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

Sweden 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The review of environmental performance draws on the country responses to the OECD agri-environmental questionnaires (unpublished) provided by countries and the OECD agri-environmental database supporting Chapter 1 (see website above).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.

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:

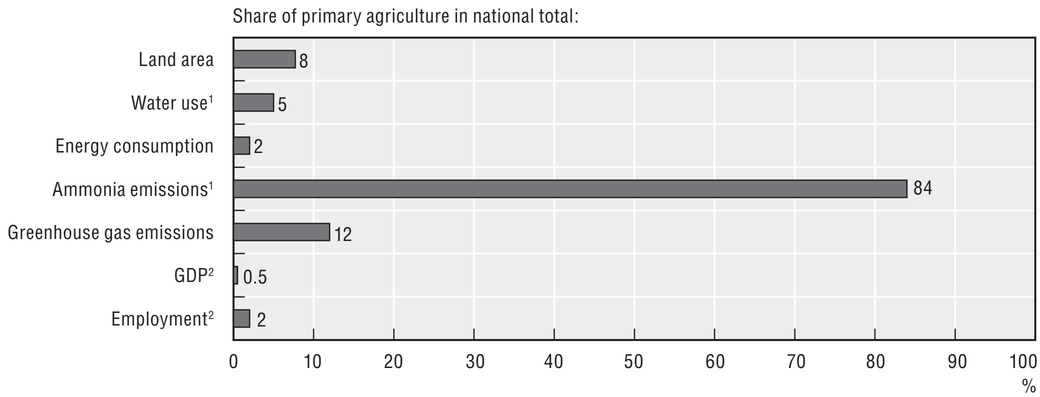
Coverage: The analysis is confined to examination of agri-environmental trends. The influence on these trends of policy and market developments, as well as structural changes in the industry, are outside the scope of these sections. Moreover, the country sections do not examine the impacts of changes 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).

3.26. SWEDEN

Figure 3.26.1. **National agri-environmental and economic profile, 2002-04: Sweden**



StatLink http://dx.doi.org/10.1787/301127740017

1. Data refer to the period 2001-03.
2. Data refer to the year 2004.

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

3.26.1. Agricultural sector trends and policy context

Primary agriculture's contribution to the economy is small and declining, accounting for 0.5% of GDP and less than 2% of employment in 2004 [1] (Figure 3.26.1). Agricultural production rose slightly by 3% over the period 1990-92 to 2002-04, due to an increase in livestock production (but livestock numbers declined), as overall crop production remained unchanged. While the area farmed declined by 6% between 1990-92 and 2002-04, the intensity of farm input use diminished with reductions in the use of: nitrogen (–11%) and phosphorus (–33%) fertilisers; pesticides (–3%); and on-farm direct energy consumption (–15%) (Figure 3.26.2).

Since accession to the EU in 1995 farming has undergone significant structural change [2]. The key developments between 1996 and 2005 include a reduction in the number of farms (–17%), an increase in farm size, and greater specialisation, mainly in dairying, pigs and cereals [1, 2]. Most farms are family owned and farming and forestry are often combined activities. The share of agriculture in the total land area, of about 7%, is among the lowest across the OECD area, because Sweden's climate and topography limit the growing season in the north. As agriculture is mainly rain-fed its use of water resources is small, accounting for only 4% of total water use in 2000 [3], which also reflects the very limited area irrigated, less than 2% of the total agricultural land area (2002-04), although in dry years the irrigated area can be more than double this share.

Farming is mainly supported under the Common Agricultural Policy, but also through national expenditure within the CAP framework. Support to EU15 agriculture declined from 39% of farm receipts in the mid-1980s to 34% in 2002-04 (as measured by the OECD Producer Support Estimate) compared to the OECD average of 30% [4]. Nearly 70% of EU15

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farm support is output and input linked, but this share was over 98% in the mid-1980s. In addition to EU support, the total Swedish farm budget was EUR 12.2 (USD 15.3) billion or almost 30% of agricultural gross value added in 2004 [4]. Following the reform of Swedish agricultural policy in the early 1990s this led to a reduction of farm support between 1991 and 1996 [5], but since joining the EU in 1995 agricultural support increased [4, 6].

Integration of environmental concerns into agricultural policy have increased since joining the EU, especially under the *Environmental and Rural Development Programme* (ERDP, 2000-06), which is based on the EU's *Rural Development Programme*, [7]. About 80% of expenditure under the ERDP is for agri-environmental programmes including less-favoured areas, with the main focus on: reducing *nutrient pollution* into water bodies; the conservation of biodiversity and cultural landscapes; and support for organic farming [4, 7]. The key measures to reduce nutrient leaching under the ERDP include payments for catch crops and spring tillage, bufferzones, and wetlands. Annual payments over the period 2000 to 2006 were for catch crops SEK 900/hectare (EUR 95); spring tillage SEK 400/hectare (EUR 45); bufferzones SEK 3 000/hectare (EUR 325); and wetlands SEK 3 000/hectare (EUR 325). Support for wetlands is also, in part, to cover costs for their establishment. *Biodiversity payments* vary between SEK 410 and SEK 6 600 per hectare (EUR 35-710) and are provided on condition that, for example, land is cleared of undergrowth and maintained on an annual basis so that no detrimental amount of growth accumulates. *Landscape conservation payments* vary between SEK 205 and SEK 400 per hectare (EUR 20-45) and are provided for ley pasture production on condition that the land is not subject to pesticide use nor tilled for at least 2 years [7, 8]. This payment is not granted to farmers in the most productive areas of Sweden. Annual ***payments to support organic production*** vary between SEK 500/hectare and SEK 7 500/hectare (EUR 55-810) for crops and SEK 1 700/hectare (EUR 180) for livestock production. Within the ERDP agri-environmental training expenditure is mainly directed (2005) at nutrients and pesticides SEK 67 (EUR 7) million, biodiversity SEK 36.5 (EUR 4) million, and organic farming SEK 34 (EUR 3.5) million [9].

Voluntary environmental schemes are common.There is widespread farmer adoption of voluntary environmental schemes, which require that certain environmental practices are achieved by farmers. The *Eco Audit Scheme* (now covering 70% of farmland and 90% of the value of production) helps farmers track their adoption of environmental practices. The *Integrated Production Scheme* for horticultural producers and the *Seal of Quality Scheme* involve stricter environmental requirements than the *Eco-Audit* [10, 11].

Agriculture is affected by national environmental policies. Since 1985 environmental concerns have been one part of agricultural policy, with specific plans of actions covering pesticides, nutrients, biodiversity and organic farming. Agri-environmental policies were further strengthened when the Swedish Parliament established 16 Environmental Quality Objectives (EQOs) with long term objectives to 2020 and about 70 interim targets [12, 13, 14]. Some of the EQOs concern agriculture, including objectives for a varied agricultural landscape, zero eutrophication, and a non-toxic environment (*i.e.* reducing pesticide risks). Linked to the EQOs are various Action Programmes including measures such as financial, research and development, and training and extension services. For example the key measures to reduce nutrient leaching under the *Action Programme for Reducing Plant Nutrient Losses from Agriculture* [15] are: regulations on the area of winter crop cover; storage of manure; covering and filling of slurry stores; limits on manure and organic fertilisers (based on phosphorus content); limits on nitrogen application, and on the handling and timing of manure and fertiliser application; environmental support under the ERDP for catch crops and spring tillage, bufferzones and wetlands; taxes on nitrogen and cadmium; extension services and information campaigns, including *Focus on nutrients* [16]; and research and development.

National taxation policies also impact on agriculture. To encourage sustainable farming practices and reduce environmental risks, fertilisers, pesticides and cadmium in fertilisers have been taxed since 1984 [2]. These taxes are based on product composition, with about three-quarters of the revenue used to fund measures to reduce pollution and the remainder for research, development, training and extension [17]. The taxes in 2002 on fertilisers amounted to SEK 305 (EUR 33) million and on pesticides SEK 43 (EUR 4) million. On cadmium the taxes amounted to SEK 10 (EUR 1) million over 2000 to 2005 [2, 16]. Farmers are reimbursed up to 100% of the energy tax on fuel, 100% for electricity (from 2004, 98%) and up to nearly 80% of the carbon dioxide duty (climate change levy) on fuel used for heating and stationary engines, while greenhouse horticulture can purchase fuel at a reduced rate [2, 17, 18]. Biofuels are exempt from carbon dioxide and energy taxes from 2004 to 2008 [18, 19].

International environmental agreements important to agriculture include: those seeking to curb nutrient emissions into the Baltic Sea (*HELCOM Convention*) and the North Sea and Atlantic (*OSPAR Convention*); the *Gothenburg Protocol* concerning ammonia emissions [15]; greenhouse gases (*Kyoto Protocol*); and commitments under the *Convention of Biological Diversity* [8].

3.26.2. Environmental performance of agriculture

Biodiversity and landscape conservation and reducing water and air pollution are the key national environmental quality objectives (EQOs) for agriculture. The ERDP is a major tool for reaching the EQOs related to agriculture. Under the EQOs some interim targets to 2010 have been established to guide programmes and initiatives compared to a baseline for the year 2000 [2]. Sometimes there are no specific interim targets in the EQOs. However, the ERDP often includes quantitative targets that are based on the EQOs in addition to other targets such as the proportion of organic farming. The EQO targets for agricultural biodiversity and landscape conservation include preservation of all pasture and more specifically an increase of: the area of traditionally managed meadow land by at least 5 000 hectares (ha); endangered pasture by 13 000 ha; the number of landscape features (*e.g.* ponds, ditches, hedges) which should increase by 70%; and the restoration/ establishment of 12 000 ha of wetlands. Within the ERDP targets by 2006 are for sustainable farming practices to be applied to 450 000 ha of semi-natural pasture and meadows, and 600 000 ha of ley farming maintained to create a varied landscape in woodland areas

EQOs interim targets for reducing water and air pollution are that by 2010 compared to 1995 levels there should be: a continuous reduction of pesticide risks; a 30% reduction of nitrogen emissions into marine waters; a 20% reduction of waterborne losses of phosphorus compounds from human activities; and a 15% reduction in ammonia emissions. There has been no specification of agriculture´s share in these nutrient targets. Agricultural water pollution is addressed within the ERDP by planning to increase by 2006: riparian bufferzones to 5 500 ha; EQO catch crops and spring tillage to 50 000 ha and wetlands to 6 000 ha. For ***organic farming*** the objective by the Parliament was to increase the area to 20% of total arable land by 2005 and for 10% of dairy cows, slaughtered cattle and lambs to be organically produced. New targets were established in 2006 to expand certified organic farming by 2010 to 20% of the total agriculture land area and sharply increase production of certified milk, egg, beef, pork and poultry meat.

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There are no severe problems with soil erosion or deterioration in soil quality, except in some very limited areas. Soil erosion by water is a marginal issue around Lake Siljan and northern river valleys, and wind erosion may occur in limited parts of south and southwestern Sweden [10, 20, 21]. There is, however, concern with soil compaction, estimated to bring about harvest losses of 5-10% [21], although some research suggests a low risk of subsoil compaction in soils [22].

Pressure from agricultural water pollutants has been reduced since 1990, but is as yet insufficient to meet domestic and international commitments to combat water pollution [2, 23, 24]. Despite the contraction of the farm sector over the past 15 years it remains the main anthropogenic source of nutrient discharge into water [25], partly because of the more rapid reduction in nutrient discharges from other sources. For example about 95% of municipal and industrial waste water treatment plants remove nutrients from their effluent [2, 26]. Concerning pesticides, while concentrations in streams remain low, they are harmful to some aquatic habitats in areas that are intensively farmed [2].

The reduction in agricultural nutrient surpluses (input minus output of nutrients; nitrogen and phosphorus) over the period 1990-92 to 2002-04 was most marked (in absolute terms) for phosphorus (–67%) compared to nitrogen (–21%), with surpluses per hectare of agricultural land considerably lower than the EU15 and OECD average levels (Figure 3.26.2). Much of the reduction in surpluses has been a result of: a decrease in inorganic fertiliser use, especially phosphorus relative to nitrogen; lower use of sewage sludge [27]; and reduced animal numbers (*i.e.* less manure). At the same time the uptake of nutrients by crops and pasture showed only a small decrease. As a result of these changes there has been a marked improvement in P use efficiency (*i.e.* ratio of P output to P input), with Sweden now having one of the highest levels of P use efficiency across OECD countries with also, but to a lesser extent, an improvement in N use efficiency. Even so, the amount of P stored in arable soils has not diminished [2], as many soils have accumulated phosphorus [26, 28], although there are considerable uncertainties about the transport of P through soils into water [23].

Nitrogen loading from arable land declined by over 7 000 tonnes between 1995 and 2003. This was largely due to: a reduction in the arable area; improved N efficiency; ERDP measures, such as the use of catch crops, the delay of tillage until spring, and legislative measures, for example, manure spreading in spring instead of autumn [12, 15, 29]. About 60% of farmland was under a nutrient management plan (NMP) in the period 2002-04, while in 2000/01 about 90% of dairy and pig farms had storage capacity for manure of more than 7 months [30]. NMPs are included in voluntary environmental schemes as Integrated Production schemes or among farmers taking part in the campaign *Focus on Nutrients* [16]. The nitrogen and cadmium fertiliser taxes have had a modest impact in lowering nitrogen fertiliser use [2, 24], although without the tax it is estimated that nitrogen fertiliser use would have been 10% higher [23].

Despite lower nitrogen loading and farm nutrient surpluses it is difficult to discern a reduction in water pollution, although there are some reports of improvement [12, 27, 31]. By 2000 excess agricultural nitrogen and phosphorus accounted for almost 50% and 25% respectively of anthropogenic pollution in surface waters, and about 49% and 46 % for N and P in coastal waters (*i.e.* the West Sea, the Baltic and the Gulf of Bothnia) [1, 26]. In 2000 none of the monitoring points in watersheds had nitrates in excess of drinking water standards for surface and groundwater. In certain monitoring points within sensitive areas nitrate levels above 50 mg/l have been measured, but overall the levels of nitrate in groundwater declined for a number of monitoring points between 1996 to 2002. Retention of nitrates in groundwater is probably low because of the drainage systems used on most arable land and the underlying geology [29]. Also more than 6% of lakes in agricultural areas exceeded the environmental threshold value for eutrophication [2, 10], especially in intensively farmed areas [32]. Moreover, losses of nutrients from the root zones in arable areas declined between 1995 and 2003 (Figure 3.26.3). Between 1995 and 2000 agricultural N and P discharges into the Baltic declined by 13% and 19% respectively, compared to respective figures of 25% and 11% from other sources [2]. The sharp reduction in sewage sludge used on farmland, from around 100 000 to 20 000 tonnes from 1987 to 2003, plus lowering the cadmium content in phosphorus fertilisers, has led to a substantial reduction in cadmium inputs to water [1, 2].

There has been a reduction in farm use of pesticides and associated environmental risks, during the period from 1990 to 2004 [12, 33]. The reduction in pesticide use (active ingredients) of 3% between 1990-92 and 2001-03 was close to the EU15 and OECD averages over this period (Figure 3.26.2). While overall pesticide use has declined since 1990, from the mid-1990s to 2004 there was a slight increase, although the intensity of use per hectare remained largely unchanged [1, 34]. The rise in pesticide use was mainly due to the growing use of herbicides (glyphosate) with the reduction in tillage and greater green cover over winter to help reduce nitrogen leaching and soil erosion [2]. However, the sharp rise in pesticide sales in 2003 resulted from stockpiling in anticipation of an increase in the pesticide tax by 50% at the beginning of 2004. Subsequently there was a large drop in pesticide sales in 2004, before it returned to trend levels in 2005 [34].

The Swedish National Chemicals Inspectorate pesticide risk indicators estimate a marked decrease in environmental risk (terrestrial and aquatic ecotoxicity) of 35% between 1988 to 2004, and an even larger reduction of 70% for farm operator health risks [13, 33]. The main reasons for the reduction in pesticide risk have been associated with: targeted information and advisory efforts; regulation of some problematic pesticides; improved product development; the impact of the pesticide tax [24, 33]; the obligation for all farm workers to undergo training to become certified pesticide users [2]; and an increase in the area farmed on which pesticides are not applied, including organic farms [10].

Systematic national monitoring of pesticides in water began in 2002 and only limited results are available. However, since 1992 data have been collected for Vemmenhög in southern Sweden, where pesticide concentration in surface water declined by over 90% by 2004 [10, 35]. However, pesticide levels high enough to cause concern have been reported for 9% of municipal wells (*e.g.* Gotland, Uppsala). However, concentrations of some persistent pesticide pollutants (*e.g.* DDT) in fish and other aquatic species continued to fall over the 1990s, although DDT has been banned in Sweden since the 1970s [2].

Ammonia emissions from agriculture declined between 1995 and 2001-03 at a greater rate than the EU15 and OECD averages (Figure 3.26.2). Farming accounts for 84% (2001-03) of ammonia emissions, with over 90% of emissions coming from livestock manure and the remainder from fertiliser use [1]. Between 1995 and 2001-03 around half the reduction in ammonia emissions resulted from improved manure management, with the rest mainly due to lower pig and dairy cow numbers [2]. Sweden achieved the 2010 target for total ammonia emissions under the *Gothenburg Protocol* by 2001-03, but requires a further cut

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of 2% to meet the national EQO 2010 target [12]. The reduction of agricultural ammonia emissions has contributed to an overall decline in acidifying pollutants, easing pressure on ecosystems sensitive to excess acidity [12].

Agricultural greenhouse gas (GHG) emissions declined, by 6% compared to over 3% from all sources across the country over the period 1990-92 to 2002-04. Under the EU *Burden Sharing Agreement* to meet the *Kyoto Protocol* commitment allows Sweden to increase GHG emissions by 4% up to 2008-12 compared to 1990 levels [19]. Farming now contributes around 12% of total GHG emissions, due to emissions of methane and nitrous oxide [19]. The main reasons for the steady decline in agricultural GHGs are linked to lower livestock numbers, reduced use of fertilisers and a decrease in spreading livestock manure [19]. Projections indicate a further reduction in agricultural GHGs up to 2010, which is likely to be influenced by the reforms of the EU CAP leading to an expected reduction in livestock numbers up to 2010 [19]. ***Carbon sequestration in agricultural soils*** has the potential to reduce GHG emissions, and while most agricultural soils are close to a steady state in terms of soil organic carbon, about 10% of arable soils are estimated to lose around 1 million tonnes of carbon (or 3.8 million tonnes of CO_2) annually [36].

Direct on-farm energy consumption decreased by 15% compared to an increase of 10% across the economy over the period 1990-92 to 2002-04, with agriculture accounting for 2% of total energy consumption (2002-04) [37]. Sweden is one of the largest ethanol fuel producers in the EU, with grain as the main source of feedstock for ethanol production, although domestic production only provides about a quarter of total consumption. The use of biofuels in transport fuels has risen to 2% by 2004 (in terms of energy content), with the government target of 3% by 2005 [19]. According to the *Swedish Environmental Protection Agency*, cereal-based ethanol production is not the lowest-cost means of reducing GHG emissions compared with some other feedstocks [19].

The impact of agriculture development on biodiversity has been harmful in many ways, but there are some positive signs that the pressure could be easing [8]. Trends in the diversity of ***agricultural genetic resources***, despite limited information, suggest that many domestic crop varieties and livestock breeds have disappeared, but recently established conservation programmes are seeking to reverse the trend [12, 38]. National *ex situ* collections of plant (in the Nordic Gene Bank) and animal genetic material have been assembled, and there are also some regional collections [12, 38]. Most livestock breeds and some crop varieties used in production have increased in diversity, but declined for pulses, root crops and forage plants. While over 20 livestock breeds were endangered in 2002 and *in situ* conservation was being considered for their conservation [12], it is unclear whether they are included under conservation programmes to date [10].

About 20% of the wild species associated with agricultural landscapes are threatened with extinction [2, 8, 12]. More than half of the threatened species of mammals, birds and several groups of insects and almost 90% of threatened vascular plants are associated with agricultural landscapes [21]. For common farmland birds (*e.g.* Skylark – *Alauda arvensis*, Starling – *Sturnus vulgaris*, Yellow Hammer – *Emberiza citrinella*, and Curlew – *Numenius arquatus*), populations have been halved or more since 1975, with reductions continuing up to 2004, such that many farmland birds are endangered [12].

Loss of agricultural habitat, deterioration in habitat quality and changes in farming practices, are key reasons for the continued reduction in the abundance and richness of wild species populations associated with farming [7, 38]. The greatest variety of species linked to farming are found in ***meadows and open or wooded pasture*** [8]. The area of semi-natural grassland, that is unfertilised meadows and pastures, has decreased substantially. Data between 1990-92 and 2002-04 show a decrease of 12 %. Due to different sources and definitions, the data are not fully comparable but from the mid-1990s when Sweden joined the EU the downward trend was reversed and the pasture area increased. The utilised area of pasture in 2005 was about half a million hectares. This was a result of the introduction of various forms of support, primarily livestock aid and agri-environmental payments to improve environmental management of pastures [2, 7, 12]. Wild species diversity has been reduced in meadows and pastures because of insufficient or discontinued grazing [7, 8]. Swedish research has shown that low-intensity grazing maintains a varied vegetation structure in semi-natural pasture which is highly favourable for maintaining some species (*e.g.* waders in coastal meadows, and certain vascular plant species) [39, 40, 41].

Small-scale habitats on farmland (e.g. field boundaries) are also declining [12], which is causing concern given their importance as a habitat for flora and fauna [42, 43, 44]. For ***wetlands***, however, agri-environmental payments are encouraging their restoration and creation on agricultural land, and between 2000 and 2005 the total area of wetlands restored and created grew from less than 500ha to over 4 500 ha [12].

There are signs that adverse impacts on culturally significant farmed landscapes are being halted, although progress varies regionally [2, 12]. This development is largely explained by the increasing number (or extent) of agricultural landscape features covered by agri-environmental schemes, by 2005 over 40% for point features (*e.g.* cairns, pollards) and almost 70% for linear features (*e.g.* hedges, stone walls) [12] (Figure 3.26.4). A survey of nearly 7000 farm buildings of cultural heritage value in 2003 showed that nearly 20% were derelict or in need of maintenance [13]. A programme introduced in 2005 is seeking to conserve farm buildings of heritage value by providing payments to farmers [12].

3.26.3. Overall agri-environmental performance

Overall agricultural pressure on the environment has diminished since 1990. The intensity of production has been reduced with environmental pressure largely decoupled from changes in farm production. The pressure on the environment has been lowered because of a growing trend towards the extensification of agriculture and measures used such as agri-environment schemes. Despite these improvements in agri-environmental performance, problems of water pollution from nutrients persist and farming remains the main source of nutrient pollution of water and ammonia emissions. Changes in farming structures and practices continue to harm biodiversity and culturally significant agricultural landscapes, although there are signs that these adverse impacts are being halted, especially for biodiversity as a result of the increasing area of semi-natural pastures under agri-environment schemes.

An increasing effort is being made to measure the environmental performance of agriculture. The Swedish Environmental Objectives Council annually updates some 100 environmental indicators, many linked to agriculture to track progress towards the national environmental quality objectives [12, 13, 14]. Further work is now underway to link these indicators with the system of national environmental accounts [2]. But detailed monitoring of biodiversity and cultural landscapes related to agriculture is an area requiring further improvement to help better evaluate recently introduced agri-environmental measures. Moreover, national monitoring of pesticides in water has only just begun [2, 7].

Progress by agriculture towards national environmental quality objective (EQO) targets has been variable [12]. It is unlikely that the EQO to reduce nutrient pollution of water and air (covering all sources of pollution, including agriculture) will be met by 2010. However, agricultural nitrogen and phosphorus surpluses (in tonnes) fell by about 20% and 70% respectively between 1995 and 2004. Nitrogen leaching from the root zone of arable land declined by some 7 000 tonnes between 1995 and 2003, which is close to the 2010 target for agriculture under the *Action Programme for Reducing Plant Nutrient Losses* (Figure 3.26.3). The EQO targets for N and P pollution of surface and coastal waters cannot easily be correlated with changes in nutrient surpluses [12, 29]. Progress has been made in lowering environmental and health risks associated with pesticide use. Sweden met the 2010 target for ammonia emissions under the *Gothenburg Protocol* by 2001-03, and only requires a cut of 2% to meet the EQO 2010 target to reduce emissions by 15% from 1995 levels. The *Swedish Environmental Objectives Council* consider that further reductions in ammonia and other acidifying emissions are necessary if critical loads for acidification are to be met [12].

For agricultural biodiversity and cultural agricultural landscape EQOs the situation is improving, but it is difficult to assess the quality of this improvement with any precision [12]. Areas of pasture, meadows and cultural features on arable land under agri-environmental schemes have all increased since around 2000 (Figure 3.26.4). At the present rate of progress in establishing and restoring ***wetlands*** it is likely that only 8 400 ha will have been restored/ established by 2010, compared to the government EQO target of at least 12 000 ha [2, 12].

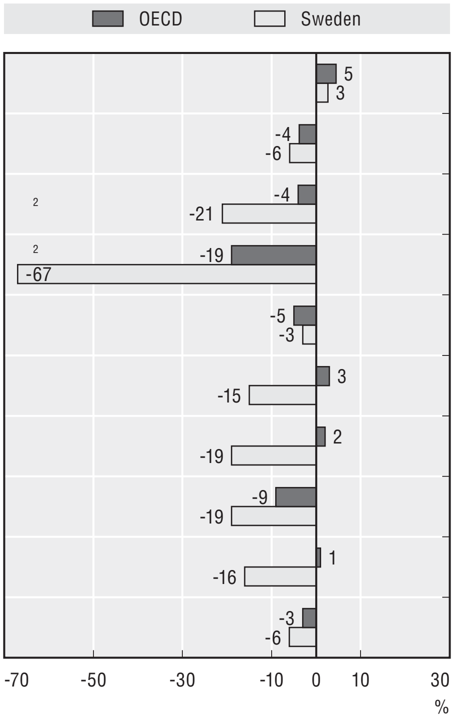
The EQO targets for organic farming have shown mixed results, with 19% of arable land under organic management by 2005 (compared to a target of 20%). The targets for organic beef and lamb production were met by 2005, but not for organic dairy. Even so, the number of certified organic farms has more than doubled between 1990 and 2004, while the area under certified organic farming rose from under 1% to around 6% of the total agricultural land area over the period 1993-95 to 2002-04 [1, 45].

Trends in the environmental performance of agriculture are encouraging but concerns remain. While about 90% of agricultural land is under some form of agri-environmental scheme [46], the projected structural changes in agriculture, especially the diminishing number of grazing livestock and continued loss of pasture to other uses in marginal areas [19], imply a potential further ***loss of semi-natural habitats***. This could have adverse impacts on flora and fauna [12, 47] and many threatened wild species may need specific action if they are not to become regionally extinct [38]. ***Energy and climate change taxes*** are used widely across the economy to meet environmental objectives, but farmers are provided a concession on these taxes which acts as a disincentive to further limit on-farm energy consumption, improve energy efficiency and reduce GHG emissions [2].

Taxes on fertilisers and pesticides have helped raise awareness among farmers of the environmental costs that use of these inputs entail, while also having an impact in reducing their use [2, 12]. Progress has been made in reducing agricultural nutrient surpluses but further effort will be required to meet the necessary EQOs and the Baltic Sea agreement *(HELCOM Convention)* to reduce eutrophication, especially for nitrogen, since much of the reduction in urban and industrial nitrogen pollution has already been achieved [2, 24]. For phosphorus (P) despite the large reduction in agricultural P surpluses, given the specific problems and uncertainty of the science related to P transport through the environment, more research and development and a long-term strategy will be required to reduce agricultural P pollution, especially with regard to contamination of the Baltic Sea [26].

Figure 3.26.2. **National agri-environmental performance compared to the OECD average**

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



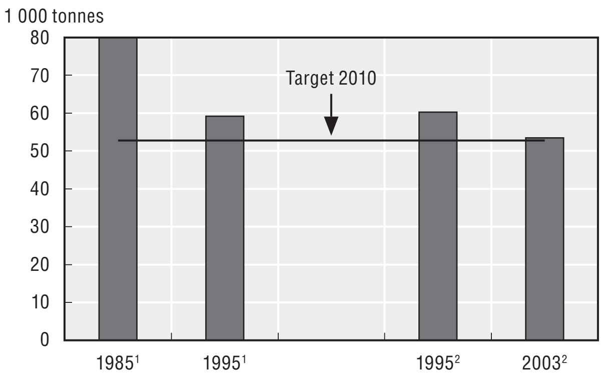
Absolute and economy-wide change/level

Variable	Unit		Sweden	OECD
Agricultural production volume	Index (1999-01 = 100)	1990-92 to 2002-04	103	105
Agricultural land area	000 hectares	1990-92 to 2002-04	–200	–48 901
Agricultural nitrogen (N) balance	Kg N/hectare	2002-04	48	74
Agricultural phosphorus (P) balance	Kg P/hectare	2002-04	2	10
Agricultural pesticide use	Tonnes	1990-92 to 2001-03	–53	–46 762
Direct on-farm energy consumption	000 tonnes of oil equivalent	1990-92 to 2002-04	–99	+1 997
Agricultural water use	Million m^3	1990-92 to 2001-03	–32	+8 102
Irrigation water application rates	Megalitres/ha of irrigated land	2001-03	1.7	8.4
Agricultural ammonia emissions	000 tonnes	1990-92 to 2001-03	–9	+115
Agricultural greenhouse gas emissions	000 tonnes CO_2 equivalent	1990-92 to 2002-04	–564	–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*.

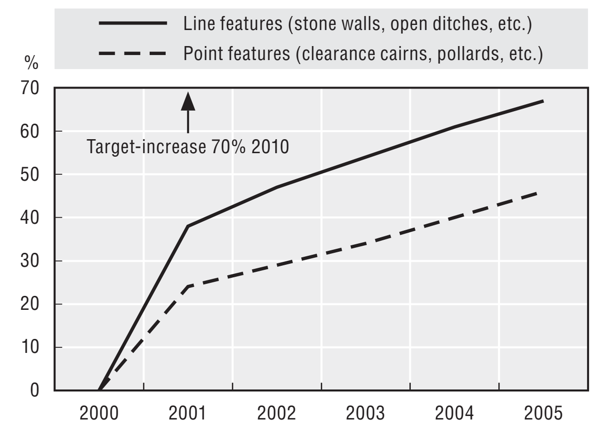
Figure 3.26.3. **Losses of nutrients from arable areas and the root zone**



1. Earlier model calculation, Environment Protection Agency (EPA), Report 4735, 1997; Report 5248, 2002.
2. Modified model calculation from H. Johnson and K. Martensson, EPA Report 5248.

Figure 3.26.4. **Cultural features on arable land**

Percentage change in number or extent of landscape features covered by agri-environment scheme



Source: Environmental Objectives Portal.

StatLink http://dx.doi.org/10.1787/301135522822

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