a minimum of 7.5 billion US gallons (28 billion litres) of ethanol be blended into gasoline. Ethanol is a substitute for MTBE (a water contaminant) as a fuel oxygenate, and has the potential to reduce greenhouse gas emissions [15]. A tax exemption is provided for the use of ethanol and assistance granted to develop ethanol production facilities. There are exemptions on Federal fuel taxes for on-farm machines and vehicles, equivalent to USD 2 385 million of annual budget revenue forgone over the period 2004-06 [5]. Government expenditure on agriculture's share of the interest subsidy on long-term loans for initial capital investment in public irrigation projects amounted to USD 269 million annually over the average period 2004-06 [5]. In terms of international environmental agreements with implications for agriculture, the US is a signatory to the *Montreal Protocol*, which provides a phase out period for the ozone depleting methyl bromide pesticide, and the *Gothenburg Protocol* on long-range transboundary air pollution, which includes ammonia.

3.30.2. Environmental performance of agriculture

Soil, water and biodiversity issues dominate agriculture's impact on the environment. Specifically, farming's main environmental impacts are on soil erosion, water pollution, competition for water resources between irrigators and other users, and on wildlife habitats and species. Other agri-environmental issues, but of lesser importance, relate to air emissions.

Agriculture is the major user of land and water resources. The sector accounted for about 52% of land use and 41% of freshwater withdrawals in 2005 [4]. About 30% of grassland pasture and range and forest land is owned by the Federal government, although most land under arable and permanent crops is privately owned [16]. There exists a vast range of agro-ecological regions and climatic zones affecting agriculture. While population density is low by OECD standards [17], there is growing competition between agriculture and other users for land (especially in Southern and Eastern States) and water resources (especially in Western and Central States), including demand on these resources for recreational and environmental uses [7].

Soil erosion is a significant problem but its damage to farmland productivity and the environment has been reduced. About 60% of total soil erosion originates from agriculture, with the remainder resulting from other economic activities (*e.g.* forestry) and natural events (*e.g.* floods and droughts) [18]. Erosion types vary between regions, for example, Western States suffer more from wind erosion while the East is prone to water erosion (Figure 3.30.3). Between 1982-2003 the cropland area eroding at excessive rates decreased by over 40%, and by 2003 approximately 72% of total cropland area was within tolerable erosion levels (Figure 3.30.3) [18]. Farms under agri-environmental programmes that target HEL, experienced a significant reduction in erosion rates [19, 20]. However, 50% of erosion reduction on HEL since the 1980s has been due to land conversion to other uses (*e.g.* to forestry), while erosion rates also declined on land not under Federal programmes [19]. The off-farm damage from soil erosion (*e.g.* costs of dredging rivers, losses to recreational values) are estimated at over USD 2 billion annually [7, 21].

Farm soil quality is also impaired by other less widespread and costly degradation processes. About 5% of farmland is affected by soil salinity, largely associated with poor irrigation practices, although in some States (*e.g.* Montana) salinity is impacting on an increasing area [22]. Soil compaction is a problem mainly in the Corn Belt, resulting in yield losses estimated at USD 100 million annually [22]. However, there is no national database to monitor trends in these physical and chemical soil processes, nor for the biological conditions of the soil [23, 24].

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Agriculture is a major and widespread source of water pollution. Overall the quality of water bodies is improving and drinking water standards are high, but in 2000 about 40% of rivers, 45% of lakes and 50% of estuaries were below the Federal guidelines set for recreational and environmental uses [25]. Agriculture is responsible for 60% of river pollution, 30% of lake pollution, 15% of the pollution in estuarine and coastal areas, and is the major source of groundwater pollution [8, 25].

Rising levels of agricultural nitrogen and phosphate surpluses over the period 1990 to 2004 risk increasing water pollution (Figure 3.30.2). Nutrient sources and types in watersheds vary greatly across regions. Fertiliser run-off is important in Midwestern States and run-off from livestock manure in the Mississippi Basin and some Eastern States [26], while phosphorus loadings are high in the Southeast and nitrogen in the Mississippi basin [4, 27]. Part of the problem of nutrient surplus disposal is linked to a greater number of confined animal feeding operations, with over 60% of manure produced on farms that cannot fully absorb the waste [28, 29]. But use of inorganic fertilisers rose by 6% for nitrogen and 4% for phosphate fertilisers, between 1990-92 and 2002-04, compared to a 15% increase in crop production volume over this period, resulting in a lowering of cropland fertiliser use intensity.

In agricultural areas nutrients levels in rivers and wells have exceeded Federal drinking water standards. Between 1995 and 2005 about 10% of rivers and 20% of wells exceeded Federal drinking water standards for nitrates in agricultural areas, and 75% of rivers had phosphorus levels above Federal guidelines to prevent excess algal growth [23]. Agricultural nutrient pollution of the Gulf of Mexico accounts for 75% of nitrogen discharges and nearly 50% of phosphorus, derived mainly from the Mississippi basin [30], leading to oxygen deficient water causing algal blooms that damage marine life and commercial fisheries [23, 30, 31, 32]. Water quality in the Great Lakes is also being impaired by agricultural nutrient run-off [14, 26], including pathogens from livestock production [14]. Water pollution from livestock pathogens and other related wastes is a growing problem, but at present there is no national monitoring of these pollutants [4, 33].

Pesticide use (quantity of active ingredients) decreased since 1990, with pesticides frequently detected in water but usually at low levels [8]. Agriculture currently accounts for about 75% of total pesticide use [34], and a 4% decrease in pesticide use (1990-92 to 2001-03, Figure 3.30.2) compared to a 15% growth in crop output over the period 1990-92 to 2002-04, indicates the reduction in the intensity of pesticide use. Over the period 1992-98 at least one pesticide was detectable throughout the year in all rivers and 60% of wells, although only 4% of rivers and less than 1% of wells had pesticides that exceeded Federal drinking water standards. But over 80% of rivers had pesticide concentrations exceeding aquatic life guidelines [23], and pesticides in reservoirs have higher concentrations than for rivers [7]. Some highly persistent pesticides, such as DDT, were detected in fish in about 30% of rivers in agricultural areas in the early 2000s, despite being prohibited for more than 30 years [8, 35]. Vulnerability to pesticide leaching varies considerably (related to a variety of factors soils, crop types, climate, etc.), but the greatest vulnerability is in the crop and horticultural growing areas of the Corn Belt, Southeastern States, the Southern Plains, the Lake States and California [7].

Higher national demand for water is putting pressure on water supplies, although overall agricultural water use declined by 2% from 1990 to 2000 (Figure 3.30.2). Irrigators are the major users of agricultural water use, with much of the remainder used by livestock producers. The availability of water for agricultural purposes is uneven, and shortages occur in some areas and in some years. In the arid West, drought conditions place increased demands on non-renewable supplies [4]. The area under irrigation rose by 12% from 1992 to 2002, accounting for approximately 5% of the total agricultural area but providing nearly 50% of the total value of crop sales [4, 36]. Total irrigation withdrawals declined by 12% between 1995-2000 with groundwater withdrawals increasing slightly (3%) and a 16% reduction in surface water withdrawals. Despite the recent decline, surface water provides nearly 60% of irrigators' water needs [4, 37]. Hence, irrigation accounted for about 75% of total groundwater withdrawals in 2000, and an even higher share in many Western and Southern States [37]. Despite the reduction in surface water use by irrigators the overexploitation of some rivers, especially in times of drought, has threatened aquatic ecosystems, such as in the Klamath Basin which has led to Federal restrictions on water supplies to agriculture in this Basin [38]. Of the nearly USD 17 billion irrigation construction expenditure for projects constructed over the last 100 years, and considered reimbursable by the Federal government, irrigators have been allocated USD 3.4 billion to be repaid at zero interest [7]. Water charges are considerably lower than retail prices paid by industrial and urban users [7, 9, 39].

Irrigated agriculture is depleting groundwater resources beyond natural recharge rates in some regions. In the High Plains (Ogallala) aquifer, for example, which irrigates more than 20% of US cropland, the water level has fallen and is close to depletion in parts of Kansas and Texas [9]. In the Texas Panhandle groundwater depletion poses a serious threat to the sustainability of the current irrigated agricultural system and associated rural economy [40, 41]. Groundwater depletion is also the main cause of land subsidence in some areas, estimated to cost USD 100 million annually [42]. But there have been improvements in irrigation water use efficiency, including a decline in per hectare water application rates (Figure 3.30.2), and adoption of water conservation practices and technologies, although low-flow systems are used on only 5% of the total irrigated area [4].

Competition for water resources is also acute on the US-Mexico border, mainly because of population growth and demands from agriculture as a major user, leading to over exploitation of water from the Rio Grande on both sides of the border [43]. The *International Boundary and Water Commission* resolves water resource allocation issues, including irrigation, at the US-Mexico border.

Ammonia emissions from agriculture have increased significantly above the OECD average, but emissions from methyl bromide use have declined. Agricultural ***ammonia emissions,*** which represent nearly 90% of total ammonia emissions, rose by 15% over the period 1990-92 to 2000, compared to the OECD average increase of 1% (Figure 3.30.2). The *Gothenburg Protocol* seeks to cut ammonia emissions by 17% from their 1990 levels by 2010, although the US (a signatory to the *Protocol*) has not yet agreed on its emission ceiling targets. Acidification of soils and water from acidifying emissions, originating mainly in Mid-Western States, pose a problem for Eastern States, but the contribution of agricultural ammonia acidifying emissions is unclear [44, 45]. Reporting of ammonia emissions from intensive livestock operations has been required since 2004 [46]. The phase-out targets of emissions resulting from the use of ***methyl bromide*** (a widely used fumigant in agriculture which is an ozone depleting substance) under the *Montreal Protocol* have been met up to 2003. But the US has been granted an increase in "Critical Use Exemptions" (CUEs), which effectively gives more time for users to develop alternatives equal to about 60% of the total OECD CUEs in 2005 [47].

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The rise in agricultural greenhouse gas emissions is above the OECD average, but soil carbon sequestration and bioenergy production is increasing. Agricultural greenhouse gases (GHGs) grew by 1% over the period 1990-92 to 2002-04, compared to a 3% decrease for the OECD, especially due to an expansion in crop production (Figure 3.30.2). Agriculture contributed 6% to total national GHG emissions in 2002-04 [48]. US cropland soils sequester about 32.2 million tonnes of carbon dioxide equivalent annually (or 8.8 million tonnes of carbon). ***This sequestration amounted to about 4% of total US terrestrial carbon sequestration in 2004.*** Annual soil sequestration rates in cropland have increased by 40% since the early 1990s [48]. The use of ***agricultural biomass for energy production*** grew by 25% over the 1990s, but still provides only about 3% of total energy consumption, less than 1% of transportation fuel mainly from maize based ethanol, and 5% of chemical product output [49]. Federal targets aim to increase these shares to 4% for energy and fuel, and to 12% for chemicals by 2010 [49], which could have significant impacts on crop production patterns, prices and international commodity markets [50, 51].

As the major land user agriculture has significant impacts on wildlife habitats and species. A US study of the CRP estimates that agriculture, as a provider of wildlife recreational activity, has led to an increase in recreational spending of USD 300 million annually under the programme [52]. Changes in farmland use that were potentially beneficial to wildlife included an increase in the share of cropland not cultivated from 11% in 1987 to 15% by 2001, and a net conversion of cropland to pasture [53]. A US study found that lands shifting in and out of crop cultivation are generally located in areas with more imperilled plant and vertebrate species than other croplands, but data were insufficient to determine whether these land-use changes had a positive or negative impact on imperilled species [54]. The spatial changes in farmland habitat are highly varied but not regularly monitored [55].

Wetlands, a key wildlife habitat, account for more than 7% of the non-federal area in the 48 contiguous United States [4]. Between 1992-97 to 2001-03 average annual losses of wetlands to agriculture were greatly reduced compared to the 1980s and offset by wetland restoration at an average net annual gain of nearly 30 000 hectares during 2001-03 (Figure 3.30.4) [56]. Research suggests that restored wetlands are quickly vegetated and colonised by a variety of wildlife species [57], but may take much longer to return to a "natural" state. The net effect on wildlife of land use changes, within and between agriculture and other uses, are more difficult to measure. Between 1992 and 1997, there was a net conversion of agricultural land to forestry and urban development, although this involved only about 1% of the total agricultural land area [58].

Increased use of chemicals, water and changes in farmland use has led to pressure on wildlife habitat and species. Agriculture was estimated in 1995 to negatively affect 380 of over 660 wild species listed as threatened or endangered [22]. Conversion of land for agricultural production and diversion of water for irrigation have had a particularly damaging impact on biodiversity since 1990 [59, 60]. Also pesticide and nutrient run-off are recognised as a widespread threat to terrestrial and aquatic ecosystems [23, 61, 62], with pesticides linked to the decline in pollinators which has reduced yields for certain crops [23, 63]. US research suggests, however, that taking cropland out of production under the CRP and WRP programmes may have had some beneficial wildlife impacts, such as the 30% increase in duck numbers attributed to the CRP [64]. In addition, a number of species have adapted well to specific agricultural systems, such as some mammals in the West [65]. In other cases the uptake of certain farming practices has been beneficial to wildlife, for example, the avoidance of livestock polluting farm ponds and rivers in Minnesota [61], and in the Northeast the adoption of conservation tillage practices has increased the availability of crop residues in autumn and winter as a food source for bird and mammal populations [66].

About 55% of the global area under transgenic crops is in the US, with uncertainty in some of the environmental impacts. In 2006, transgenic crops accounted for 89% of the US planted area under soybeans, 83% for cotton, and 61% for maize. US farmers adopted herbicide tolerant (HT) varieties, which help control weeds, at a faster rate than insect resistant (Bt) varieties [67]. However, a noticeable trend in recent years is the rapid growth of cotton and maize varieties with both HT and Bt (stacked) traits. US studies indicate that the use of transgenic crops is associated with a lower overall volume of pesticide use, although pesticide use varies with the crop and the technology. There is a lack of consensus on the possible long-term impacts on biodiversity of using transgenic crops [13, 68]. Moreover, the degree of genetic erosion in crops remains the subject of debate [69]. However, yields for many major crops have been relatively stable as temporal diversity has replaced spatial diversity. Although there may be greater spatial uniformity of crops planted at any given time today, the release of new varieties with new resistance traits has been steady over time [69]. All major animal breeds in the US confront issues that include small effective population size, limited genetic diversity, and genetic erosion resulting from intense selection for some production traits [70].

3.30.3. Overall agri-environmental performance

Pressure on the environment is likely to continue with the projected expansion of the farm sector. The expansion of agricultural production, at a rate well above the OECD average, is exerting growing pressure on land, water, and biodiversity, especially in those areas where population densities are highest (*e.g.* the East Coast) or the growth rate is rapid (*e.g.* Southern States). With an expansion of the farm sector projected over the next decade the pressure on the environment and competition for natural resources from agriculture might intensify in these regions.

Monitoring and evaluation of agri-environmental performance is highly developed by OECD standards. Extensive and regularly updated databases at Federal, State and County levels exist for many agri-environmental issues. Drawing on these databases agri-environmental indicators and spatially referenced agri-environmental models to assist policy evaluation have been developed [71]. However, gaps exist, especially in tracking agriculture's impact on water pollution from livestock pathogens, on soils from damaging processes such as salinisation, and on biodiversity [23]. But efforts are being made to fill these data gaps, including developing a better understanding of agriculture's role in ecosystem service provision, such as soil carbon sequestration and biomass production [49, 72, 73].

Agricultural pressure on the environment since 1990 has been lowered in some cases, notably reduced rates of soil erosion, but is increasing for other indicators, especially groundwater depletion but also air pollution. The area of cropland suffering high rates of ***soil erosion*** has been significantly reduced, but about a quarter of cropland is still subject to high rates of erosion. Farming, the major contributor to ***water pollution***, is lightly regulated compared to other polluters [74]. Agricultural water pollution is widespread and increasing loadings of nutrients and livestock pathogens suggest the risks of water pollution from agriculture might be rising in areas where crop or livestock agriculture is intensifying, although pesticide use

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declined over the period 1996 to 2003. Most rivers and wells meet Federal drinking water standards in farming areas, but many rivers, lakes, estuaries and coastal waters do not meet Federal guidelines to support recreational and environmental uses.

Competition for surface and groundwater resources between farmers and other users is becoming acute in drier areas. In some regions the use of groundwater by irrigators is substantially above recharge rates. Moreover, subsidising irrigation infrastructure and water charges as well as the energy costs to power irrigation facilitates, can be a disincentive to reduce water use or use it more efficiently. Overexploitation of groundwater is becoming more widespread and could undermine the viability of agricultural and rural economies in some regions [9]. Also subsidising on-farm fuel energy costs is a disincentive to improving energy use efficiency and reducing greenhouse gas emissions.

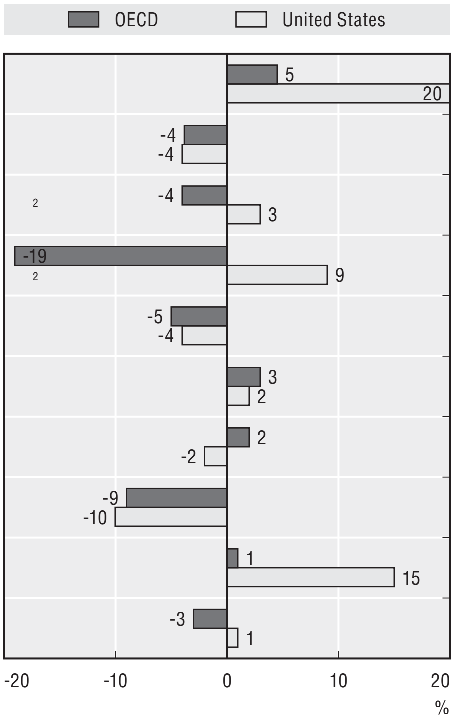
Air pollution from ammonia and greenhouse gases has increased above average OECD rates. Carbon stocks in agricultural soils, however, have risen and carbon emissions reduced as a result of bioenergy production from agricultural biomass.

Conversion of wildlife habitats to agricultural use, increasing water use and pollution, has been harmful to wildlife. But the overall pressure by agriculture on biodiversity appears to have eased, especially where cropland has been retired from production, including restoration of wetlands, and where changes in farming practices, such as conservation tillage, have enhanced habitat conditions on cropland leading to larger wildlife populations.

Policies are addressing many of the remaining agri-environmental challenges. The 2002 *Farm Act* has increased funding for agri-environmental measures up to 2007, including strengthening the CRP and WRP, and shifting emphasis towards programmes that support conservation practices on working farmland, especially the EQIP. According to US research these programmes have led to improved agri-environmental performance on many fronts. There are signs that farmers have increased fertiliser, pesticide, energy and water use at a much slower rate than the growth in the volume of agricultural production. These developments are in part due to the adoption of soil and water conservation practices by producers [19]. However, these impacts have been offset to some extent by output and input linked support to agriculture which raises production and increases pressure on the environment and thus the cost of achieving specific environmental goals [75].

Figure 3.30.2. **National agri-environmental performance compared to the OECD average**

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



Absolute and economy-wide change/level

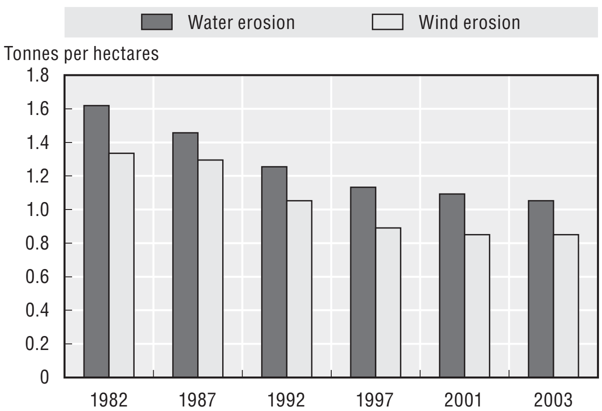
Variable	Unit		United States	**OECD**
Agricultural production volume	Index (1999-01 = 100)	1990-92 to 2002-04	120	105
Agricultural land area	000 hectares	1990-92 to 2002-04	–17 074	–48 901
Agricultural nitrogen (N) balance	Kg N/hectare	2002-04	37	74
Agricultural phosphorus (P) balance	Kg P/hectare	2002-04	3	10
Agricultural pesticide use	Tonnes	1990-92 to 2001-03	–11 944	–46 762
Direct on-farm energy consumption	000 tonnes of oil equivalent	1990-92 to 2002-04	+370	+1 997
Agricultural water use	Million m^3	1990-92 to 2001-03	–3 645	+8 102
Irrigation water application rates	Megalitres/ha of irrigated land	2001-03	8.4	8.4
Agricultural ammonia emissions	000 tonnes	1990-92 to 2001-03	+524	+115
Agricultural greenhouse gas emissions	000 tonnes CO_2 equivalent	1990-92 to 2002-04	+4 806	–30 462

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

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

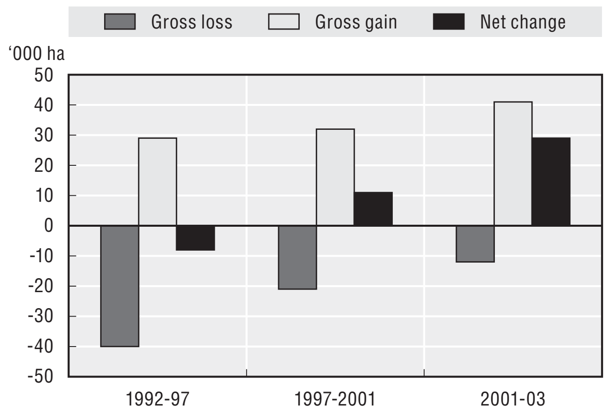
Source: OECD Secretariat. For full details of these indicators, see Chapter 1 of the *Main Report*.

Figure 3.30.3. **Soil erosion on cropland**



Source: Natural Resources Conservation Service, United States Department of Agriculture.

Figure 3.30.4. **Change in palustrine and estuarine wetlands on non-federal land and water area**



Source: Natural Resources Conservation Service (2003), Annual National Resources Inventory.

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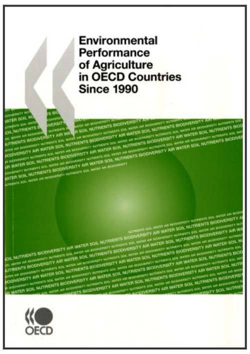

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