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

Poland Country Section

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

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

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BACKGROUND TO THE COUNTRY SECTIONS

Structure

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

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The review of environmental performance draws on the country responses to the OECD agri-environmental questionnaires (unpublished) provided by countries and the OECD agri-environmental database supporting Chapter 1 (see website above).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

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

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

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

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Coverage, caveats and limitations

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

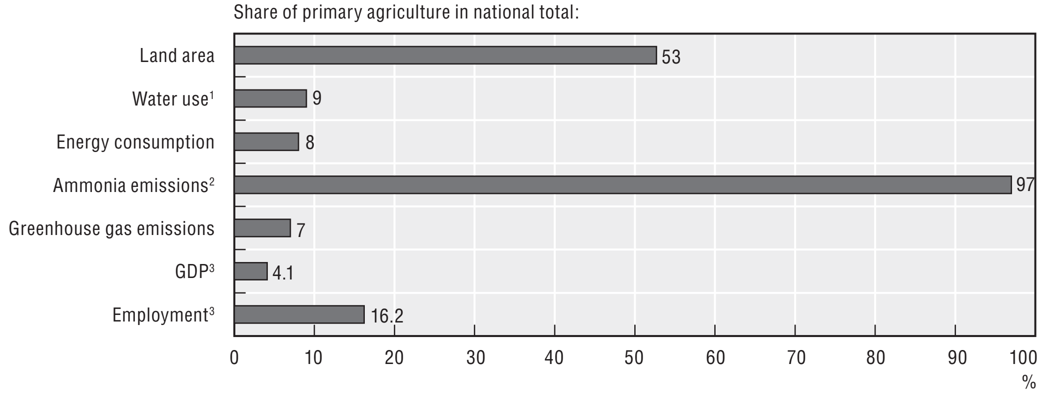
Coverage: The analysis is confined to examination of agri-environmental trends. The influence on these trends of policy and market developments, as well as structural changes in the industry, are outside the scope of these sections. Moreover, the country sections do not examine the impacts of changes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

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

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

3.22. POLAND

Figure 3.22.1. **National agri-environmental and economic profile, 2002-04: Poland**



StatLink http://dx.doi.org/10.1787/300818843555

1. Data refer to the period 2001-03.
2. Data refer to the year 2001.
3. Data refer to the year 2005.

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

3.22.1. Agricultural sector trends and policy context

Agriculture plays a key role in providing employment in the national economy, but that role has shrunk considerably over the period since 1989. The share of agriculture in total employment was 16.2% in 2005 compared to 26.4% in 1989, but the decline in agriculture's contribution to GDP has been even more significant from 12.8% in 1989 to 4.1% in 2005 [1, 2, 3, 4, 5] (Figure 3.22.1).

The volume of agricultural production decreased by 5% over the period 1990-92 to 2002-04 (Figure 3.22.2), among the largest reductions across OECD countries (Figure 3.22.2). But in the recent period 2000 to 2006 production has begun to stabilise and even increase for some commodities, both in value and volume terms, notably for pig and poultry products [2, 3, 6]. Trends for purchased farm input use (volume terms) over the period 1990-92 to 2002-04, however, have been variable, decreasing for nitrogen (–2%) and phosphorus (–32%) inorganic fertilisers, as well as for agricultural water use (–31%), but increasing for pesticides (52%) and direct on-farm energy consumption (29%) (Figure 3.22.2). Although the use of farm inputs stabilised and even began to rise slightly from the late 1990s, by 2005 they still remained below their peak of the middle to late 1980s [3].

Transition from a centrally planned to a market economy has impacted significantly on agriculture, since the early 1990s. The fundamental change in political and social institutions as well as economic conditions has affected how land use decisions are made and led to extensive changes in farm ownership patterns, productivity and competitiveness [7, 8, 9, 10, 11, 12]. Contrary to many other centrally planned economies in

Central and Eastern Europe, Poland was never fully collectivised and many small private individual farms prevailed [4, 13]. The most salient trend in farm structures over the transition period has been the increasing fragmentation of the farm structure with a growing number of small subsistence and semi-subsistence farms (1 to 10 hectares), which has arisen mainly because of a lack of other employment options. There has also been a small increase in the number of large farms (over 20 hectares) which in 2005 accounted for about 4.5% of all farms but more than 40% of farmland largely in the western part of Poland [1, 2, 4, 10, 14, 15]. Agricultural productivity (as measured by total factor productivity indices) declined over the period from the early 1990s to the early 2000s, with estimates varying at an average annual decline of between –2% to –4%, the lowest across OECD countries [10, 13, 15, 16, 17]. This decline reflects the transition to a market economy in terms of the poor profitability and structural problems of farming over the past 15 years, such as low levels of education and capital investment (although investment rose between 1990 and 2005), but also a lack of any significant adjustment in farm employment in contrast to the much sharper reduction in the sector's share in GDP [1, 14, 15].

Farming is now supported under the Common Agricultural Policy (CAP), with support also provided through national expenditure within the CAP framework. Support to agriculture has fluctuated considerably over the past 20 years. Due to the implementation of economic reforms, support declined from around 40% of farm receipts (as measured by the OECD Producer Support Estimate – PSE) in the mid-1980s to a negative PSE in 1990 (*i.e.* farmers were implicitly taxed as domestic prices were lower than world market prices), but then gradually rose to 13% by 2001-03, as policies were geared toward EU membership in 2004. For Poland support under the CAP started in 2004. During Poland's preparation for EU membership, Polish agriculture benefited from funds allocated under the pre-accession policies (see below). Measures taken under these policies will be continued in accordance with the *Rural Development Plan* (RDP) for 2004-06. The EU15 PSE was 34% in 2002-04 compared to the 31% OECD average [4, 7, 18]. Nearly 70% of EU15 support to farmers was output and input linked in 2002-04, the forms of support that most encourage production [7]. Total annual budgetary support to Polish agriculture was almost PLN 15 (EUR 4.6) billion for 2005, of which around 47% was nationally financed, the remainder coming from EU funding [2, 7]. Agri-environmental measures in Poland accounted for about 6.1% of budget support under the RDP [19].

Agri-environmental and environmental policy has had to address several key challenges. Firstly, policy had to respond to the environmental problems left from the legacy of the centrally planned economy; and secondly, policy responses have been required for EU accession and membership. Over much of the period of transition up to the time of EU membership agri-environmental policy was not a priority, while the government lacked resources to invest in environmental protection [4, 20, 21]. Indirectly, however, through the removal of government support for purchased farm inputs (*e.g.* fertilisers, pesticides, energy) and other production related support, this had the effect of lowering agricultural production intensity and consequently pressure on the environment. Even so some limited agri-environmental measures were introduced over the 1990s, such as the: *Green Lungs of Poland Programme* which was a voluntary agri-environmental scheme established by non-governmental organisations in the early 1990s to protect high nature value agricultural areas in north-eastern Poland; 1st *National Environmental Policy* (1991) which established some regulations to protect soils and water; *Protection of Agricultural and Forest Soil Act (1995)* and the *Nature Conservation Act* (1991), providing protection for agricultural genetic resources [5, 22, 23]. In 2001 a strategy was developed to protect water resources against agricultural nitrate pollution and the Ministry of Agriculture and Rural Development began to offer support for agri-environmental measures at *Natura 2000* sites.

EU accession and membership from 2004 has also brought policy change. The EU provided pre-accession funds for agriculture up to 2006 (including for environmental purposes) through three programmes: *SAPARD*, the most important for agriculture in terms of funding the establishment of institutions and systems of policy implementation; *PHARE*, covering institutional building; and *ISPA*, to assist infrastructure development, including environmental protection [18, 20]. The EU accession period since 2004 has required the adoption of EU agri-environmental and environmental policies, and harmonisation of technical standards [7, 20]. Policies under the CAP are being phased in up to 2013, when CAP support will reach 100% of the EU15 level.

The National Agri-environmental Programme (NAEP), covering the initial period of EU membership is a part of the broader *Rural Development Plan* (2004-06). The NAEP, as well as promoting environmental beneficial farming practices and raising environmental awareness among farmers, has three main objectives for agriculture: protection of the environment and landscapes; development of organic farming; and conservation of biodiversity, including agricultural genetic resources [2, 3, 24]. Since 2000 the state budget has provided support for the maintenance of livestock populations covered by genetic resource protection programmes, and from 2005 the protection of livestock genetic resources has been financed under the agri-environmental programme. Funding for the NAEP amounted to PLN 782 (USD 250) million in June 2007, with two main types of measures: first, those implemented nationally, for example payments for organic farming, soil and water protection (*e.g.* payments for buffer zones) and protection of local breeds; and secondly, those implemented in terms of 69 priority zones with specific environmental problems or which possess high natural value, such as payments for the maintenance of pastures and extensive meadows [3, 24]. To comply with the *EU Nitrate Directive*, several programmes and schemes have been implemented, including designation of *Nitrate Vulnerable Zones* (covering 1.7% of the total land area in 2004), to regulate farms in terms of fertiliser and manure application and storage practices, and provide farm support investment aid for the construction of manure storage facilities [25, 26, 27, 28].

Agriculture is affected by national environmental and taxation policies. Under the *National Woodland Extension Plan*, part of the *2nd National Environmental Policy* (2000), it is planned to expand the afforestation of land unsuitable for agriculture by 680 000 hectares between 2001 to 2020, which could have important implications for flood control and climate change protection efforts [1, 5]. Farmers pay a lower rate (7%) of value added tax (the standard rate is 22%) on pesticides and fertilisers, and support was provided for lime fertilisers up to 2004 [5, 28]. From 2006 a fuel tax concession is provided to farmers, with PLN 650 (USD 209) million allocated in 2006 (*i.e.* the total tax concession available depending on the extent of tax refund claims by farmers) [19]. There are regulations to restrict the conversion of farmland to other uses in some regions [9]. General budgetary expenditure covers irrigation infrastructure improvements and management of almost PLN 50 (USD 16) million in 2006. Farmers are also exempt from water abstraction charges under the Water Law providing their total abstractions do not exceed 5 m^3 of daily abstractions from surface water and groundwater used within the farm household [4, 5, 19, 21].

Poland is a signatory to a number of international environmental agreements, some with implications for agriculture including limiting emissions of: nutrients into the Baltic Sea (*HELCOM Convention*); ammonia (*Gothenburg Protocol*); methyl bromide (*Montreal Protocol*); and greenhouse gases (*Kyoto Protocol*). Under the *National Strategic Plan for 2007-13 Rural Development* and the NAEP, there are a range of measures which contribute to reducing GHG emissions from agriculture, including: support for afforestation of farmland [2, 3]; provision of advisory services to improve fertiliser and manure application practices; and payments to develop manure storage capacity. In addition, under the guiding principles of the *Development Strategy of the Renewable Energy Sector* (2001) support is provided to farmers for renewable energy produced from agricultural biomass feedstock. These include: payments for energy crops (*e.g.* energy willow) of PLN 216 (USD 67) per hectare; support for bioenergy plant construction, such as straw and wood fired boilers, biogas systems, and capacity for biofuel production; and excise tax exemptions for biofuels, although from January 2007 these exemptions were lowered to align them with EU regulations to PLN 1.0 (USD 0.32) per litre for biodiesel and PLN 1.5 (USD 0.48) per litre for bioethanol [29, 30, 31]. As part of its commitments under the *Convention of Biological Diversity*, the *National Strategy for Conservation and Sustainable Use of Biological Diversity* (2003) through the NAEP has established programmes for conservation of agricultural genetic resources and the protection of high nature value meadows and pastures [3, 32]. Poland also has a number of bilateral and regional environmental co-operation agreements with neighbouring countries. These include some agreements important to agriculture and the environment in Poland, such as transboundary nature conservation, through the *Carpathian Convention* (2006) covering the mountains in the South [5, 32], and transboundary river pollution, linked to limiting nutrient flows into the Baltic Sea [5, 27].

3.22.2. Environmental performance of agriculture

Environmental concerns related to agriculture have changed dramatically over the past 20 years. With the reduction in farm production and purchased input support, and shift to a market economy, farming moved from an intensive production orientated system to adoption of more extensive farming methods, linked particularly to the large decrease in use of purchased farm inputs, and in some areas adoption of agri-environmental management practices. In the pre-transition period the primary agri-environmental problems were soil erosion, heavy pollution of some water bodies and poor uptake of environmentally beneficial farming practices [3, 4, 5]. Over the 1990s certain environmental problems persist, due to the legacy of decades of damaging farming practices, notably soil erosion and in some areas industrial pollution of farmed soils, especially from acidification and heavy metals [3, 4, 33]. The pressure on water and air quality, and biodiversity has eased with more extensive farming practices, but pollution continues in some regions, while land use change and cessation of farming has led to damage to biodiversity in some areas [3, 5, 33].

Soil erosion and soil acidification are major and widespread environmental problems [3, 11, 22, 33, 34]. According to assessment in 2005 about 29% of Poland's total land area is at risk of water erosion and about 28% at risk to wind erosion. In 2005 a total of about 19% of the total agricultural land area is at risk of medium to strong wind erosion, and around 28% and 13% of agricultural and forest land was at risk to medium and strong water erosion and gully erosion respectively (Figure 3.22.3) [14]. Farming areas worst affected by water erosion are mainly in the North and mountainous South East (*e.g.* Małopolskie and Lubuskie districts), while central and eastern regions are mostly

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endangered by wind erosion (*e.g.* Łódzkie and Mazowieckie districts) [33]. ***Soil acidification*** in the late 1990s was estimated to be a problem on over 50% of agricultural land, and primarily originates from natural conditions, mainly unfavourable climate, soil and hydrological conditions, but also from industrial pollution [1, 3, 11]. Soil conservation practices are not widely adopted by farmers, mainly because of the lack of resources for farmers to undertake preventive measures, such as liming acidic soils and the creation of wind shields (hedges and trees) [3, 33]. The liming of soils through use of calcium fertilisers, for example, to counteract soil acidification has decreased from over 180 kg/ha of agricultural land (expressed as pure calcium) in the late 1980s to around 94 kg/ha in 2001/02 [3].

Overall water pollution from agricultural sources is not as acute as in many other OECD European countries, as the intensity of fertiliser and pesticide use, as well as livestock operations, are appreciably below those for most OECD countries [3, 5, 26]. But recent trends are mixed and in some locations inappropriate farming practices have led to pollution risks. While the intensity of nutrient surplus per hectare of agricultural are more than 50% lower than the OECD and EU15 averages (Figure 3.22.2), since the late 1990s nutrient surpluses have begun to rise after dropping sharply in the transition period from the late 1980s, with a similar development also apparent for pesticides. Although intensive cropping and livestock operations are a source of pollution, a key problem is the inadequate storage of manure on small farms and the poor uptake of environmental farm management practices on small farms that limit pollution from nutrients and pesticides [3, 4, 20, 28, 33].

There have been large reductions in agricultural nutrient surpluses (Figure 3.22.2). The trends in the intensity of nutrient surpluses per hectare of total farmland, both of nitrogen (N) and phosphorus (P), over the period from the late 1980s to 2004 fluctuated considerably. In the late 1980s nutrient surpluses were at a level comparable to those of the EU15 average, although by the early 1990s there was a sharp reduction, especially for phosphorus. From around the late 1990s while there has been a slow increase in surpluses, they were still well below the averages for the OECD and EU15 by 2002-04 (Figure 3.22.2). The reduction in support to fertilisers and crop and livestock products during the transition period largely explains the decrease in nutrient surpluses. This is highlighted by the fluctuations in the use of inorganic N fertilisers which fell from (figures in brackets are for P fertilisers) around 1 400 000 (900 000) tonnes in the late 1980s down to 650 000 (230 000) tonnes in the early 1990s, rising to about 860 000 (315 000) tonnes by 2002-04 [3].

Overall the agricultural pollution of water bodies from nutrients is generally low [21]. In 2002, 0.4% of surface water monitoring sites across the country exceeded the EU standards on nitrate in drinking water (50 mg NO_3/l) [1, 3]. But excessive eutrophication is apparent in about 50% of lakes located in agricultural water catchments, while the Ministry of Health data for 2000 estimated that 24% of farm wells had water of poor quality in excess of the EU drinking water standards [3, 5, 25]. Poland also contributes to nutrient loadings into the Baltic Sea, and is the major contributor to pollution of the Baltic [5]. Agriculture contributes about 45-50% of national nitrogen discharge and 30-35% of phosphorus discharge into the Baltic, and although the absolute level of nutrient discharge has declined since 1990, Poland's share of agricultural nutrients into the Baltic remains high compared to other Baltic states [3, 4, 5, 25].

The rising levels of nitrogen surpluses since the late 1990s, however, have increased pressure on water quality in certain areas. Some 1.7% of the total land area in 2004 was designated as *Nitrate Vulnerable Zones* (NVZs) under the EU *Nitrates Directive* [1, 25, 26, 27]. It was estimated by the Government in 2001 that for Poland to comply with the *Nitrates Directive* (*e.g.* cost of installing manure storage facilities) would cost over PLN 12 (USD 3) billion [26, 28]. For ***phosphate*** the trend has been different since over most of the period from the early 1990s phosphate surpluses have been declining, reducing the potential pollution of water bodies. ***Heavy metal*** pollution of water from use of inorganic fertilisers and manure, is also minor mainly due to the low intensity of using fertilisers and manure surpluses compared to other OECD European countries [35]. Concentrations of heavy metals in the vast majority of Poland's soils (about 97% of the farmed area) are at a natural level or only slightly elevated [36].

In those areas suffering nutrient pollution of water from agriculture this is predominantly associated with small farms. About 50% of farms in 2000 had storage facilities for manure and only 4% had liquid manure tanks with sufficient capacity for four months of manure production, while this is obligatory in NVZs [3, 25]. Moreover, there are low rates of uptake of nutrient management plans or soil nutrient testing. These problems are partly linked to farmers' lack of capital to invest in manure storage and other manure treatment technologies; and also to inadequate knowledge of nutrient management practices [27]. Poland has also suffered the historic legacy that prior to 1990 investment in manure storage systems was not a priority [27].

The increase in pesticide use was among the highest across OECD countries from 1990-92 to 2001-03, but the trend has fluctuated considerably over this period (Figure 3.22.2). Pesticide use declined from around 12 000 tonnes (of active ingredients) in the mid/late 1980s to around 7 000 tonnes by the early/mid-1990s, then rose to nearly 10 000 tonnes by 2002-04 [3]. The reduction in support to pesticides and crops during the transition period explains much of the decrease in pesticides use in the early 1990s [4]. The more recent growth in pesticide use is largely linked to the expansion in cereals and horticultural production, and the use of pesticides to help raise crop yields taking into account that pesticide application rates are considerably lower than many other OECD European countries [2, 3, 5, 6]. To a limited extent the growth in pesticide use has been restricted with the expansion in ***organic farming***, with more than half of the total organic area under arable and horticultural crops in 2002 [2]. Even though organic farming grew rapidly over the 1990s, by 2003-05 it only accounted for 0.6% of agricultural land compared to the EU15 average of nearly 4% [2, 14, 37, 38].

With the growth in pesticide use since the mid-1990s the pressure on water quality has been increased, although there is little information on pesticide concentrations in surface and groundwater. The highly persistent DDT pesticides, which were banned from use at the end of the 1970's, were detected in rivers and the Baltic Sea up to 2000, at levels below limits harmful to human health but of some concern for their impact on aquatic ecosystems [39]. There are also concerns for environmental pollution from inadequate pesticide application technologies and inappropriate storage and waste disposal [4].

As agriculture is largely rain-fed use of irrigation is limited accounting for 0.6% of the total farmland area in 2003 [14]. Farming's share in national water use was 9% in 2001-03, although agricultural water use declined by over 30% between 1990 and 2003 (compared to an 18% reduction for national water use), largely because of the sharp reduction in irrigation water use [5]. Particular concerns related to agriculture and water resources are: the limited capacity of on-farm water storage facilities, which does not provide adequate protection against periodic floods and droughts; and also lowering of groundwater levels in some rural areas [1, 4, 6].

There has been a major reduction in air pollution linked to agriculture. Agricultural ***ammonia emissions*** decreased by –22% between 1990-92 and 2001, among the largest reductions across OECD countries (Figure 3.22.2) [3]. Farming accounted for nearly all ammonia emissions in 2001, with the drop in emission levels mainly due to the decrease in livestock numbers and nitrogen fertiliser use. With total ammonia emissions falling to 326 000 tonnes by 2001 [6], Poland has already achieved its 2010 target of 468 000 tonnes required under the *Gothenburg Protocol* [5]. Further reductions in ammonia emissions could be achieved if poor manure storage and fertiliser spreading practices were improved [33]. For ***methyl bromide*** use (an ozone depleting substance) Poland reduced its use between 1991 to 2003 by 70% as agreed by the phase-out schedule under the *Montreal Protocol* which sought this level of reduction by 2003 and to eliminate all use by 2005. But Poland, together with a number of other OECD countries, was granted a "*Critical Use Exemption*" for 2005 (equivalent to over 20% of 1991 levels) which effectively gives more time for users to develop alternatives.

Agricultural greenhouse gas (GHG) emissions rose by 4% from 1990-92 to 2002-04 (Figure 3.22.2). However, there were considerable annual fluctuations in agricultural GHG emissions over this period and by 2004 emissions (nearly 34 million tonnes of CO_2 equivalent) were below the level of the late 1980s (50 million tonnes of CO_2 equivalent tonnes) [29]. This compares to an overall decrease across the economy of 21% from 1990-92 to 2002-04, and a commitment under the *Kyoto Protocol* to reduce total emissions by 6% over 2008-12 compared to 1990 levels. Agriculture's share of national total GHGs was 7% by 2002-04. Much of the rise in agricultural GHGs was due to the recent growth in livestock numbers (raising methane emissions), higher fertiliser use (increasing nitrous oxide emissions) and greater use of energy. Projections suggest that agricultural GHG emissions could stabilise in the period from 2005 to 2008-12, as a result of an expected decrease in cattle production offset by a rise in crop, pig and poultry production [29, 40]. This implies that agricultural GHG emissions by 2008-12 could remain at around 30% below the level of the late 1980s [29].

Agriculture has contributed to higher GHG emissions by increasing direct on-farm energy consumption, partly offset by agricultural GHG carbon sinks from expanding renewable energy production and developing afforestation of agricultural land. ***Direct on-farm energy consumption*** rose by 29% between 1990-92 and 2002-04 compared to a reduction of 4% for total national energy consumption, with farming contributing 8% of total energy consumption (Figure 3.22.2). The growth in agricultural energy consumption is largely explained by the substitution of farm labour for machinery, with farm employment declining by around 20% between 1990-92 and 2001-03 compared to an increase in the number of farm tractors by nearly 9% (26% increase in terms of average tractor power) over the period 1995 to 2005 [14].

While production of renewable energy from agricultural and other biomass feedstocks is growing, it provides only about 4% of total primary energy supply in 2006 [29, 30, 41, 42]. Agricultural biomass feedstocks are mainly used for: *heating*, about 450 local thermal power stations and 250 000 biomass heated boilers in farm dwellings of around 5 000 Megawatts were established between 2001 and 2004; and for *liquid fuel* production (biodiesel and bioethanol), mainly from molasses, low quality cereals, potatoes and other agricultural products [29, 30]. Biofuel production was estimated at 113 million litres of bioethanol and 72 000 tonnes of methyl esters used in biofuels annually in 2005 [29, 42]. There is considerable potential to expand current biomass feedstocks, especially from short rotation farm forestry [30, 41], but to achieve the government's biofuel goal of 5.75%

share of total transportation fuel by 2010 would require a significant increase in production from current levels [43]. Of the 20 agricultural biogas plants that were installed in the 1980s only one is currently in operation [29].

Agricultural carbon sequestration has been affected by two main developments. First, the 16% decrease in the area under permanent pasture over the period 1990 to 2004 has likely led to a reduction in soil organic carbon, and second, the afforestation of farmland under various government schemes is probably increasing carbon sequestration. Under the *National Woodland Extension Programme*, for example, 111 300 hectares of farmland were converted to forestry between 1995 and 2000, which was under 1% of the total agricultural land area [3].

Poland is widely perceived to have a rich biodiversity in agricultural areas, compared to many other OECD European countries [1, 3, 33]. But pressure on biodiversity from agricultural activities is becoming more evident, although evaluating the effects of farming on biodiversity since 1990 is complex [3, 4]. Unlike many other centrally planned economies the lack of farm collectivisation lowered pressure on biodiversity [8], while over the early to mid-1990s threats to biodiversity diminished, especially with the reduction in use of fertilisers and pesticides. Since the mid/late 1990s, however, there has been some intensification of agricultural (*e.g.* higher pesticide use), while the fragmentation of farms into a growing number of small and semi-subsistence units has led to the poor uptake of farming practices to help biodiversity and low investment in environmental protection (*e.g.* manure storage). However, the fragmentation of farm holdings has contributed to a mosaic landscape structure, to the benefit of biodiversity by providing a greater diversity of habitats.

Protection of agricultural genetic resources is being addressed through* in situ *programmes and* ex situ *collections of genetic material [3, 33, 44]. The number of registered plant varieties has risen steadily with 917 varieties registered by the Research Centre for Cultivar Testing in 2000. Between 1986 and 1995, between 30-32 varieties were registered every year, whereas in 2006 the number increased to 47 varieties annually [44]. But the shift toward monoculture and less complex rotations since 1990 has possibly diminished crop plant diversity and, although information is incomplete, evidence suggests the genetic erosion of plant resources over recent decades [3, 44]. Even so, some 300-400 plant genetic materials are added to the national plant gene bank annually [32]. For livestock, 32 programmes were implemented in 2002 for the conservation of livestock genetic resources, covering 75 breeds, varieties and sub-species of livestock and fish [44]. *In situ* and *ex situ* livestock conservation programmes were introduced from 1999 and since this period the National Coordination Centre for Animal Genetic Resources has been monitoring the size of livestock breeding populations [3, 32].

A major share of agricultural land is designated as having a high nature value, and with 53% (2002-04) of the total land area farmed this has important implications for biodiversity [3, 33, 45]. There is a great diversity of habitats on agricultural land. Around 50% of meadows and pastures are classified as semi-natural (about 10% of total farmland), which include wet meadows and other important wetland habitats. Also farmland comprises over 40% of national protected landscapes (which cover around a quarter of the total land area) in 2002 [3, 46]. The main threats to the high nature value agricultural habitats are: their conversion to forestry and urban use; their shift to more intensive forms of management (*i.e.* higher fertiliser and pesticide use); and in some marginal areas their abandonment to overgrowth where it may be too costly to convert them to cropland or forestry [11, 33]. The nearly 12% reduction in area farmed between 1990-92 and 2002-04 was among the highest across OECD countries, with a decrease in arable and permanent crop land by 11% and permanent pasture by 16% over this period. Nearly 18% of farmland was estimated to be idled or abandoned in 2002, with this share rising to over 30% in some regions (*e.g.* Lubuskie, Podkarpacie,Śląsk) [1, 3]. The overgrowth of grazed wet meadows is considered to be one of the most serious threats to open wetlands [46].

An important area of semi-natural grasslands and cultural farmed landscapes is in the Carpathians, a mountainous region extending over 7 European countries. This includes the Tatra mountains in south eastern Poland, which is recognised as a UNESCO *Biosphere Reserve* since 1996 [5, 32, 47]. These grasslands are considered to be among the most species rich in Europe with many protected plant species, such as those belonging to the orchid family [23, 48]. But their continued existence is coming under a variety of threats, especially the increase in the area under fallow and the drastic reduction in livestock over the 1990s, especially the sheep flock. This has led to the abandonment of some semi-natural grasslands or for others under grazing below a level necessary to maintain the plant species richness of the grasslands [47, 48]. The Carpathians also have significance for Poland (and other bordering countries) in terms of their cultural landscape value, in particular, associated with transhumance shepherding [49]. The major decline in extensive sheep production since the early 1990s, however, has led to the disappearance of shepherding tracks and historic mountain shepherd huts to the detriment of the cultural landscape [49].

The extensive farming system in many parts of the country has been beneficial to wild species conservation. With the extensive nature of farming practices and diverse habitat structures in most rural areas, this is providing favourable conditions for many wild species of flora and fauna [3]. But the abandonment of farmland in some areas and intensification and removal of habitat features in others is increasing pressure on wild species, although monitoring of wild species, especially related to farming activities, is only beginning to be established [1, 3]. An estimated 2.2% of vascular ***wild plant species*** occurring in Poland are endangered or threatened as a result of the cessation of grazing and mowing practices; ploughing grassland; and the use of fertilisers and pesticides [3]. Research has shown that ***grassland butterflies*** in southern Poland are also subject to similar threats as plant species [50]. Even so, most ***game species*** have recovered in numbers since 1995, such as the various species of deer, bears, wild boars, foxes and moose, but a few populations have declined markedly, such as hares and partridges [6]. Wolf numbers, a wholly protected species in Poland (the largest population in Europe), have also increased.

Over the short period farmland bird populations have been monitored (2000-04), the population index has declined slightly (Figure 3.22.4) [1]. But Poland was considered to have had relatively stable farmland bird populations over recent decades [51]. The decline in farmland bird numbers is of concern as farming was estimated to have posed a threat to around 25% of important bird habitats through changes in management practices and land use in the late 1990s [52]. Moreover, Poland, is host to major remaining populations of many of Europe's endangered farmland bird species, such as the Corncrake (*Crex crex*), Corn Bunting (*Miliaria calandra*), Whinchat (*Saxicola rubetra*), Aquatic Warbler (*Acrocephalus paludicola*), White Stork (*Ciconia ciconia*) and Orotlan Bunting (*Emberiza hortulana*) [3, 53]. Recent research suggests that abandonment of farmland has been a major influence on bird populations, but with both negative and positive impacts on bird species and populations [53, 54, 55]. In addition, intensification of farming and removal of habitat features has had adverse impacts on bird populations. For some other farmland bird species, such as the Little Owl (*Athene noctua*), the cause of their decline is unclear [56].

3.22.3. Overall agri-environmental performance

Overall agricultural pressure on the environment has been low since 1990, compared to that in many OECD countries [5]. The agricultural system is largely characterised by small and semi-subsistence farms especially in the Eastern part of the country, as Poland was never fully collectivised pre-1990. These farms use a low intensity of purchased farm inputs (*e.g.* fertilisers, pesticides, energy and water) and have a diversity of habitats across the agricultural landscape [5]. Although the use of farm inputs stabilised and even began to rise slightly from the late 1990s, by 2005 they still remained below their peak of the middle to late 1980s [3]. But the rising levels of agricultural nutrient surpluses and pesticides since the late 1990s have increased pressure on water quality. Moreover, soil erosion and soil acidification are major and widespread environmental problems associated with farming activities. Also declines in farmland bird populations and changes in land management practices have raised concerns with respect to agriculture's impact on biodiversity.

While improvements are being made to agri-environmental monitoring many data gaps remain, which need to be addressed if policy makers are to be provided with the information required to effectively monitor and evaluate agri-environmental performance and policies. Agriculture plays only a limited role in the environmental protection monitoring activities of the *Unit of Environmental Monitoring* of the *Chief Inspectorate of Environment Protection* (GIOS) [33]. Data related to soil degradation are only available from surveys conducted in the late 1990s and there are no time series data available nor information on soil conservation practices [22]. More quantitative data on erosion processes at the catchment level are needed to support policy and management schemes aimed to combat erosion [22]. It is not possible to adequately assess the extent of water pollution from agriculture as there is no national water monitoring system for farm pollutant sources of rivers, lakes, groundwater, and coastal waters although projects financed by PHARE are seeking to improve the monitoring system. Similarly the extent of agri-biodiversity monitoring is still too limited [43], but from 2000 the monitoring of farmland bird populations was established.

Agri-environmental policies have been strengthened in the period since EU membership, but the low level of environmental awareness of farmers is an impediment to the success of these policies. The *National Agri-environmental Plan* (NAEP), part of the broader *Rural Development Plan*, is placing particular emphasis on environmental protection, especially lowering water and air pollution, development of organic farming, and biodiversity conservation [2, 3, 24]. A serious barrier to meeting the higher environmental standards required under these agri-environmental programmes and other EU and international environmental policies, however, is the low level of environmental awareness among farmers [3]. The large number of small holdings, their weak financial base, coupled with low educational standards, are obstacles to meeting agri-environmental policy objectives [3]. According to recent research only 30% of farmers are aware of the potential detrimental impact of their activities on the environment, while there is a chronic lack of investment in the necessary facilities (*e.g.* manure storage tanks) and equipment (*e.g* manure spreaders) that could bring environmental improvements [3]. Also farmers have stocks of obsolete capital (*e.g.* old machinery) that impede environmental and production efficiency gains [16].

Despite the relatively low environmental pressure of the farming sector, a number of concerns remain. Given the lack of ***manure storage*** facilities and uptake on nutrient management plans, a considerable effort will be required for Poland to comply with the EU *Nitrate Directive* and meet Poland's *HELCOM* commitments to limit nutrient pollution of the Baltic Sea [28]. While nutrient run-off into the Baltic has been significantly reduced and measures adopted to address the problem, Poland still contributes the major share of nutrient inputs from agriculture into the Baltic. This reflects not only the progress of other Baltic countries in reducing their nutrient inputs, but also that Poland has a greater share of arable land and population than other Baltic countries [5].

There has been success in lowering the use of methyl bromide use over the 1990s, but a further reduction in use will be required if Poland is to phase out use completely as agreed under the *Montreal Protocol*. But granting *Critical Use Exemptions*, to give farmers additional time to find methyl bromide substitutes, may impede the effectiveness of achieving reduction targets and act as a disincentive to finding alternatives.

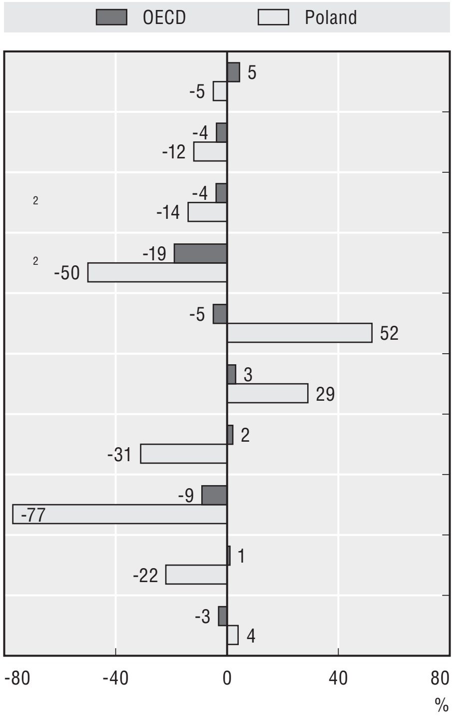
Tax exemptions on fossil fuel used by farmers provide a disincentive to improve energy efficiency, and help further reduce greenhouse gas emissions, especially as agricultural GHG emissions and direct on-farm energy use have been increasing. Renewable energy production based on agricultural biomass, however, is being expanded. Although the current intensity of pesticide and fertiliser use is low, but recently on a rising trend, the reduced value added tax on these inputs does not encourage more efficient use, hence, lowering potential environmental pressure [5].

Agriculture supports a rich and abundant biodiversity [51, 53]. A major concern for biodiversity, however, is the abandonment of agricultural land to plant overgrowth, especially where this involves semi-natural grasslands. In some western parts of Poland the intensification of farming (*e.g.* higher stocking rates, and greater use of fertilisers and pesticides) is also increasing the pressure on biodiversity. The introduction of agri-environmental measures to protect biodiversity will be important, as Poland is host to major remaining populations of many of Europeans endangered farmland bird species [3, 53], while the Carpathians (of which a part falls within Polish territory and is a UNESCO Biosphere Reserve) are an important area of farmed mountainous semi-natural grasslands and cultural landscapes.

Projections suggest that agricultural production is likely to remain stable up to 2015, but the consequences of these projections for the environment are unclear. This is because the projections expect that while dairy and beef cattle production may contract, crop (*e.g.* cereals and sugar beet), pig and poultry production could expand [29, 40]. However, not all projections of Polish agriculture show consistent results when compared with each other. Moreover, the agricultural sector is undergoing structural changes which have environmental implications. A key aspect to structural change in agriculture, which may impact on agri-environmental performance, is the extent to which small semi-subsistence farms can escape the vicious circle of low technical efficiency and technological and educational limitations [15]. As much as 40% of those engaged in agriculture have only elementary education compared to around 10% in industry [16]. Improvements in human capital are clearly crucial to the future of Polish farming and in raising agri-environmental performance, both by improving the efficiency of those remaining in farming and also increasing opportunities for others to leave the sector and seek other employment [16].

Figure 3.22.2. **National agri-environmental performance compared to the OECD average**

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



Absolute and economy-wide change/level

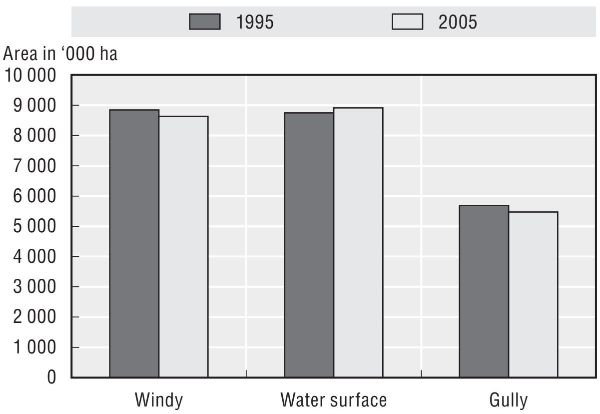
Variable	Unit		Poland	OECD
Agricultural production volume	Index (1999-01 = 100)	1990-92 to 2002-04	95	105
Agricultural land area	000 hectares	1990-92 to 2002-04	–2 221	–48 901
Agricultural nitrogen (N) balance	Kg N/hectare	2002-04	48	74
Agricultural phosphorus (P) balance	Kg P/hectare	2002-04	3	10
Agricultural pesticide use	tonnes	1990-92 to 2001-03	+3 375	–46 762
Direct on-farm energy consumption	000 tonnes of oil equivalent	1990-92 to 2002-04	+1 009	+1 997
Agricultural water use	Million m^3	1990-92 to 2001-03	–475	+8 102
Irrigation water application rates	Megalitres/ha of irrigated land	2001-03	0.9	8.4
Agricultural ammonia emissions	000 tonnes	1990-92 to 2001-03	–90	+115
Agricultural greenhouse gas emissions	000 tonnes CO_2 equivalent	1990-92 to 2002-04	+985	–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*.

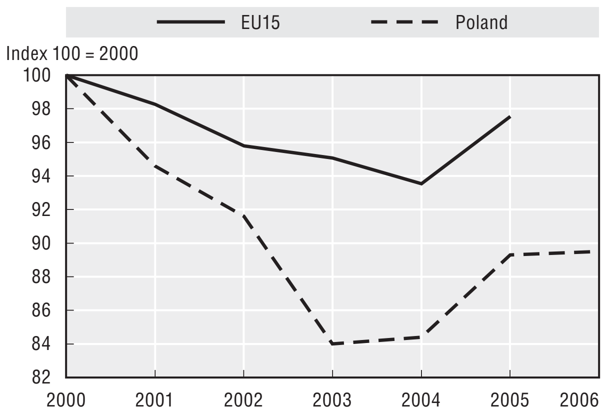
Figure 3.22.3. **Agriculture and forest land at risk to erosion**



Source: Central Statistical Office in Poland.

Figure 3.22.4. **Index of population trends of farmland birds**

2000 to 2006



Source: State Environmental Monitoring Scheme in Poland.

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