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Integration of environment into EU agriculture policy — the IRENA indicator-based assessment report

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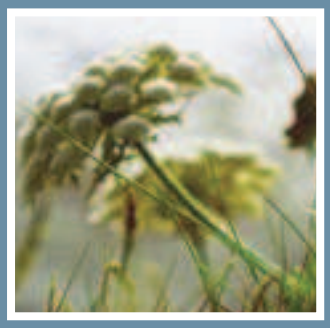

European Environment Agency

Integration of environment into EU agriculture policy — the IRENA indicator-based assessment report

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1 Introduction: background and purpose

1.1 Purpose and approach of the report

This report aims to provide a fair reflection of the progress, the achievements and obstacles in the integration of environmental concerns into EU agriculture policy, based on indicators developed in the IRENA operation (see Section 1.3). It also tackles limitations to successful policy implementation at Member State level, and challenges ahead. Policy examples from some Member States aim to show good practice in agri-environmental policy implementation or design. Due to the scope of the IRENA operation the analysis focuses on the EU-15 Member States.

Assessing progress of environmental integration in any policy field is a challenging task. Progress depends not only on institutional structures and processes, or on the importance of environmental issues to policy making in a given policy area. It is also influenced by factors outside immediate policy influence, such as market trends, technological developments, international trade issues and interactions with other sectors. It is beyond the scope of this report to provide a full analysis of all relevant factors. However, it is essential to set out the wider framework within which agricultural policy operates.

There are different possibilities for analysing policy integration, ranging from an in-depth investigation of policy processes in the social science research tradition, or analytical approaches based on a set of integration criteria, to a pragmatic analysis of the targeting of policy instruments on the environmental issues to be addressed in a given sector. This report follows the latter approach as the results of agri-environment indicator work under the IRENA operation provide a good basis for attempting to look at the environmental targeting of agricultural policy instruments in the EU. In addition to the targeting analysis, the report also evaluates the usefulness of the currently available information framework itself for assessing policy integration.

In developing the report the aim is to link the analysis to the integration strategy endorsed by the Agriculture Council and other EU policy documents that are relevant to the policy integration debate, such as the EU Sustainable Development Strategy. Work of the OECD on agri-environment policies has informed the approach, as have discussions with members of the IRENA steering group and EEA staff. The starting point for analysis was the 35 IRENA indicators that form the backbone of the report, also in the policy response domain. However, EU agriculture policy has developed considerably since the publication of the Commission Communications on indicators. This has made it necessary to add some indicators and information to fully reflect the evolved common agricultural policy (CAP) framework.

The report builds on a combination of:

- Outlines of the external and internal drivers behind agricultural trends, partly derived from IRENA indicator fact sheets (Chapter 2);
- The identification of the key agri-environmental issues at stake in different regions of the EU and at Community level, based on the comprehensive indicator analysis carried out in the IRENA indicator report (Chapter 3);
- A review of the EU agri-environmental policy framework and its implementation in Member States (Chapter 4);
- An analysis of the targeting of agri-environmental policy instruments to environmental issues described by IRENA indicators (Chapter 5); this chapter applies the analytical framework to two key environmental issues: minimising nutrient pollution risk and the conservation of farmland biodiversity;
- An assessment of the usefulness of the agri-environmental information system developed under IRENA for analysing policy integration (Chapter 6).

Where results stem from the analysis of agri-environmental indicators, a clear reference is made to the specific indicator used. Thus, the reference 'IRENA No. n ' indicates 'agri-environmental indicator number n' (see list of IRENA indicators in Annex 1).

Similar to the timeframe taken for the development of agri-environmental indicators under IRENA the starting point for analysis in this report is 1990. This spans a key period in the evolution of the CAP from before the MacSharry reform in 1992 to the 1999 ('Agenda 2000') and 2003 CAP reforms.

1.2 The policy context of integration

The European Council at Cardiff (June 1998) endorsed the principle that major policy proposals by the Commission should be accompanied by an appraisal of their environmental impact and it invited all relevant formations of the Council to establish their own strategies for giving effect to environmental integration and sustainable development within their respective policy areas. This marked the beginning of the so-called Cardiff process.

The European Council in Helsinki (December 1999), adopted the strategy for integrating the environmental dimension into the CAP. The policy instruments are those of the CAP as shaped by Agenda 2000. The Integration Strategy stresses the key role of Member States in implementing the integration measures and asks for the development of appropriate agri-environmental indicators to monitor such integration. The integration requirement refers to the introduction of measures seeking environmental protection in agriculture policy itself, to complement the 'traditional' approach of environmental regulation. It implies an active pursuit of coherence and complementarity between agriculture and environment policies, which have, however, their own separate and legitimate objectives.

In response to this, the Commission issued two communications related to environmental integration in agricultural policy and the development of agri-environmental indicators. These are COM (2000) 20, which defines the objectives for monitoring the integration process and identifies a set of 35 agri-environmental indicators, and COM (2001) 144, which identifies concepts and potential data sources and describes further necessary work.

1.3 The IRENA operation

The IRENA operation (Indicator Reporting on the Integration of Environmental Concerns into Agriculture Policy) is a joint exercise between several Commission Directorates-General (DG Agriculture and Rural Development, DG Environment, DG Eurostat and DG Joint Research Centre) and the European Environment Agency (EEA). Its main purpose was to develop agri-environmental indicators for monitoring the integration of environmental concerns into agriculture policy in the European Union (EU-15). IRENA follows the two Commission communications mentioned above.

The IRENA process foresees the following project outputs:

- 35 agri-environmental indicators supported by data sets at NUTS 2/3 level (where data is available) and classified according the DPSIR model (Driving force — Pressure — State — Impact — Response);
- an *indicator report* ('Agriculture and environment in EU-15 — the IRENA indicator report') providing an integrated environmental analysis of EU-15 agriculture based on those 35 agri-environmental indicators as well as an assessment of the progress made in their development and interpretation;
- and an *indicator-based* assessment report on the integration of environmental concerns into agriculture policy (this report).

These reports and internal working documents also include proposals for improving the data and methods for further work on agri-environmental indicators.

This report builds therefore on the 42 (sub-)indicators (see Annex 1) finally produced and the analysis presented in the indicator report in order to identify the essential agri-environmental issues (through the indicators related to 'driving forces', 'pressure', 'state' and 'impact'), and to analyse the targeting of policy responses (through the 'response' indicators related to the 'public policy' dimension).

The indicator fact sheets and supporting databases as well as the indicator report can be found on the IRENA website: http://webpubs.eea.eu.int/content/irena/index.htm.

2 Driving forces for agricultural trends

2.1 Introduction

In order to understand key factors behind the environmental impacts of agriculture, it is necessary to identify the driving forces that influence farming trends. These originate from market trends, technological and social changes as well as the policy framework. In this report these factors are grouped into 'external' and 'internal' driving forces. Factors considered to be external to agriculture include international trade patterns, changes in consumer preferences or trends in the access to production factors, such as land or labour. 'Internal' driving forces are those that act directly at the farm level, such as trends towards specialisation and intensification of agricultural holdings, the changing attitudes of farmers, or the introduction of new technologies, e.g. precision farming. Most of these cannot be discussed comprehensively in this report due to limitations of space and the focus on material arising from the IRENA indicators.

Where the causes of environmental change associated with agriculture are understood, usually they can be traced to changes in farm management and land use. These include the use of new or larger quantities of inputs, changes in the farming practices employed, variations in the numbers, distribution and methods of rearing livestock, and alterations in cropping patterns and landscape features. These direct causes of environmental change may include the cessation of previous farm management practices as well as the adoption of new ones. Some can be isolated individually, as in the case of direct impacts arising from the use of a single pesticide. Others are viewed more conveniently as changes in farming systems or new management approaches. The replacement of mixed crop and livestock systems with specialist arable or livestock farms and the displacement of low input dryland agriculture with more intensive irrigated production are examples of changes in farming systems. Organic farming and integrated production can be seen as examples of new approaches to farming.

Previous analysis (e.g. IEEP, 2002) has shown that it is difficult to distinguish the specific effects of the CAP on the driving forces internal to agriculture (i.e. changes in input use, land use, farm practices, specific regional trends in the agriculture sector) from that of other factors (technological change, change in market demand, other policies, etc). Nevertheless, understanding the influence of different driving forces on agri-environmental dynamics and their interaction with policy is an important step for understanding opportunities for integrating environmental concerns into the CAP and for monitoring progress in this direction.

The following sections describe external and internal driving forces that impact on agriculture. Some of these driving forces are captured by IRENA indicators, while for others no indicator is available.

2.2 External driving forces

2.2.1 Changing trade patterns

As a major importer and exporter of food, the EU and its agriculture sector are strongly influenced by changing international trade patterns. The commitments under the World Trade Organisation (WTO) have resulted in a gradual reduction of border protection in the EU. This has increased the impact that market competition has on the economic decisions of EU farmers and the food sector. In line with the liberalisation of international trade, the EU export support for cereals and dairy products has declined and a reduction is also agreed or expected for further commodities, such as sugar.

International trade discussions have also influenced the EU internal debate on CAP reform. In this context, the gradual decoupling of direct farm support in successive CAP reforms is probably not only a reaction to economic and environmental considerations within the EU, but also a reflection of wider concerns.

Changes in trade patterns arise also from EU internal development, in particular the enlargement process, which has impacts on the operation of the single market and patterns of agricultural

production. Using previous EU enlargements as an example (e.g. the accession of Spain and Portugal in 1986), new patterns of trade have already emerged in such sectors as pig meat, dairy and fruit and vegetables. In the medium to longer term this can cause substantial shifts, positive or negative, in the production patterns in both old and new Member States and hence will impact on the geographical patterns of environmental pressures on agricultural land, including land abandonment.

2.2.2 Consumer and market factors

Consumer trends: the example of organic production

Consumer demands arising from concerns about food quality, animal welfare and the environmental issues in farming are important driving forces in the EU food sector. Consumers' preferences find expression in various ways, foremost in changing shopping patterns but also through political influence on national and regional governments, retailers, food processors and farmers themselves.

The most direct consumer influence is exercised via the shopping basket. The growing use of organic labels and the significant and continuing expansion of consumer demand for organic produce in many European countries (e.g. Rippen, 2004) have undoubtedly influenced farming practices in EU-15 Member States, but only for a minority of producers.

At present there are no indicators that can be used to analyse linkages between the consumer demand for produce meeting some special requirements in terms of quality, hygiene or animal welfare on the one hand and environmental impact on the other. Nevertheless, shifting consumer preferences are a driving force of increasing importance. IRENA No. 7 shows that the area under organic farming is increasing, suggesting farmers are responding to increased consumer demand for organic produce. The area under organic farming in 2002 covered 4.8 million ha in the EU-15 (3.7 % of total UAA), an increase of 112 % compared to 1998. The share of organic farming area in utilised agricultural area (UAA) varies considerably between and within the Member States (Figure 2.1). Most of the centres of organic farming (northern and central EU-15 Member States, parts of Italy) seem to coincide with consumer markets for organic products, which tend to be more developed in these countries (Recke *et al*., 2004).

Apart from price 'premia', the market share of organic products is a very good indicator of market development and consumer willingness to buy organic products (IRENA No. 5.1). The market share of organic food will also be a key factor for the future development of the sector. In 2001, organic production accounted for 2 % of EU-15 total production of milk and beef, but less than 1 % of total production of cereals and potatoes. Income opportunities in organic farming will be the decisive factor for the majority of farmers to convert to or remain in this farming system (IRENA No. 5.2). EU-FADN data for 2001 show that organic farms generate comparable incomes to conventional farms. In particular, returns to family and employed labour are similar, which is significant given the labour intensive character of organic farming.

Influence on national/regional policies

The public exerts pressures on national and regional legislators in relation to, for example, food safety, animal welfare and environmental production standards that can result in standards being set at levels higher than the EU legislative minimum. For instance, national programmes of pesticide level reductions have been introduced in the Netherlands, Denmark and Sweden, and national targets in terms of the area under organic farming are found in half of the EU-15 Member States (IRENA No. 3).

Influence of supermarkets and other retailers

The power of major supermarkets and retailers is perceived as a growing force, not only in determining price and food quality attributes, but also in other spheres. These include compliance with standards related to the environment or animal welfare, and often a preference for purchasing from reliable suppliers working in integrated supply chains. Such forces in combination with other aspects of consumer demand can influence farm enlargement and specialisation, the use of inputs and patterns of land use, as well as basic husbandry decisions, such as the selection of crop types and varieties and the timing and frequency of management operations. There is no relevant IRENA indicator for these issues.

Labelling and quality assurance

Labelling of products is widely used as a means of informing consumers about the environmental conditions under which those products have been produced and can be a useful tool for encouraging environmental standards in agriculture. Labelling is just one aspect of the wider development of the concept of 'quality assurance' in food processing and retailing. Quality assurance can be seen as a potentially powerful tool to encourage producers to

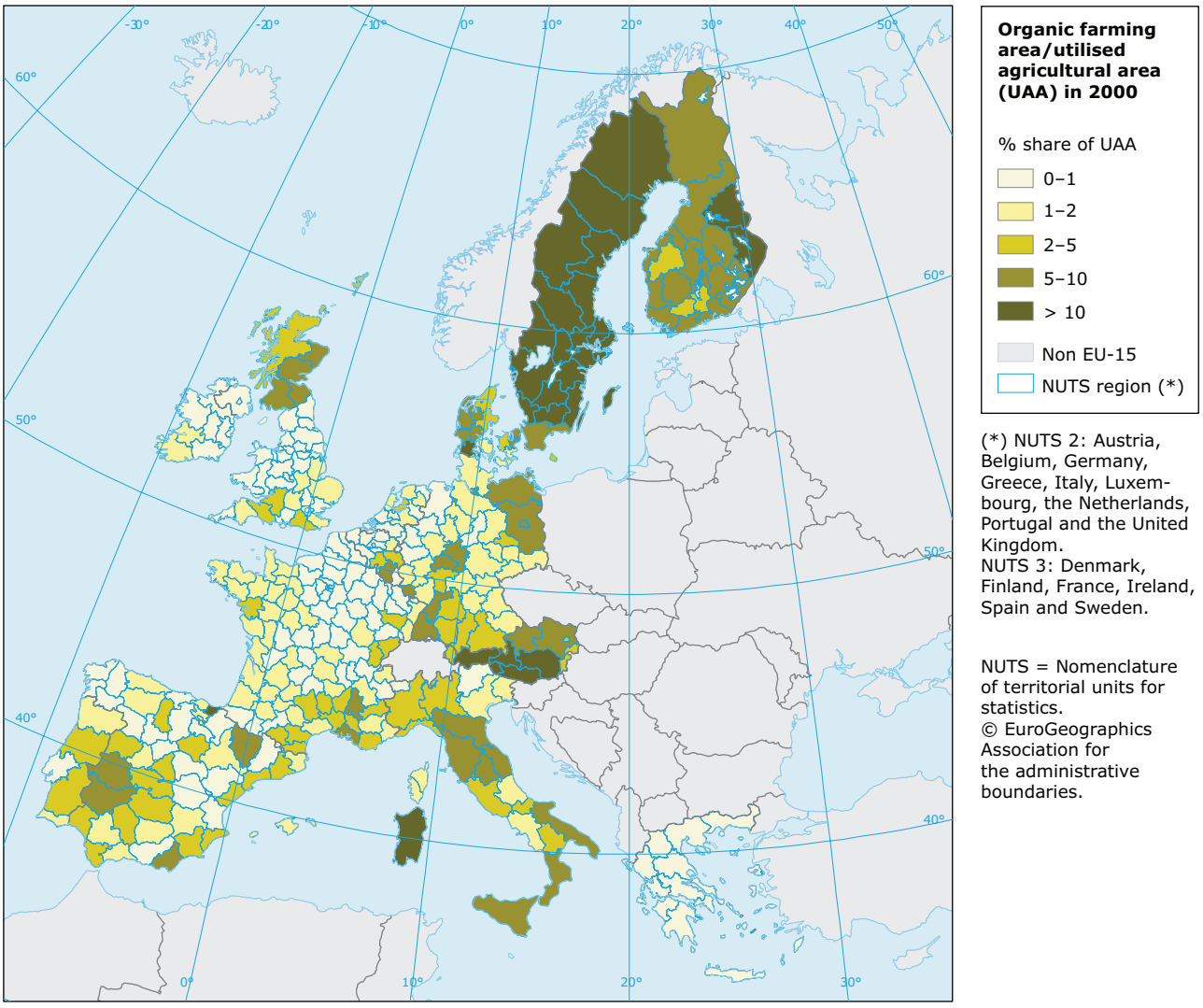
adopt more environmentally beneficial production methods, providing that retailers, processors, and consumers agree that environmental attributes are an important feature of agricultural products.

To date, the vast majority of quality assurance initiatives by the food industry have focused mainly on other aspects of food quality, including storage qualities, appearance and consistency of product as well as safety. However, there are some positive developments with regard to the labelling of products that have particular environmental attributes. These include, for example, labels for integrated crop management or the adoption of biological control methods. This shows a potential to increase the environmental component of quality assurance schemes in future.

2.2.3 *Availability of land for agricultural production*

Agriculture is in competition for land with other economic sectors and with alternative uses of social interest. The surface area devoted to agriculture is shrinking gradually in Europe, mainly due to urbanisation and afforestation. IRENA No. 12 shows that the change in land use area as a percentage of agricultural area ranged from 0.3 % (France) ([1]) to

Figure 2.1 Regional map showing the share of organic farming area in total UAA in 2000



Source: Community survey on the structure of agricultural holdings (FSS), Eurostat (for some Member States this includes also areas not certified under Regulation (EEC) No 2092/91).

([1]) National data show a stronger urbanisation trend in France than detected by CORINE land cover, which is the source used for this indicator.

2.9 % (the Netherlands) between 1990 and 2000. In general the highest percentage of agricultural land converted to artificial surfaces over this period occurred in urban regions. Major alternative users of land were industry, services, housing, recreation, and mines and waste dumps. The importance of different land use changes varied between the Member States concerned.

In part, as a result of pressures for land use, the total utilised agricultural area (UAA) in the EU-12 has decreased by 2.5 % (from 115.3 million ha to 112.4 million ha) between 1990 and 2000 (IRENA No. 13).

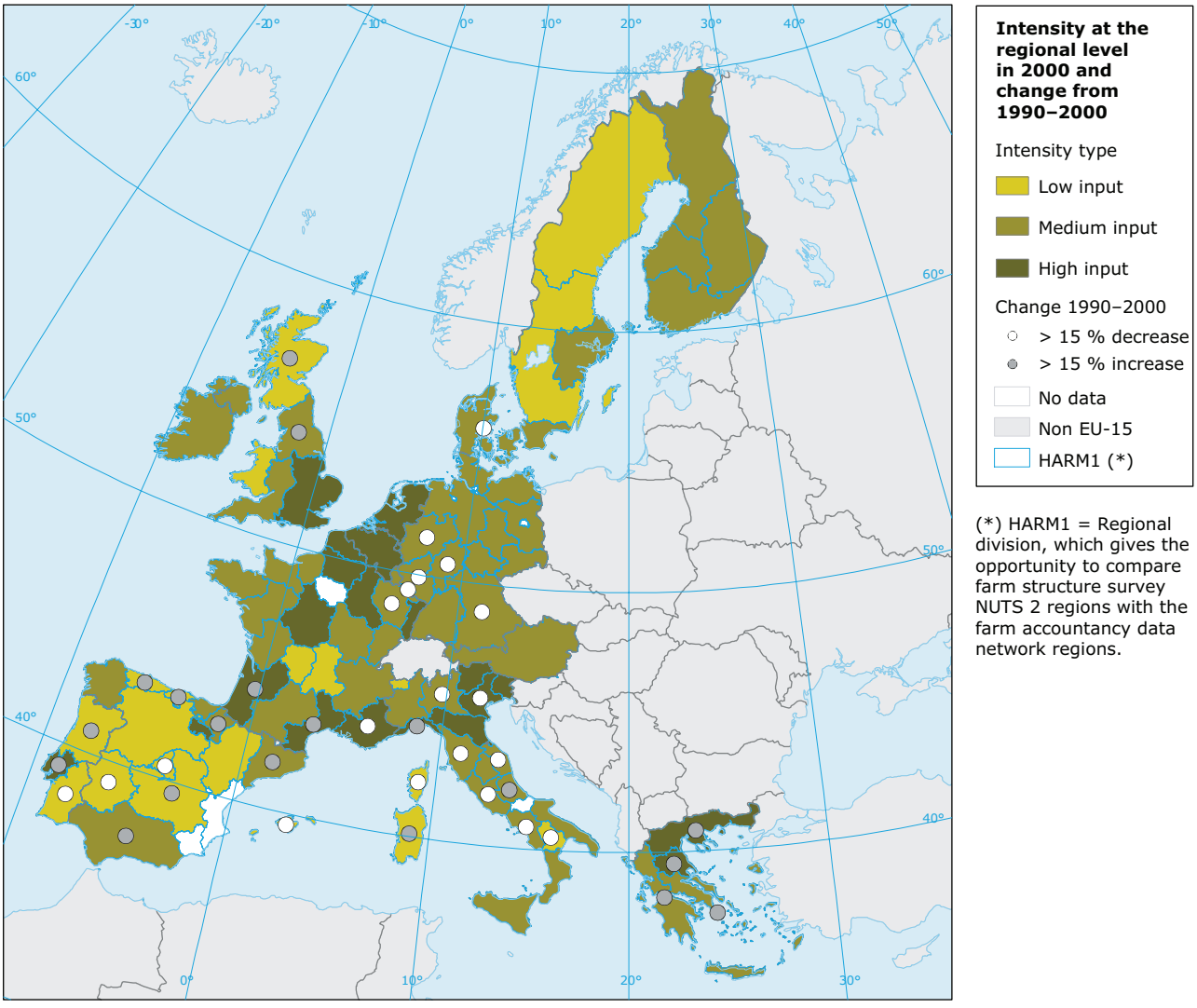
2.3 Internal driving forces

2.3.1 Economic trends in farming

The economics of production, and especially cost-price ratios between inputs and outputs, remain a major driving force and will increasingly do so after the 2003 and 2004 CAP reforms. The general trends in EU-15 agriculture concerning farming systems are captured by several IRENA indicators.

Both intensification and marginalisation (or abandonment) are driven by farmers' economic considerations, in particular the increasing

Figure 2.2 Regional importance of low-input, medium-input and high-input farming and the trend 1990–2000



Note: The low-input regions are the 20 regions with the lowest average expenditure on inputs; high-input regions are the 20 regions with the highest average expenditure on inputs, and medium-input regions constitute the remainder. Information on trends in Finland, Sweden, Austria, and in the New Bundesländer in Germany is not available.

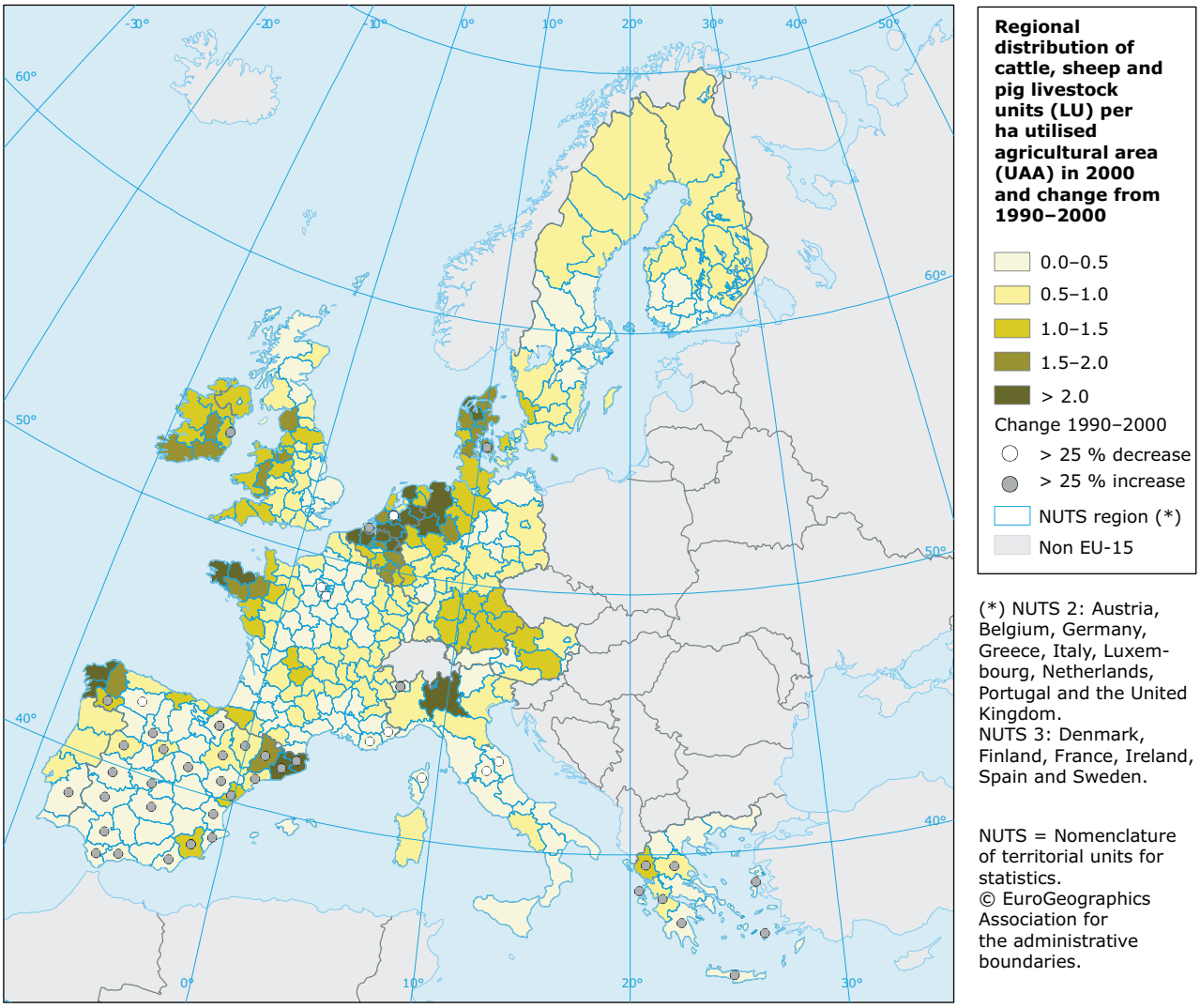
Source: FADN-DG Agriculture and Rural Development, adaptation LEI.

costs of labour. These interact with continuous technological development, allowing for an improved use of inputs, and the development of CAP support. Interpretation of the policy influence on intensification patterns is thus difficult. Given a significant increase in the area under agri-environment schemes it would be desirable to determine the influence this particular policy has on the use of inputs. However, given the different time series and geographical areas covered under IRENA No. 15 (intensification/extensification) and IRENA No. 1 (area under agri-environment support) such an analysis is not possible.

2.3.1.1 Intensification versus extensification

Intensification/extensification (IRENA No. 15) can be measured by different parameters: changes in stocking densities, dairy cow productivity or the yield of selected crops considered in conjunction with the use of external inputs per cropped area. The Community Farm Structure Survey provides time series data on regional livestock numbers. Regional average yields for milk and major crops may be calculated based on FADN data. However, there is only indirect regional information on the use of external inputs per cropped area. Changes in the share of agricultural land managed by farms

Figure 2.3 Regional distribution of cattle, sheep and pig livestock units (LU) per ha of UAA in 2000 and change from 1990–2000



Note: Poultry figures are part of the calculation of national gross nitrogen balances but not included in this graph. Adding poultry production would emphasize some regional livestock hot spots, for example in the Benelux region.

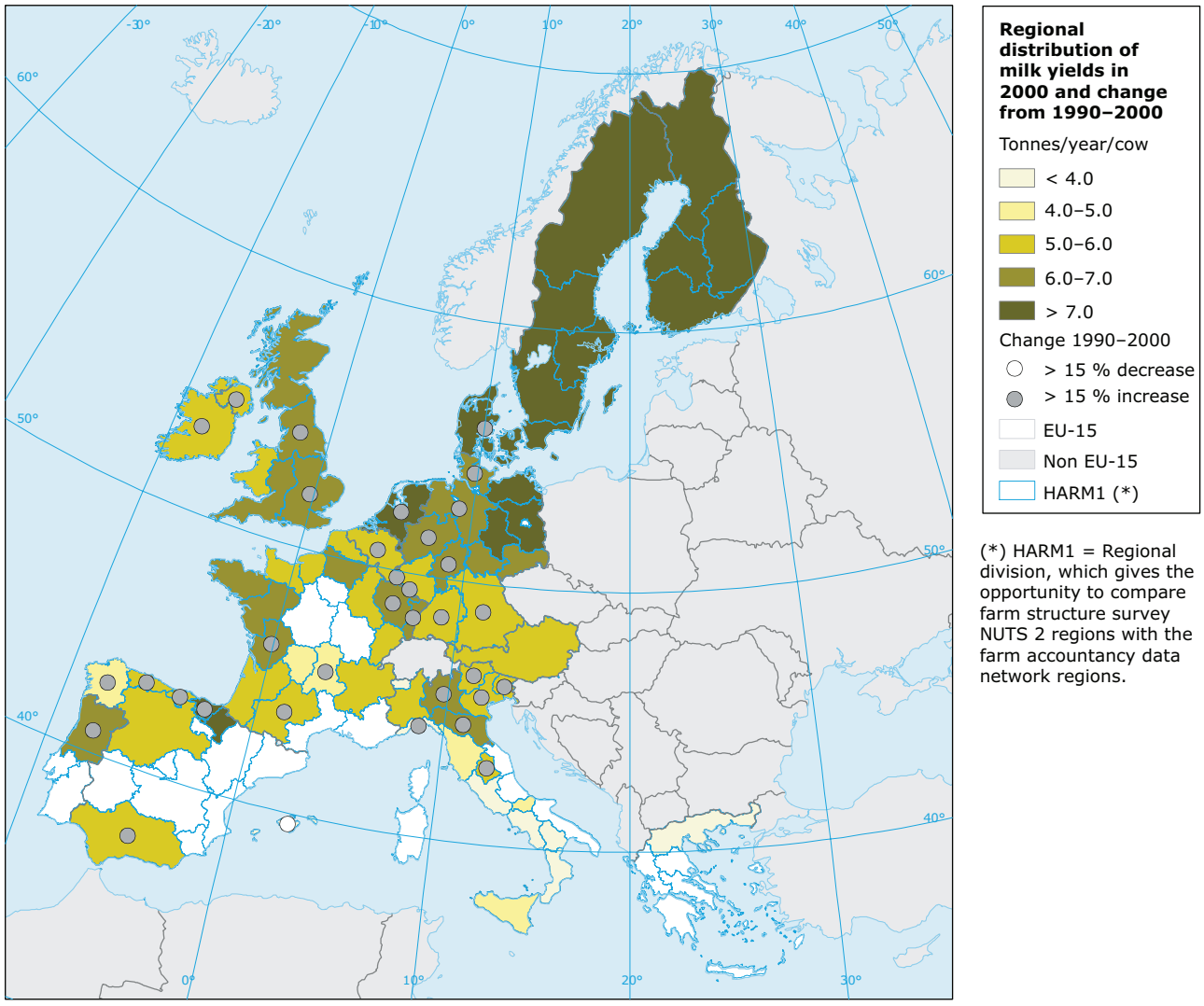
Source: Community survey on the structure of agricultural holdings (FSS), DG Eurostat.

of three intensity levels, according to their average expenditure on farm inputs, stocking rates and yields have been used by IRENA No. 15 as proxy indicators of intensification.

Trends in the use of inputs

Intensification has been the predominant trend in most EU-15 regions for several decades. However, since 1990 there are signs of a trend towards a more efficient use of agricultural inputs. The share of agricultural area managed by farms identified as low and medium-input farm types has increased slightly between 1990 and 2000 across the EU-12. In 1990, low-input farms managed 26 % of the agricultural area across EU-12, and this share increased to 28 % in 2000. Although a high proportion of the agricultural area is still managed by high-input farms, these are decreasing in importance as their share across the EU-12 declined from 44 % in 1990, to 37 % in 2000. As it can be seen in Figure 2.2, low input farms are mainly predominant in Spain, Portugal, central regions of France, Scotland and Sweden. Generally, high input farm types are predominant in the Netherlands, Belgium, South-East United Kingdom, Northern France, Northern Italy and Northern Greece. However, trends of increased use of inputs have also been identified in regions dominated by low input farm types, such as in the Mediterranean area and Scotland.

Figure 2.4 Regional distribution of milk yields in 2000 and change from 1990–2000



(*) HARM1 = Regional division, which gives the opportunity to compare farm structure survey NUTS 2 regions with the farm accountancy data network regions.

Note: Trends can only be shown for FADN regions with at least 15 sample farms. There is little milk production in the northern areas of Finland and Sweden. Results for Sardinia were not included as they seemed to arise from a statistical error.

Source: FADN-DG Agriculture and Rural Development, adaptation LEI.

Trends in stocking densities

The overall livestock stocking density (livestock units per hectare of agricultural land) has been quite stable at EU level and has even gone down for some types of grazing livestock farms. However, in some regions the stocking rates increased by more than 10 % (Figure 2.3). There are regional concentrations of livestock linked to intensive pig and dairy production in the west of Germany, the Netherlands, Belgium, Brittany, northwest and northeast Spain, the Italian Po valley, Denmark, the west of the United Kingdom and southern Ireland.

Cereals and milk yield trends

Additional information on intensification/ extensification trends can be derived from the development of milk and cereal yields. FADN data show that average milk yields for the EU-12 increased by about 14 % between 1990 and 2000. This results from a higher use of protein-rich feed, advances in livestock breeding and more focused herd management. At national level the strongest increases occurred in Portugal, Spain, Germany, Italy, Luxembourg and Greece. Milk production potential in the EU-15 increases from south to north due to natural conditions (length of grazing season, rainfall and temperature patterns). Figure 2.4 provides a picture of the regional distribution of these increases. Increases above 15 % are mainly found in northern Italy, the northwest of Spain and Portugal, mountainous regions of France, Ireland, Belgium, the Netherlands, most of Germany and in Denmark.

Crop yields have also increased. The average increase in the yield of cereals for the EU-12 was 16 % between 1990 and 2000. Yield increases occurred on all types of farms with the strongest growth on farms that specialise in cereal cropping. Improvements in farm management, a targeted and sometimes increased use of inputs, progress in plant breeding and technological advances, e.g. precision drilling, are key factors behind this yield increase. Average cereal yields continue to vary strongly across the EU-15. Average yields of eight or nine tonnes per ha can be seen in favoured arable regions of the United Kingdom, Denmark, Germany or France compared to yields as low as two to three tonnes per ha in the dry interior of the Iberian Peninsula.

The results of IRENA No. 15 point overall to a decrease of input costs and stocking densities coupled with a considerable increase of milk and cereal yields, both of which indicate more efficient farm management. This implies a reduced use of most external inputs but also denser crop and grass stands at the expense of non-agricultural species. The IRENA indicator report provides more in-depth analysis of those trends by types of farm.

2.3.1.2 Marginalisation

The marginalisation of farming areas is a process driven by a combination of social, economic, political and environmental factors. Some rural areas become less attractive in comparison with urban locations as places to work and live. Declining economic viability of farming seriously contributes to this trend. Over time it leads to lack of successors and to eventual abandonment of agricultural land (within farms or as a whole farm), especially in remote rural areas. Marginalisation can have far-reaching effects on the environment by favouring farm abandonment with an associated loss of biodiversity and heritage landscapes. The scale of land abandonment is difficult to assess due to lack of data and the IRENA indicator of marginalisation has a focus on economic and social factors.

IRENA No. 17 refers to a 'double risk' of marginalisation in areas where the proportion of holdings with farmers aged 55 years and over exceeds 40 per cent, and the proportion of holdings with farm net value added per annual work unit below half of the regional average exceeds 40 percent. Data show that marginalisation may occur in Ireland, the south of Portugal, Northern Ireland and large parts of Italy. Marginalisation seems to have increased during the 1990s in Northern Ireland and southern Portugal. FADN data and national information also point to the occurrence of marginalisation in parts of Spain and France. The proportion of holdings with a farmer aged 55 years and over varies largely across the EU-15. The EU average is 34 percent, and the highest share is 52 per cent in Portugal. In 2000, the proportion of holdings with farmers aged 55 years and over exceeded 40 per cent of the holdings in Portugal and Ireland, but also in some regions of Spain, Italy and the United Kingdom. This share has increased during the 1990s in large parts of the EU-15.

2.3.1.3 Specialisation versus diversification

Specialisation

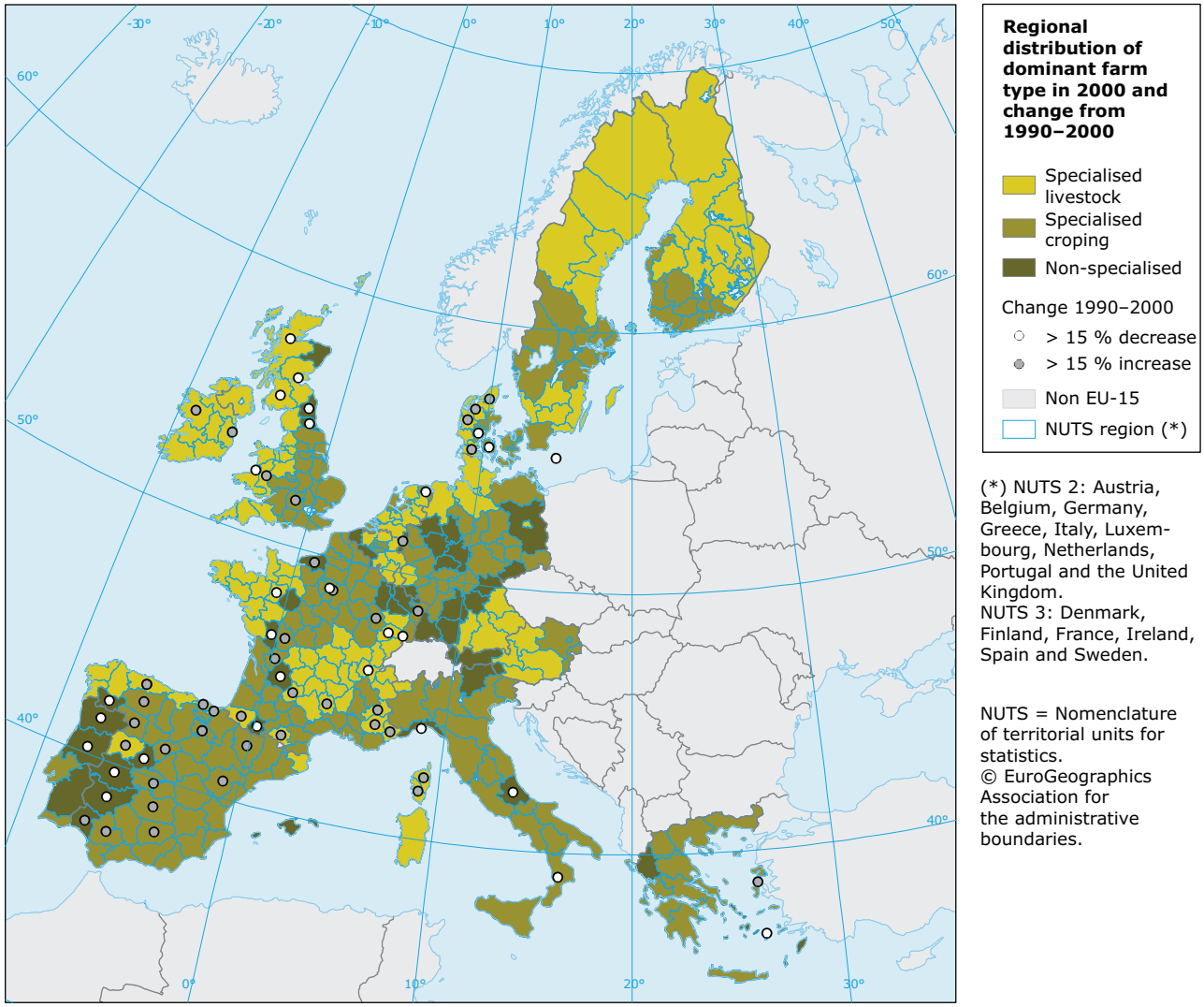
At the most general level, choices are made by farm managers in terms of specialisation or diversification of agricultural activities. The main forces behind this choice are economic efficiency and changes in market conditions. Specialisation generally leads to a higher production efficiency but may also

result in negative environmental effects. This is the case when it results in specialised, homogenous cropping or livestock patterns that eventually lead to a loss of diversity in farmland habitats, crop varieties and animal breeds. Serious environmental implications can arise from the cumulative impact of such decisions over large areas. However, some specialised farming systems are linked to special agricultural landscapes as, for example, extensive livestock farming in mountainous areas.

IRENA No.16 shows a strong trend towards specialisation during 1990–2000. The share of the agricultural area in EU-12 managed by specialised farms has increased by 4 %, whereas the area managed by non-specialised farms decreased by 18 %. The largest percentage change occurred on 'non-specialised livestock' farms, which declined by about 25 %.

At regional level, the changes mainly affect the regions in which non-specialised farm types were prevalent in 1990 (see Figure 2.5). Large decreases in the share of the agricultural area managed by non-specialised types are found in regions of Italy, Greece and Portugal. In this process some high

Figure 2.5 Regional distribution of dominant farm types by specialisation (2) and the trend 1990–2000 (3)



Source: Community survey on the structure of agricultural holdings (FSS), Eurostat.

(2) 'Non-specialised' includes non-specialised livestock, non-specialised cropping and non-specialised cropping/livestock.
(3) Information on trends in the regions of Finland, Sweden, Austria and Germany is not available.

quality agricultural habitats and landscapes that are associated with the remaining traditional, non-specialised systems could be lost.

Diversification

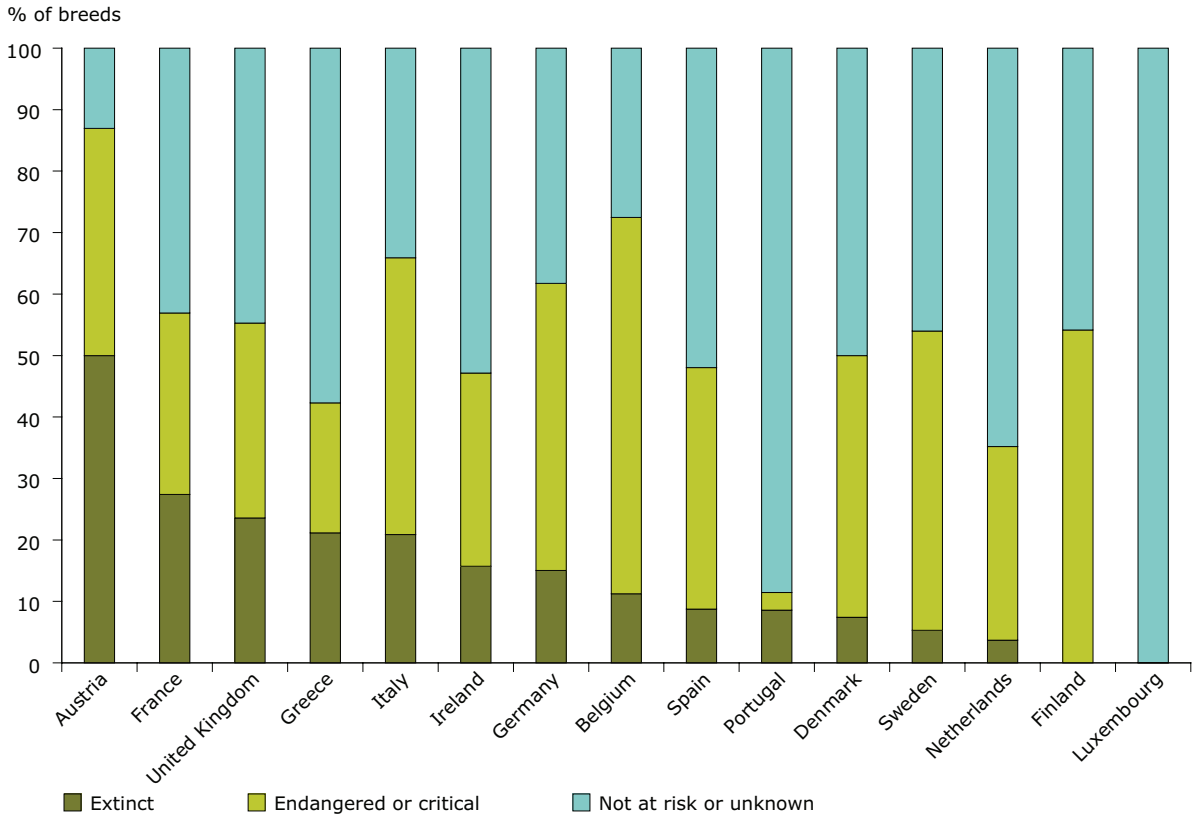
Diversification of farms not only refers to a widening of agricultural and non-agricultural activities on the farm, but also to off-farm income generation (e.g. a part-time labour) by farmers and/or family members. Diversification is usually driven by the need to provide a higher or more secure income and may indirectly prevent farmland abandonment, which is usually considered environmentally undesirable. However, few data are available to monitor changes in farm diversification.

The share of agri-environment payments in gross farm income can be used to assess to what extent farms are diversified towards delivering environmental services (IRENA No. 16). The importance of these payments as a new source of income for farmers has increased since the early 1990s. The share of agri-environmental payments in farm income depends *inter alia* on opportunities offered to farmers for joining agri-environment schemes under national rural development policies. Such income currently accounts for about 3 % of total income for specialised cropping farms and 6.5 % for specialised livestock farms. This may reflect the importance of grassland management as a widely supported agri-environment measure but could also reflect the fact that (extensive) livestock farms find it easier to comply with agri-environment scheme prescriptions.

2.3.1.4 Economic threats to endangered breeds of livestock and to the genetic diversity of crops

According to the data available, close to half of all livestock breeds in the EU-15 are already extinct, endangered or in critical status (IRENA No. 25, genetic diversity). The highest proportion of breeds in these categories is in Austria, and the lowest in Portugal and the Netherlands. Due to their productivity limitations many of these breeds cannot compete successfully with more modern breeds of farm animals that are better adapted to modern high productivity farming systems.

Figure 2.6 Distribution of the endangered risk status of national main livestock breeds (cattle, pig, sheep, goat and poultry) in EU-15



Source: FAO's Domestic Animal Diversity Information System (DAD-IS), status July 2003.

A further development of links between IRENA No. 25 and No. 1, which presents numbers of livestock units of endangered breeds supported under agri-environment programmes, could offer some indication on how this problem is addressed.

The picture is much less clear for agricultural crops (IRENA No. 25). Changes in the diversity of varieties (estimated on the basis of share of seed multiplication area) show a very broad range for different crops. Whereas some crops experience no dramatic decrease in the diversity of varieties, for some others (e.g. oilseed rape) crop production is based upon very few varieties only. Nevertheless, strong differences exist in the described situation between Member States. Overall, there is still a need for better information on local varieties of annual and perennial crops in danger of genetic erosion.

2.3.2 Social trends (attitudes)

It is not only economic factors that determine farm management decisions. Farmers' attitudes are also important, although it is difficult to prove this on the basis of the indicators available. Increasing participation in agri-environment schemes, the growth in organic farming and reductions in fertiliser use may however provide some evidence of the growing awareness by the farming community of the environmental consequences of agricultural practices. These factors may also indicate their acceptance of the importance of the environmental services and values the sector can deliver. Farming is also affected by socio-economic trends in rural areas, such as the availability of non-farm economic opportunities and wider social trends (e.g. higher expectations of leisure time activities or travelling).

Some of the changes in the awareness of farm managers can be attributed to training, although data sets on farmers' training levels presented in IRENA No. 6 are not sufficiently targeted or reliable to draw strong conclusions from. Moreover, in some cases older, less-educated farmers are the ones that still continue traditional agricultural practices important for maintaining biological and landscape diversity.

At European level, 14 % of the total number of training actions co-financed by the EAGGF-Guarantee fund within rural development programmes (2001) was aimed at preparing farmers for the application of production practices compatible with the protection of the environment and the maintenance and enhancement of the landscape (IRENA No. 6). Large variations in the importance attached to agri-environment related training are observed between the Member States. In the Netherlands, Sweden and Italy, agri-environmental management is the most important type of training (around 70 % of the total). In Germany and France around half of the training actions are related to environmental issues. In Spain, Finland, the United Kingdom and Austria, agri-environment training financed through rural development measures is far behind the training related to economic management.

2.3.3 Technological developments

Improved productivity of crops and livestock resulting from plant breeding or from the development of new technologies allowing for more optimal use of feed, water and other inputs may lead to both decreased use of such inputs and more intensive production systems. In some cases certain scale (e.g. field size justifying purchase of new spraying equipment) or production systems (in-house keeping of calves for optimisation of feeding regimes) are needed to allow for utilisation of the new technologies. In other cases new technological developments can be more widely used and help to reduce the use of inputs. Some of the reduction in the use of mineral fertilisers (IRENA No. 8) can be attributed to improvements in application technology. Research by the chemical industry has led to the development of new pesticides with more targeted effects and lesser toxicity to wildlife species. Nevertheless, IRENA No. 9 indicates a considerable increase in the consumption of pesticides (active ingredients) during the period 1992 to 1999, which counteracts the previous trend. The increasing numbers of farms that use conservation tillage systems (IRENA No. 14.2) can serve as another example of how development of knowledge drives changes in agricultural practice.

The development of technology in the private sector is often targeted at intensive production systems. However, an improved knowledge base and new technologies are also being developed to serve the expansion of integrated production, organic farming and other low/reduced input production systems. EU research programmes as well as farm advisory services can provide useful support for such trends.

3 Environmental issues in agriculture

3.1 Introduction

To assess the extent to which environmental concerns are integrated into agriculture policy, it is necessary to understand the environmental pressures and impacts that arise as a result of agricultural activity and its interaction with the environment. The IRENA indicator report provides a broad overview of environmental issues in agriculture on the basis of 42 agri-environmental (sub-)indicators produced. This chapter summarises results of the indicator report with regard to soil, air and climate change, water use and quality, biodiversity and landscape. The issues of water quality and nutrient management as well as biodiversity are reviewed in more detail in the policy analysis carried out in Chapters 4 and 5.

3.2 Environmental issues and agri-environment indicators

The interactions between farming and the environment are distinctive because, unlike other economic activities, farming forms part of an ecosystem rather than being external to it. Farming manipulates the natural environment to produce agricultural commodities through a range of different practices, such as land drainage, tilling of soil, diverting natural water sources, irrigation and applying nutrients and pesticides. These practices impact on soil, air, water, biodiversity and landscapes. Other environmental issues that need increasingly to be taken into account include climate change and waste. The relationship between agriculture and the environment, and the environmental processes that result from that interaction, have been described in (COM (2000) 20 final) 'Indicators for the Integration of Environmental Concerns into the common agricultural policy' (see Table 3.1).

Agriculture exerts pressures on the environment that are both beneficial and harmful and can result in both positive and negative environmental impacts. These impacts determine the overall state of the environment that can be shown to change over time. The wide variation in farming systems and practices throughout Europe, and differing environmental characteristics such as geology, topography and climate, mean that the effects of agriculture on the environment arise at site specific level but can have impacts at local to global level.

The relationship between agriculture and environment can be described by indicator groups that relate to **d**riving forces, **p**ressures, **s**tate, **i**mpact and **r**esponses (the DPSIR framework). This chapter deals with pressure, state and impact indicators, in particular those relevant to the policy response analysis presented in Chapter 4 and 5. More detailed information on the IRENA agri-environment indicators is presented in the related fact sheets and the IRENA indicator report (see the IRENA website: http://webpubs.eea.eu.int/content/irena/index.htm).

There are many key issues of concern regarding agriculture's environmental impacts. Two simple models of adverse impacts arising from 'cycles' of intensification and marginalisation can be used as

Table 3.1 The environmental impact of agriculture and resulting environmental processes

Relationship agriculture-environment	Environmental processes
Pollution of environment	Pollution by nitrates and other nutrients, pesticide residues, salinisation, ammonia and methane emissions/depositions.
Depletion of environmental resources	Inappropriate use of water and soil, destruction of semi-natural and natural land cover and related biodiversity.
Preservation and **enhancement** of the environment	Creation/preservation of landscapes, habitats, land cover, and general biodiversity, preservation of genetic diversity in agriculture, production of renewable energy sources.

a tool to simplify these potentially complex and regionally variable effects, even though they do not capture all important details (Figure 3.1).

3.3 Soil

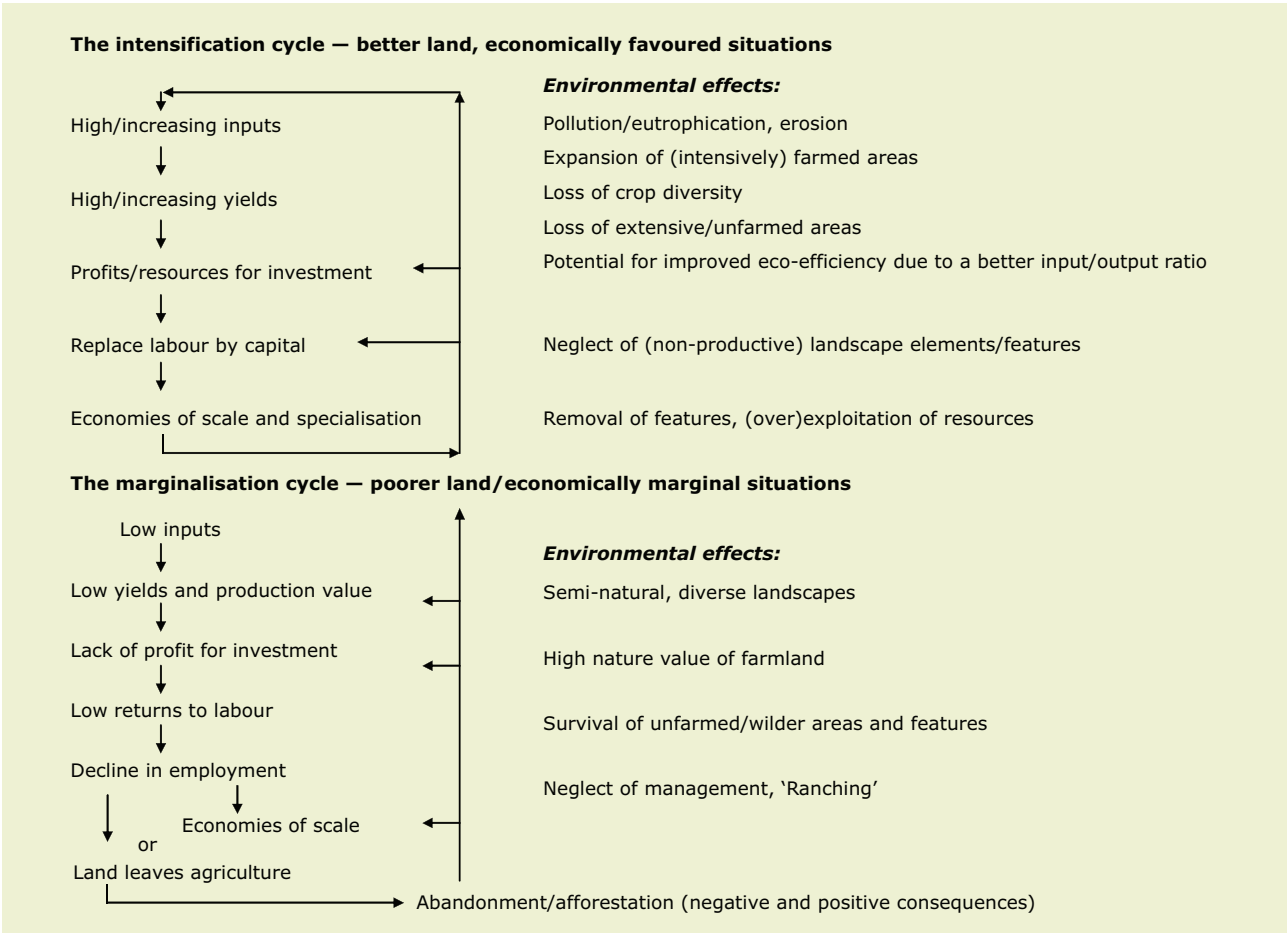
Soil is one of the most fundamental assets on farms and a limited resource for agricultural production. Preventing loss of soil and maintaining and enhancing soil quality is essential for maintaining agricultural productivity. Soil is also a resource for purposes beyond agriculture; it can act as sink for carbon (carbon sequestration) given the right conditions (see IRENA indicator report).

Pressures on the soil resource may result from the cropping-livestock patterns, farm management practices, in particular tillage practices and the management of soil cover, and intensification/ extensification processes, as identified by IRENA Nos. 13, 14 and 15, respectively. In addition, IRENA No. 24 (Land cover change) focuses on the land cover flows between agriculture, forest and semi-natural areas (see section on landscape). The state of soils is shown by the indicators on soil erosion (IRENA No. 23) and soil quality (IRENA No. 29).

3.3.1 Soil erosion

Soil erosion is a natural process that causes environmental concerns in situations of accelerated erosion, where the natural rate has been significantly increased by human activity (Gobin *et al*., 2004). The IRENA fact sheet No. 23 documents that soil erosion rate is very sensitive to both climate and land use, as well as to detailed conservation practice at farm level. The Mediterranean region is particularly prone to erosion because it is subject to long dry periods followed by heavy bursts of rain. This favours erosion, in particular if falling on steep slopes with fragile uncovered soils.

Figure 3.1 Cycles of intensification and marginalisation in agriculture



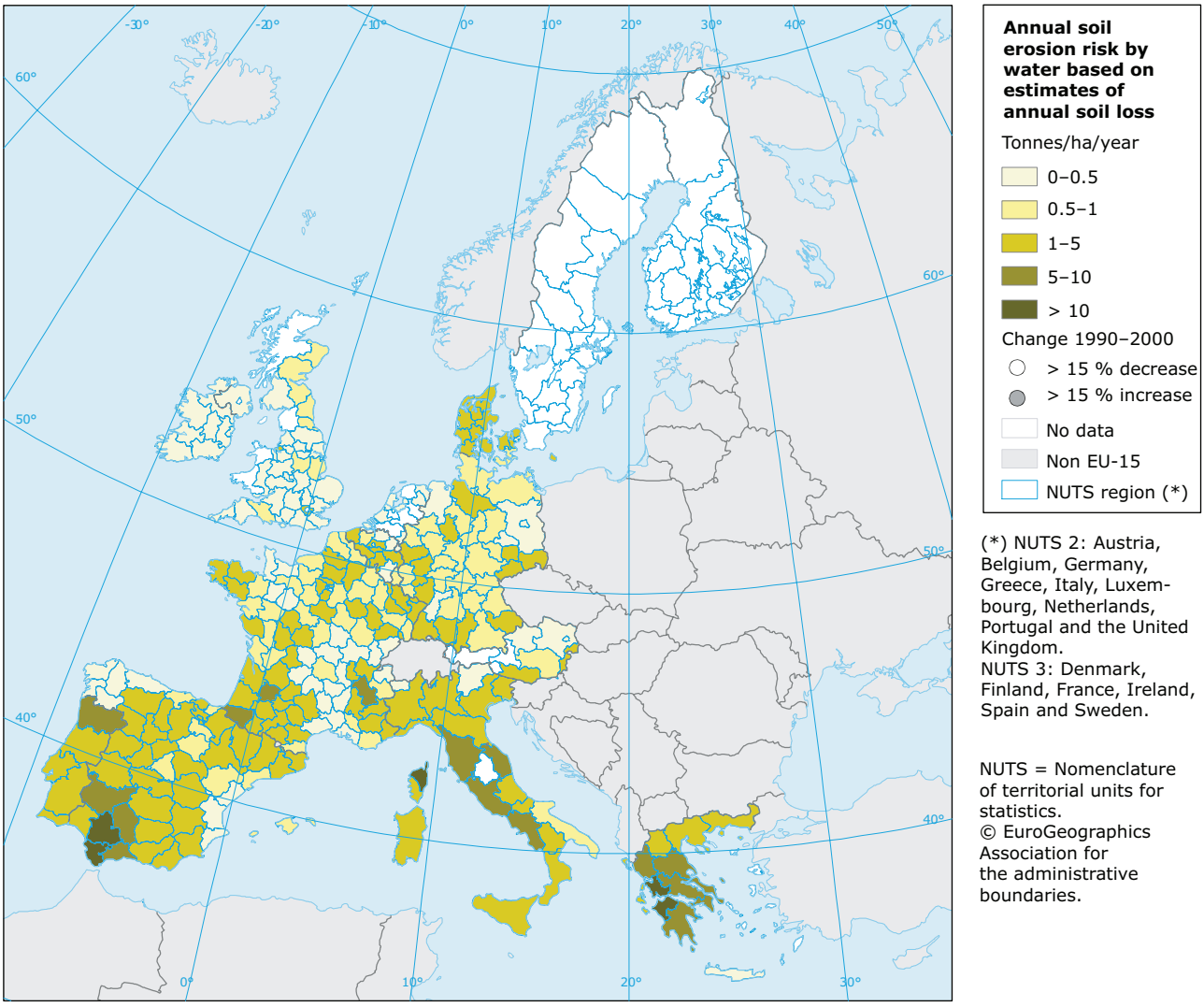
Source: Adapted from IEEP, 2002.

The Pan-European Soil Erosion Risk Assessment (PESERA) model uses a process-based and spatially distributed model to estimate soil erosion risk by water across Europe. The largest area with a high erosion risk is southern and western Spain, with local erosion hotspots on the southern coast, northern Portugal, southern Greece and central Italy (see Figure 3.2). The interpretation of this map needs to take into account that some input data to the model have low spatial resolution, e.g. precipitation is on a 50 km grid only. Furthermore, limitations in the available agricultural land-use and crop management information do not allow a trend assessment for this indicator.

3.3.2 Soil quality

In the IRENA operation, soil organic carbon content in topsoil has been adopted as a proxy indicator for soil quality for agri-environmental purposes since it covers both strictly agricultural criteria and wider environmental and societal concerns. According to IRENA No. 29, areas of very low organic carbon content (between 0–1 %) appear mostly in southern Europe and correspond with areas with high soil erosion rates and warmer climates. In northern Europe, highly organic soils (peat) are clearly distinguished. The organic carbon content of soils is an important parameter for their role in the climate

Figure 3.2 Annual soil erosion risk by water based on estimates of annual soil loss (aggregated results at NUTS 2/3 level)



(*) NUTS 2: Austria, Belgium, Germany, Greece, Italy, Luxembourg, Netherlands, Portugal and the United Kingdom.
NUTS 3: Denmark, Finland, France, Ireland, Spain and Sweden.

NUTS = Nomenclature of territorial units for statistics.

Source: IRENA No. 23 (Pesera project).

change context (as a potential sink, or a potential source as in the case of highly organic soils). Further information can be found in the indicator report or IRENA fact sheet No. 29.

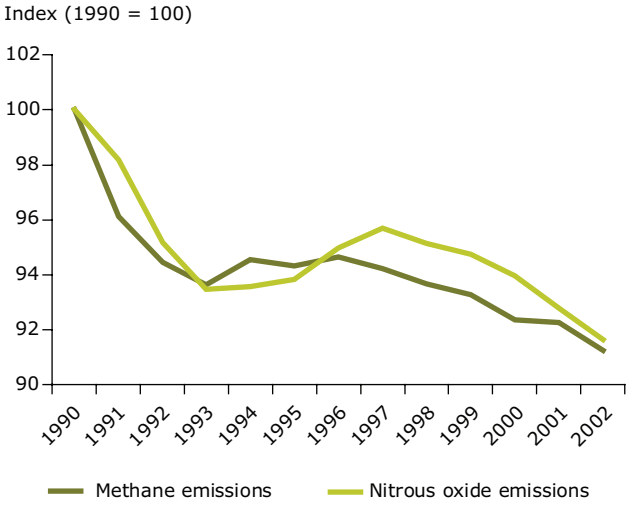
3.4 Air quality and climate change

There is mounting evidence that greenhouse gas emissions from human activities, such as energy, industry, transport, household and agriculture, contribute to climate change (IPCC, 2001). IRENA No. 34.1 shows that agriculture contributed 10.1 % of total greenhouse gas emissions in EU-15 in 2002. The main greenhouse gases emitted by agriculture are nitrous oxide and methane, both of which have a far greater global warming potential than carbon dioxide (CO_2). Agriculture also consumes fossil fuels for farm operations, thus emitting carbon dioxide.

The two pressure indicators relevant to the issue of climate change and air pollution are IRENA No. 19 'Emissions of methane (CH_4) and nitrous oxide (N_2O) from agriculture' and No. 18sub 'Atmospheric emissions of ammonia from agriculture'.

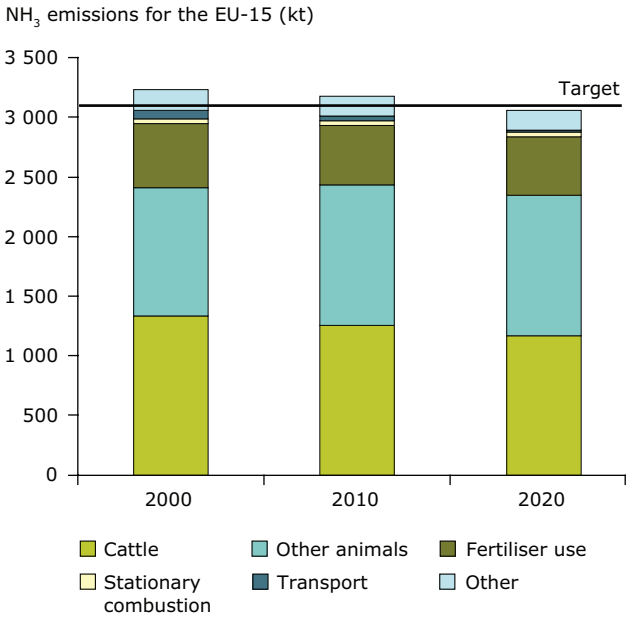
According to IRENA No. 19, methane emissions are closely related to livestock production, whereas emissions of nitrous oxide arise from the use of mineral nitrogen fertilizers and manure storage when manure nitrogen is converted into nitrous oxide. Between 1990 and 2002, emissions from agriculture — methane and nitrous oxide — decreased by 8.7 %. This was due mainly to a 9.4 % reduction in methane from reduced livestock numbers and an 8.2 % reduction in nitrous oxide from decreased nitrogenous fertiliser use and changed farm management practices.

Figure 3.3 Methane and nitrous oxide emissions from agriculture 1990–2002 (EU-15 Member States) indexed relative to 1990 emission levels



Source: EEA, 2004 (IRENA 19).

Figure 3.4 Projections of ammonia emissions to 2020 for the EU-15



Note: The NH_3 2010 emission ceiling under the NEC directive for the EU-15 is 3 110 kt.

Source: CAFE Programme scenario (Amann *et al.*, 2005).

IRENA indicator 18sub identifies ammonia (NH_3) as an important pollutant with regard to air quality. In Europe ammonia emissions mainly occur as a result of volatilisation from livestock manure, whether this occurs from livestock housing, manure storage, urine and dung deposition in grazed pastures or after manure spreading onto land. The indicator assesses that within the EU-15, emissions of ammonia from agriculture have decreased by 9 % between 1990 and 2002. The majority of this reduction is likely to have resulted from a reduction of livestock numbers across Europe (especially cattle), and the lower use of nitrogenous fertilisers across the EU-15. Ammonia is one of the pollutants included in the Gothenburg Protocol on the reduction of air pollution in Europe and the National Emissions Ceilings (NEC) Directive (2001/81/EC), see Section 4.3.1.3. According to the available projections (Amann *et al.*, 2005), which do not take into account possible effects of the

2003 CAP reform, the projected future decrease in emissions would not be sufficient to reach the NH_3 reduction targets set under the NEC directive.

3.5 Water

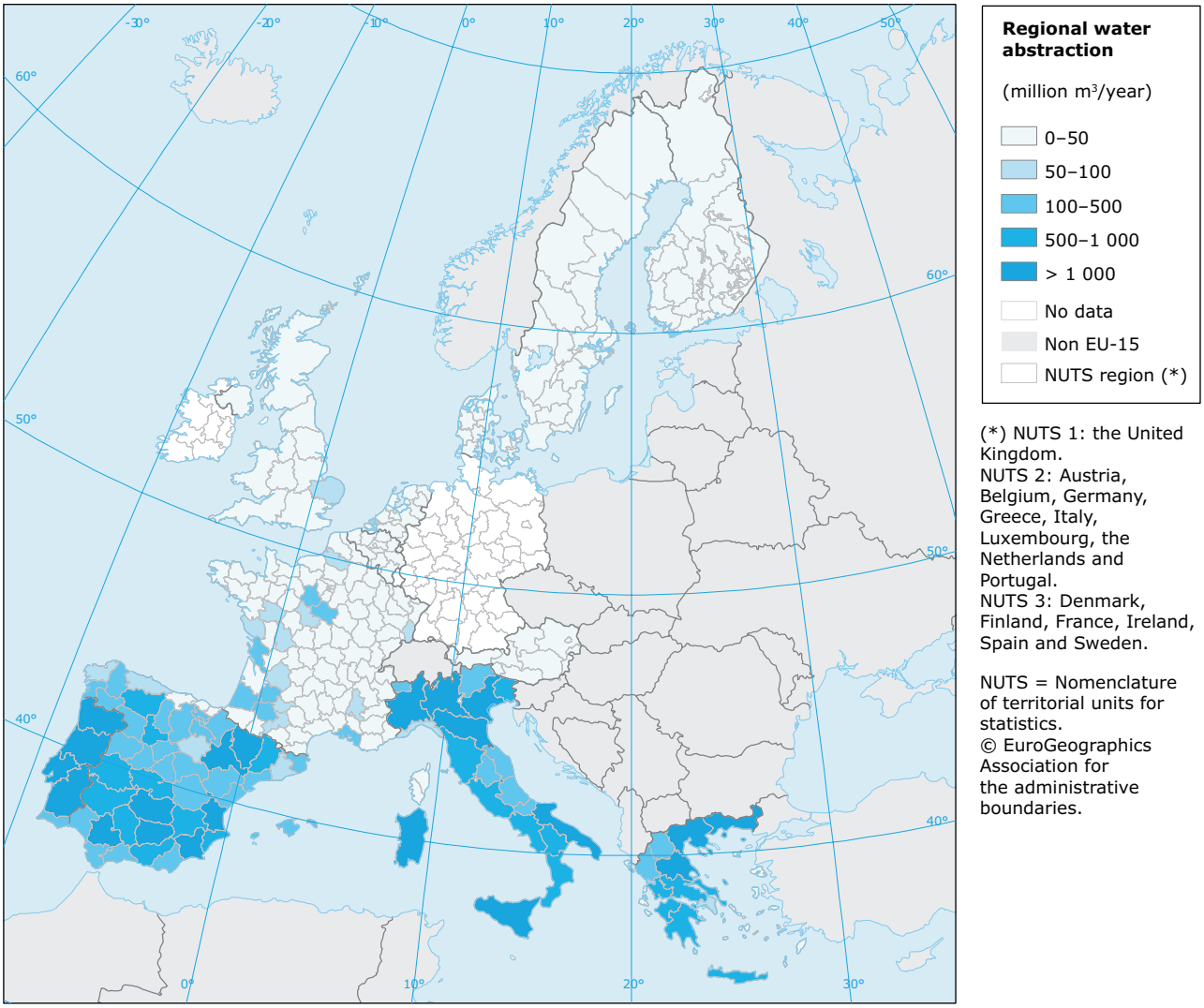
Water related issues arising from agricultural activity fall into two categories: water quantity (sustainability of resources) and water quality (change in chemical and biological status).

3.5.1 Water quantity

Agriculture is an important sector in terms of total water usage in Europe. New production methods reliant on irrigation play an important role in the development of the agricultural sector in many Member States, but the increase of agricultural irrigation can put pressure on water resources (EEA, 2004). The depletion of water resources can decrease groundwater and river levels, which in turn can influence aquatic and riparian ecosystems negatively.

Farmers may select crops that require more water during the growing season, or that have growth periods more sensitive to soil moisture stress. The main agricultural driving force behind the sustainable use of water is the consumption of water for irrigation. An increase in irrigable area can be expected to have an impact on the demand

Figure 3.5 Regional water abstraction rates for agriculture (million m³/year) during 2000



(*) NUTS 1: the United Kingdom.
NUTS 2: Austria, Belgium, Germany, Greece, Italy, Luxembourg, the Netherlands and Portugal.
NUTS 3: Denmark, Finland, France, Ireland, Spain and Sweden.

NUTS = Nomenclature of territorial units for statistics.
© EuroGeographics Association for the administrative boundaries.

Note: United Kingdom estimations are based on 1997 data for irrigable area and reported water abstraction rates. Ireland, Luxembourg and Germany do not provide data on irrigable area for NUTS regions.

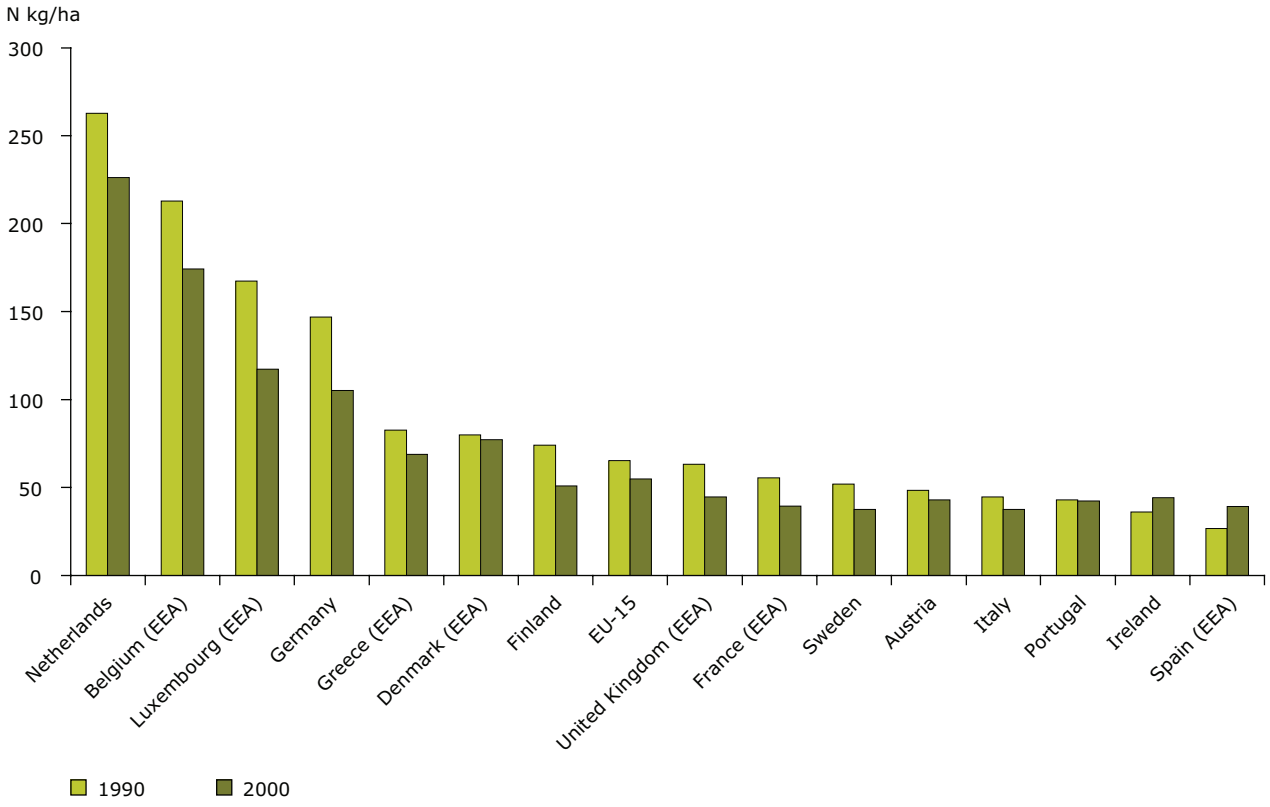
Source: Community Survey on the Structure of Agricultural Holdings (FSS), Eurostat combined with information from OECD/Eurostat questionnaire.

for water because more farmers are likely to use irrigation methods. However, the adoption of new irrigation technology improves the water use efficiency of irrigation systems, reducing gross water requirements. The key results of the indicator 'water use' (IRENA No. 10) are that the irrigable area in EU-12 increased from 12.3 million ha to 13.8 million ha between 1990 and 2000, an increase of 12 %. In France, Greece and Spain, the irrigable area increased from 5.8 million ha to 7.4 million ha during the same timeframe, representing an increase of 29 %.

IRENA No. 22 estimates regional water abstraction rates for agriculture by weighting national reported water abstraction rates by regional irrigable area values (see Figure 3.5). Water abstraction rates depend on a range of factors: crop selection, irrigation area, irrigation technology, water prices, water restrictions, pumping costs and climate. The indicator shows large regional variations ranging from 1 636 million m^3/year in Sevilla region (south-west of Spain) to 0 m^3/year in Northern Ireland (the United Kingdom). During the 1990s, the reported water allocation rates for irrigation decreased across the EU-15 Member States. This indicates a likely reduction in water application rates per hectare of irrigated land, implying an increase in water efficiency, even though agricultural water consumption remains high in the south.

The state of water resources was the scope of indicator IRENA No 31 'Ground water levels'. Due to lack of data, the indicator builds on a case study. The case study shows that the aquifer of La Mancha Occidental (Upper Guadiana basin in Spain), was declared to be overexploited at the end of the 1980s. Excessive abstractions of water for irrigation purposes had led to a severe negative impact on the nature reserve and Natura 2000 site of 'Las Tablas de Daimiel', threatening the destruction of this wetland area. Significant restrictions on water use were implemented with the help of an agri-environment programme during the 1990s. These have resulted in a steady recovery of regional groundwater levels although at considerable budgetary costs.

Figure 3.6 National gross nitrogen balances (kg/ha) in 1990 and 2000



Note: In Belgium (Flanders) the first calculation is for 1998; in Sweden and Portugal the first calculations are for 1995.

The country name followed by (EEA) indicates balances that have been calculated by the EEA on the basis of EU level data sets.

Additional data on the global impact of agricultural water use on water resources are provided by IRENA No. 34.3, which concludes that in northern EU-15 Member States, the share of agriculture in water use was around 7 % in both 1991 and 1997. This reflects the overall high availability of water in these Member States and the relatively low share of irrigated land in agriculture. In the EU-15 context, no major environmental concerns are associated with agricultural water use in these Member States even though temporary impacts on water resources may occur at local level.

In southern EU-15 Member States, the share of agriculture in water use remained stable at about 50 % between 1991 and 1997. The high share of agriculture in total water use reflects the importance of irrigation to agricultural production in these Member States. Irrigation is often essential in the production of high value crops, such as vegetables and fruits that are delivered to markets across the whole EU-15. However, a large share of irrigation water also goes to the production of lower value crops, such as cereals, maize and sugar beet.

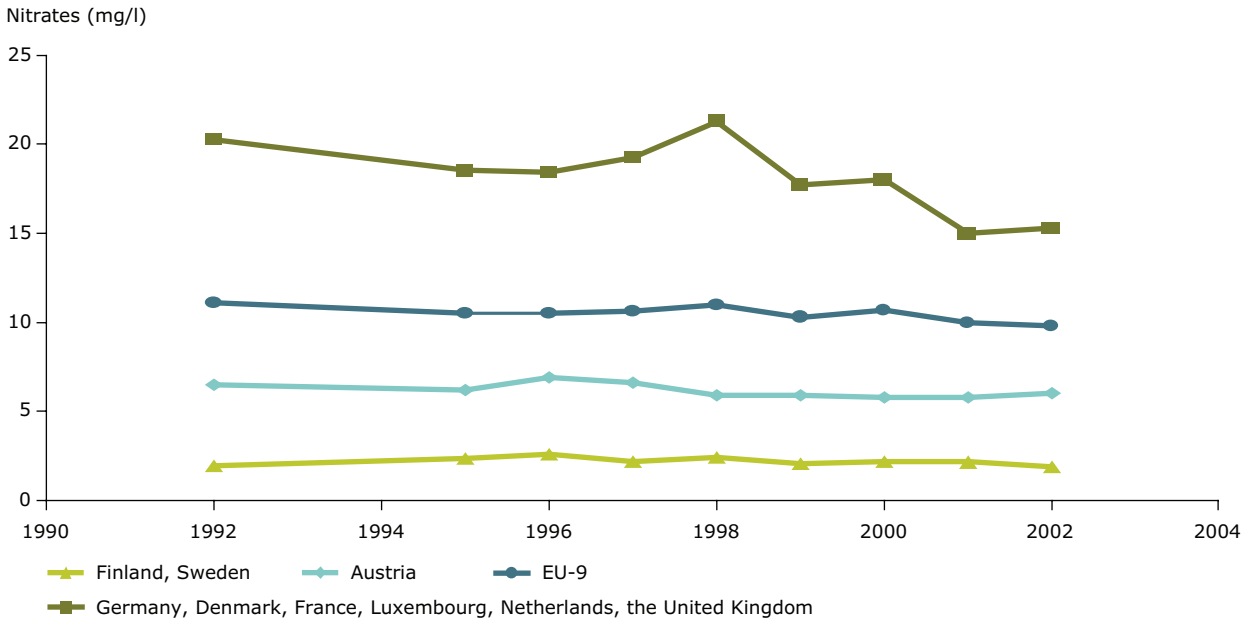
3.5.2 Water quality

The quality of water is a major environmental concern in Europe. The overloading of seas, coastal waters, lakes and rivers with nutrients (nitrogen and phosphorus) can affect the environment. Whereas phosphorus is normally the limiting factor determining eutrophication in fresh water ecosystems, nitrates are the key limiting factor for eutrophication and algal blooms in marine ecosystems (EEA, 2003). Nitrate pollution of surface and ground waters also impairs their suitability as a source of drinking water (e.g. European Commission, 2002).

Potential agricultural pressure on water quality is indicated by the 'gross nitrogen balance' (IRENA No. 18). Gross nitrogen balance relates to the potential surplus of nitrogen on agricultural land. This is estimated by calculating the balance between nitrogen added to an agricultural system and nitrogen removed from the system per hectare of agricultural land. The gross nitrogen balance indicator accounts for all inputs and outputs from the farm, and includes all residual emissions of nitrogen from agriculture into soil, water and air.

At EU-15 level, the gross nitrogen balance in 2000 was calculated to be 55 kg/ha, which is 16 % lower than the 1990 estimate of 66 kg/ha. In 2000, the gross nitrogen balance ranged from 37 kg/ha (Italy) to 226 kg/ha (the Netherlands). All Member States show a decline in estimates of gross nitrogen balance

Figure 3.7 Annual trends in the concentrations of nitrates (mg/l) monitored in rivers (1992 to 2001)



Source: EEA data service, 2004.

between 1990 and 2000, apart from Ireland (22 % increase) and Spain (47 % increase). Nevertheless, their gross nitrogen balances remain among the lowest of all EU-15 Member States.

National nitrogen balances can mask important regional differences in the surplus of this nutrient that determine the actual leaching risk at regional or local level. Individual Member States can thus have acceptable gross nitrogen balances at national level but still experience significant nutrient leaching in certain regions, for example in areas with high livestock concentrations. The calculation of regional gross nitrogen balances would provide a much better insight into the actual likelihood of nutrient losses to water bodies, in combination with data on farm management practices as well as climatic and soil conditions. Due to data gaps, such an indicator could not be developed in the timeframe of the IRENA project. Consequently, the analysis in this report relies on national gross nitrogen balances.

Use of sewage sludge (IRENA No. 21) as well as soil pesticide contamination (IRENA No. 20) may also lead to additional pressures on water quality through leaching or run-off into ground- and surface water bodies. These are, however, not discussed here due to the lack of direct monitoring data for these issues.

The state of/impacts on water quality is shown by the indicators on nitrates and pesticides in water (IRENA No. 30.1 and No. 30.2) and the share of agriculture in nitrate contamination (IRENA No. 34.2).

IRENA No 30.1 gives an overview of trends in nitrate concentrations in groundwater bodies and rivers across EU-15. River data for nine EU-15 Member States shows an overall declining trend between 1992 and 2002. Nitrate concentrations in Denmark, Germany, Luxembourg, the Netherlands and the United Kingdom tend to decline at a high level whereas French data show a slight increase. Data for Austria, and even more so Sweden and Finland, remain stable at low concentrations (see Figure 3.7).

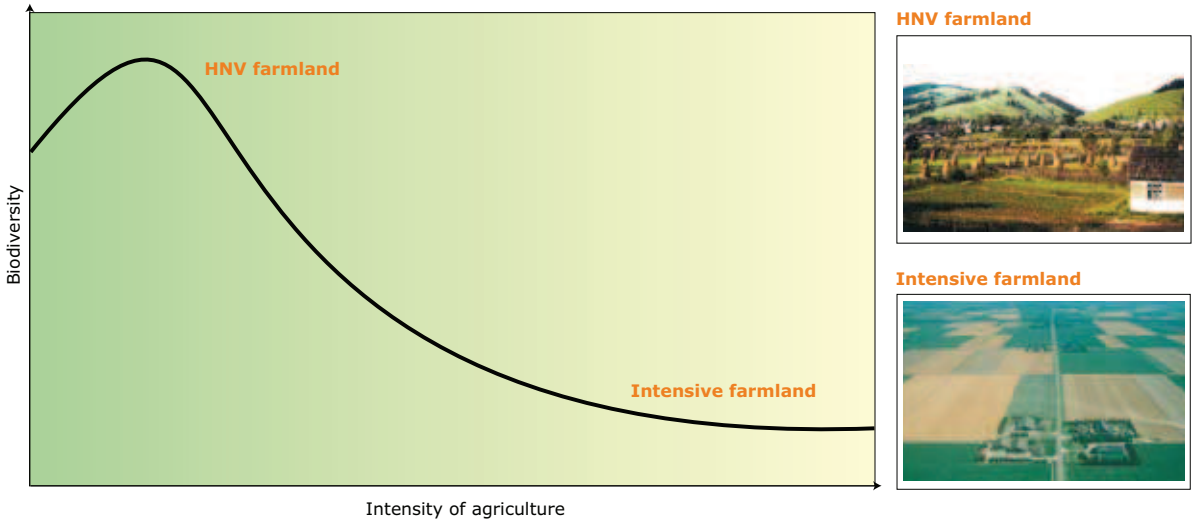
3.6 Biodiversity and landscape

3.6.1 Biodiversity

About half the land in the EU-15 is managed by farmers, which gives agriculture an important role in the maintenance of biodiversity. Varying farming traditions, combined with specific soil and climate conditions, have resulted in diverse and highly characteristic agricultural landscapes often with a rich flora and fauna.

The historic relationship between land use and biodiversity began with the opening up of forested landscapes for agriculture, leading to greater habitat and species diversity. Around 1700 to 1800

Figure 3.8 General relationship between agricultural intensity and biodiversity



Source: Adapted from Hoogeveen *et al.*, 2001.

a plateau of high biodiversity was reached in most European countries, and thereafter biodiversity decreased as agriculture intensified (Figure 3.8). Drainage of bogs and wetlands and the cultivation of heathlands occurred already in the 19th century. Fertiliser and pesticide use, mechanisation and the decline of labour intensive practices added further pressures on biodiversity in the 20th century (Hoogeveen *et. al.*, 2001).

As illustrated in the figure above, the most favourable conditions for maintaining the biological and landscape diversity of farmland are created under extensive and/or traditional agricultural management, also in Natura 2000 sites. Extensive farming systems have long been threatened, however, by two different trends: intensification and abandonment (see also Figure 3.1).

Crucial farm trends for biodiversity are linked to changing cropping/livestock patterns (IRENA No. 13), intensification (IRENA No. 15), specialisation (IRENA No. 16), as well as land cover (IRENA No. 24). These can have negative and positive effects on landscapes and biodiversity. IRENA indicator No. 13 notes that permanent grassland and permanent crops decreased by 4.8 % and 3.8 % respectively. However, these general trends mask even stronger regional changes that have potential negative implications for biological and landscape diversity. According to IRENA No. 16, the share of land managed by 'mixed livestock' farms declined from 16 % in 1990 to 12 % in 2000. This trend has serious implications since such farms (often a combination of cattle and sheep) are frequently associated with high biodiversity and landscape quality.

Data on genetic diversity (IRENA No. 25) are limited and difficult to interpret. Traditional livestock breeds are often associated with extensive grazing practices and high nature value farmland. Moreover, modern high-yielding dairy cattle require high-energy fodder and are therefore not suitable for grazing semi-natural grasslands, for example. Thus, there is a need to assess the trends in genetic diversity in crops and livestock. FAO data show that about 50 % of the main livestock breeds (cattle, pig, sheep, goat and poultry) in EU-15 countries are either extinct or have an endangered or critical status.

A number of indicators can be identified that show the state of biodiversity as well as the impacts of agriculture. These include: IRENA No. 28 'population trends of farmland birds', IRENA No. 26 'high nature value farmland areas', and IRENA No. 33 'impact on habitats and biodiversity'.

The trend in farmland birds is a barometer of change for the biodiversity of agricultural landscapes in Europe. The indicator assumes a close link between the bird species and the farmland habitat, and shows that there has been a significant decline in farmland bird populations (Figure 3.9). Population trend index data between 1980 and 1990 are only available for three countries (Denmark, Sweden and the United Kingdom). The number of EU Member States with annual breeding bird surveys based on nationwide samples has increased over time. During the period 1990–2000 data from 11 countries were available, allowing the calculation of an EU-15 aggregated index.

Farmland bird populations declined on average by over a third between 1980 and 2002 with the steepest decrease in the 1980s, and a smaller decline since 1990. The countries most affected by this decline are Belgium, France, the Netherlands, Sweden and the United Kingdom. There is a big variation however, within countries and among countries.

Impacts on habitats and biodiversity are assessed in IRENA No. 33, which analyses agricultural impacts on Important Bird Areas (IBAs) and on Prime Butterfly Areas (PBAs) on the basis of case studies. The indicator reports that the habitat quality of IBAs in the EU-15 is affected by agricultural intensification and/or abandonment. Intensification affects the highest share of IBAs in Spain, Greece and Italy, but also France, Germany, Scotland as well as southern Portugal have significant clusters. It occurs mainly on lowland, upland and coastal sites. Abandonment mostly takes place in mountain or coastal IBAs but is less frequent than intensification.

The indicator also shows that 92 % of all target butterfly species in Europe depend on agricultural habitats (extensive grasslands). Their conservation status is generally negative throughout the EU-15, with Spain and Greece as positive exceptions. 80 % of all agricultural Prime Butterfly Areas experience negative impacts from intensification, abandonment or both. 43 % of all agricultural sites suffer from intensification, whereas abandonment is a significant problem in 47 %. Both impacts occur simultaneously in 10 %.

IRENA No. 26 shows that high nature value areas (HNV farmland), which contain biodiversity hotspots on agricultural land, are mainly found in southern, western and northern regions of the EU-15. Roughly 15–25 % of the European countryside qualifies as HNV farmland. There are few data about the actual conservation status or species diversity of HNV farmland areas, but

the distribution and population trend of rare and threatened butterflies gives an indication of biodiversity trends on HNV farmland.

IRENA No. 4 indicates the proportion of Natura 2000 sites covered by targeted habitats that depend on a continuation of extensive farming practices (see Figure 3.10). Results show that across the EU-15 targeted agricultural habitat types represent 17 % of the terrestrial part of Natura 2000 sites. This means that 2 % of the EU-15 territory consists of targeted agricultural habitats of Community Importance and depends on a continuation of extensive farming practices, for example hay-making or extensive sheep grazing. The appropriate management of such areas by farmers will strongly benefit from support through agricultural policy instruments, such as agri-environment schemes, in particular where it would otherwise be economically unviable.

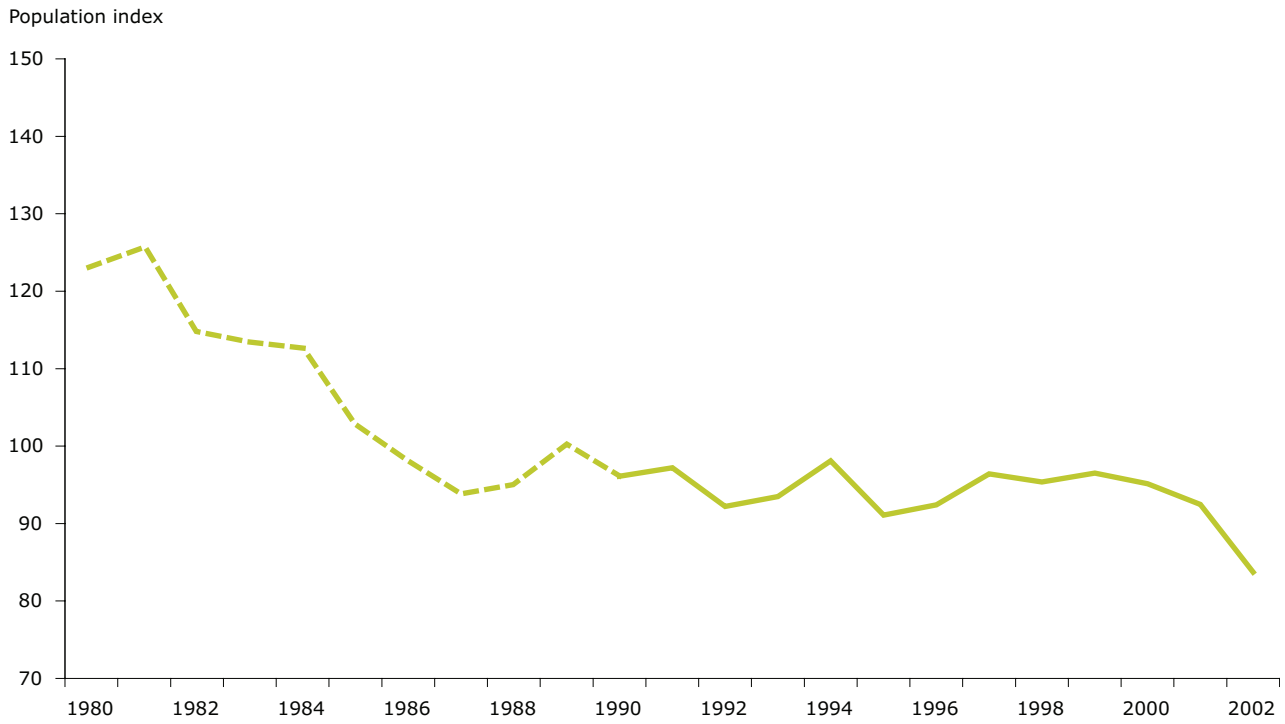
The management of biodiversity on farmland is a key example where farmers provide a public good that cannot find a direct reward on the market place. This environmental service thus generally needs to be supported by public intervention. This issue is also very relevant in Natura 2000 areas. The protection and management of biodiversity on farmland is therefore taken as a case study to investigate the suitability and targeting of different policy instruments.

3.6.2 Landscapes

Europe has a great variety of agricultural landscapes that reflect differences in biophysical conditions, farm management practices and cultural heritage. Farmers play a crucial role in shaping and maintaining these landscapes.

IRENA No. 24 identifies land cover changes to and from forest/semi-natural and agricultural land. It concludes that these were most dynamic in Mediterranean Member States, in particular Spain, between 1990 and 2000. In Italy, there were considerably more land cover changes from agriculture to forest/semi-natural land than

Figure 3.9 Trend in farmland bird population index from 1980-2002 in EU-11 ([4])



Source: Pan-European bird monitoring project (BirdLife International, EBCC, RSPB and Statistics Netherlands).

Note: The population trend before 1990, even if estimated with a statistical model, relies on data from three Member States only (Denmark, Sweden and the United Kingdom). Thus, this part of the trend line is presented as dashed in the graph.

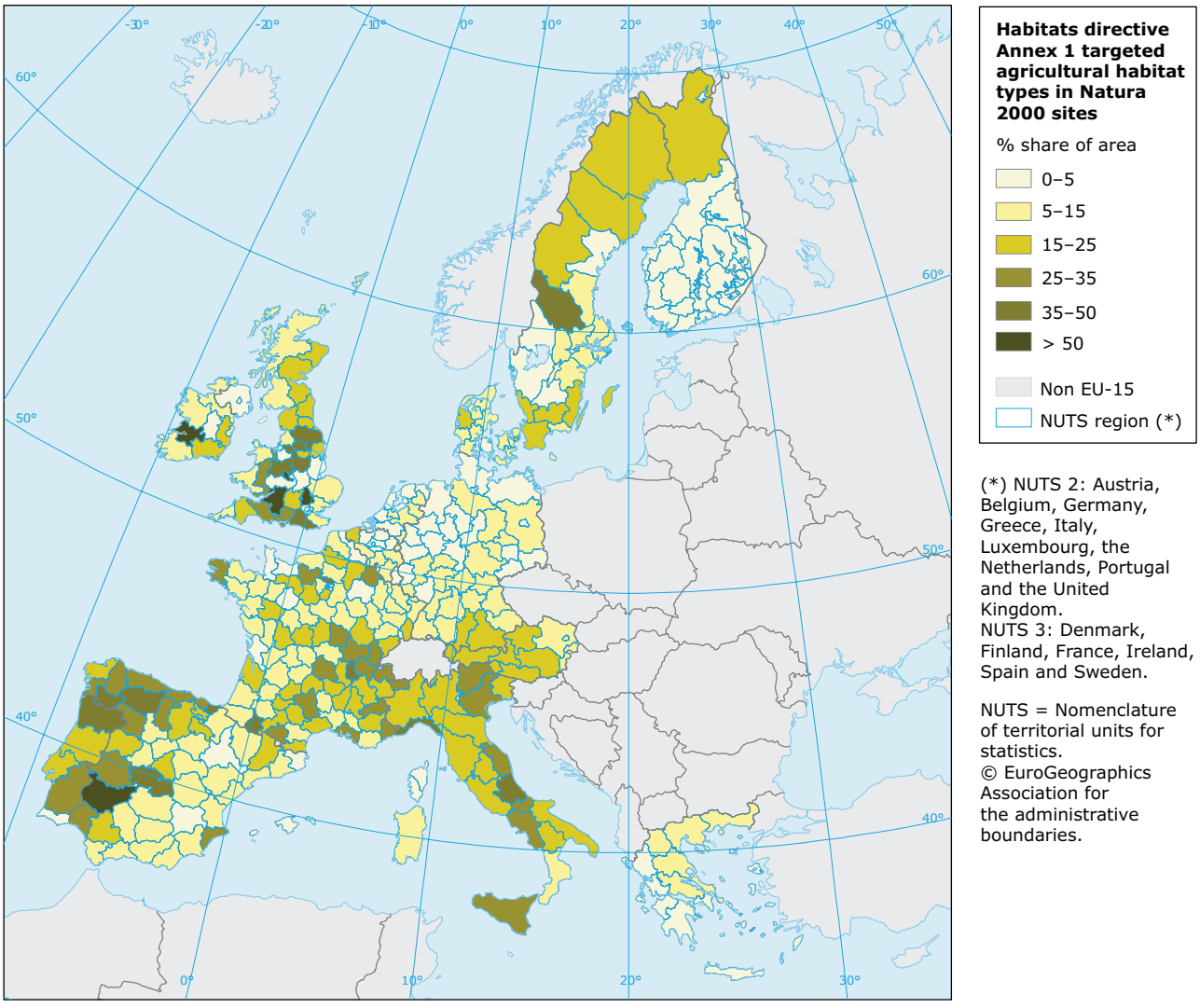
([4]) Bird population trend data is obtained from the EU-15 Member States except Finland, Greece, Luxembourg, and Portugal.

from forest/semi-natural to agricultural land. In Portugal there were similar land cover flows in both directions between forest/semi-natural and agricultural land.

IRENA No. 32 shows the importance of agriculture and the dominant agricultural land uses in relation to landscape type. Agricultural land is most dominant in the bocage (84 %) and least dominant in the alpine (24 %) case study areas. The distribution of arable, grassland, permanent crops and other agricultural land uses shows great variation between landscapes. Around 60 % of the land surface is covered by arable land in the open fields landscapes of Castilla León and Eastern Denmark. Grasslands cover half of the territory in the *dehesas* of Extremadura, *bocage* landscape in Normandy and Irish highlands. Permanent crops represent one quarter of the agricultural land in the *montados* landscape (Portugal), while these are non-existent in the highlands regions of the United Kingdom and Ireland.

IRENA No. 35 looks at the impact of changes of agricultural characteristics on landscapes on the basis of case studies. The case study area with the highest increase of grasslands (10 %) was the Mediterranean Open field region of Castilla y León. On the contrary, in the Atlantic Bocage region of Normandy, the surface of grassland decreased by 10 %, and at the same time there was a 4 % increase in arable land during the last decade. The area of permanent crops has decreased by 5 % in the Montado case study region in Portugal.

Figure 3.10 Regional share of Natura 2000 habitats that depend on a continuation of extensive farming practices within Natura 2000 sites



Note: The analysis focuses on agricultural Natura 2000 habitats that are listed in Annex I of the Habitats Directive (92/43/EC).

Source: Natura 2000, DG Environment, 2004. Snapshot, July 2004.

4 A framework for assessing policy integration

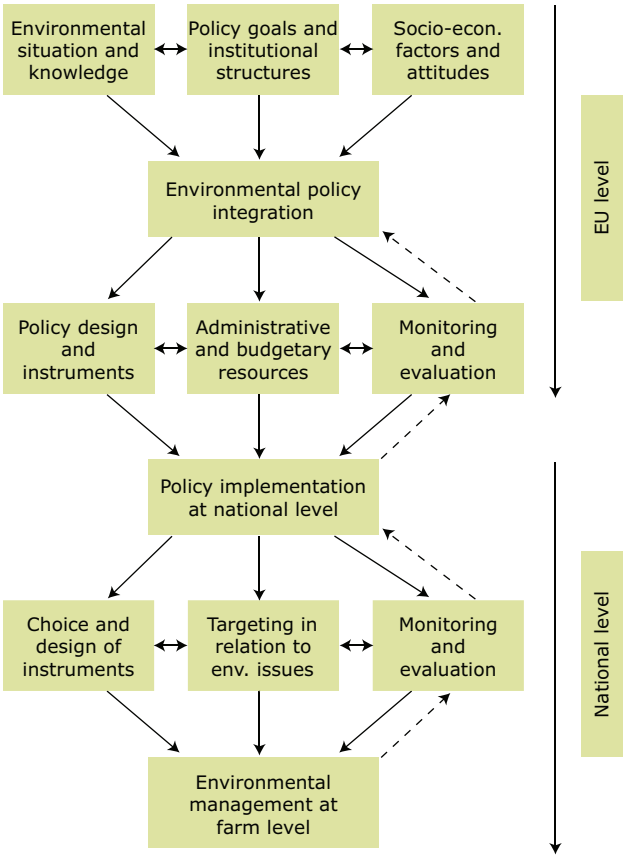
4.1 Introduction

Changes in agricultural land use and intensity create pressures on the environment leading to impacts on, and changes in, the state of the environment. At the same time extensive farming practices are still important for the management of habitats within Natura 2000 areas and elsewhere. This relationship between agriculture and the environment has been illustrated by IRENA indicators in Chapters 2 and 3 of this report.

This chapter sets out the analytical approach taken in this report for analysing policy integration, and the associated analytical issues and data gaps (Section 4.2). The analysis attempts to link key environmental results from Chapters 2 and 3 to the policy response to agri-environment problems at EU and national level.

As a first step, Section 4.3 reviews a range of EU and national communications and documents for specific objectives and targets that address environmental problems in the agriculture sector. Section 4.4 identifies, as a second step, existing policy instruments and measures that can, in principle, be employed to address environmental problems. This provides the policy framework within which environmental integration has to be assessed.

Figure 4.1 A schematic framework of factors influencing policy integration



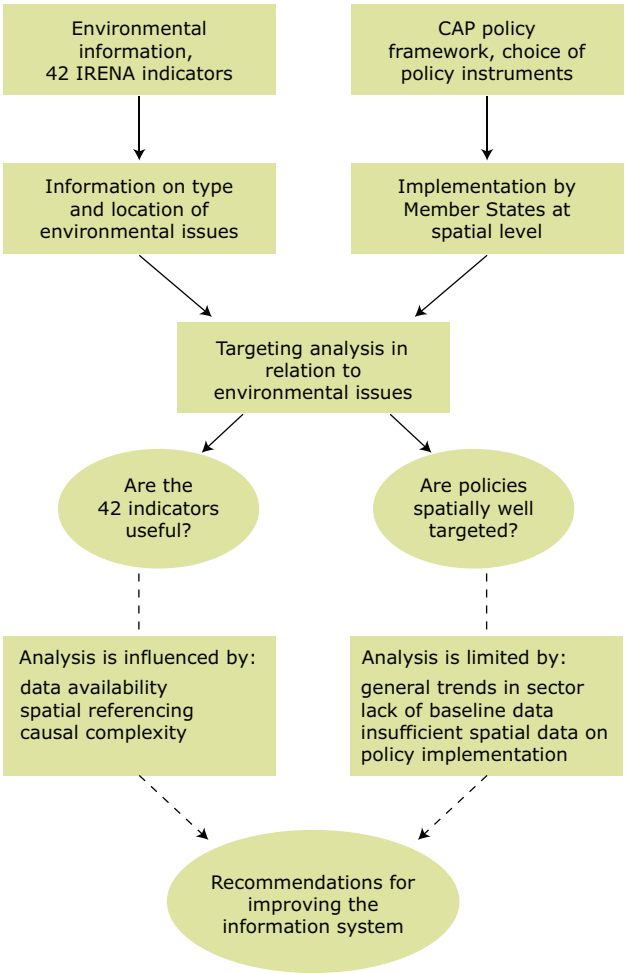
4.2 Assessing policy integration

For assessing success with environmental integration in the CAP this report utilises an approach that aims to build on the comprehensive indicator-based analysis that has been developed in the IRENA operation. This approach is outcome-oriented and assesses the success of policy integration by investigating the use and targeting of policy instruments on environmental issues according to their geographic distribution and character. Ultimately, such an approach aims to assess the environmental impact of the measures investigated. It should, however, only be taken as a proxy indicator for policy integration.

The IRENA operation aims at an analysis of '*environmental status in relation to the main policy issues and targets and their interlinkages*'. The 42 IRENA (sub-) indicators allow identification of key environmental issues that can be compared to the policy instruments available within the CAP to address them. Once the key agri-environmental issues of concern in different regions have been identified (through the indicators related to 'driving forces', 'pressure' and 'state'), an analysis of the 'policy responses' indicators is provided to help understand the extent to which agricultural policy responds to these issues. However, the effectiveness of policy instruments ultimately depends on their implementation at national and regional level.

Figure 4.1 sets out a schematic framework for factors influencing policy integration. This shows part of the complexity of interactions between environmental factors, socio-economic developments, policy and institutional processes and environmental information derived from monitoring and evaluation. The success of policy integration in the agriculture sector depends on two key issues: the policy framework (mainly relevant at EU level) and policy implementation (mainly relevant at national level). Policy design and available public resources are important factors that are largely decided at EU level, whereas Member States largely determine the choice and geographic targeting of (rural development) policy instruments at national and regional level. A well-functioning monitoring and evaluation framework can provide essential feedback loops between the implementation and policy design spheres, and promote progress with environmental integration via a process of policy learning.

Figure 4.2 Assessing environmental integration in the CAP and the underlying information system



Policy implementation is a key challenge in relation to CAP instruments as well as environmental legislation and, therefore, strongly influences the success of policy integration. To make progress in this area requires not only analysis but also positive examples to learn from. Thus, Chapter 5 includes some examples of national policy measures that help achieve agri-environmental policy integration targets. Assessing the success of environmental policies also requires effective monitoring and evaluation. The 42 (sub-)indicators developed in the IRENA operation are important in this regard but other data on policy implementation not covered by the IRENA 'Response' indicators are also relevant.

Figure 4.2 summarises the key elements of the framework for analysing policy integration and the indicator information system that is used in this report. It shows that even a limited approach to policy integration analysis can be hampered by the complexity of causal links and by the availability and quality of data in the environmental and policy implementation fields, in particular with regard to spatial referencing. However, exploring the limitations of the approach and the data is a necessary first step for further development.

In summary, the approach for policy integration analysis builds on a combination of:

- the identification of key environmental concerns based on agri-environmental results presented in the IRENA indicator report on agriculture and environment in the EU-15;
- a review of the EU agri-environmental policy framework and its implementation in Member States;
- an analysis of the targeting of agri-environmental policy instruments on key environmental issues identified on the basis of IRENA indicators; and
- an initial assessment of the usefulness of the agri-environmental information system developed under IRENA for analysing (proxy measures of) policy integration.

4.3 Environmental targets and objectives in the agriculture sector

The European Commission and the European Council have presented several communications, strategy documents and action plans on sustainable development and the integration of environmental objectives into sectoral policies over the last 10 years. The list of documents that have been reviewed and analysed is provided in Table 4.1. These have been summarised in relation to achieving environmental objectives in the agriculture sector.

4.3.1 Review of objectives and targets contained in key documents

IRENA No. 3 (Regional levels of environmental targets) provides information relevant to this section. The following paragraphs review the objectives and targets contained in selected key documents in relation to: soil, water, air, biodiversity and landscape. Section 4.3.1.7 summarises and evaluates the material presented below.

4.3.1.1 Soil

The environmental and sustainable use of soils is addressed in various political documents that cover the physical, chemical and biological degradation of soil. Soil issues that are specifically addressed include salinisation, erosion, loss of soil organic matter, soil contamination, compaction, sealing, and loss of soil biodiversity and habitats.

In 2002 the Commission issued a Communication 'Towards a Thematic Strategy for Soil Protection', proposing *inter alia* the possible consideration of an extension of the use of the habitats directive to protect selected soil-based habitats, increasing the importance of soil in the management plans for Nature 2000 sites, as well as the development of new directives on the use of sludge and biodegradable products on soil and on soil monitoring. The European Council has delivered conclusions on the Communication, and the European Parliament commented on the Strategy. The work on the thematic strategy on soil protection was ongoing at the time of writing and foreseen to be completed by the end of 2005, accompanied by legislative

Table 4.1 List of policy documents reviewed that establish environmental objectives or standards for the agriculture sector (1990–2004)

Document	Reference
1991	
Directive concerning the protection of waters against pollution caused by nitrates from agricultural sources	Council Directive 91/676/EEC of 12 December 1991
Directive concerning the placing of plant protection products on the market	Council Directive 91/414/EEC of 15 July
1993	
Towards Sustainability: A European Community programme of policy and action in relation to the environment and sustainable development (5th environmental action programme)	Resolution of the Council and the Representatives of the Governments of the Member States (1 February 1993) (93/C 138/01)
1998	
European Community's Biodiversity Strategy	COM (1998) 42
1999	
Directions towards sustainable agriculture	COM (1999) 22
Council strategy on environmental integration and sustainable development in the CAP	Council document N° 13078/99
2000	
Directive establishing a framework for Community action in the field of water policy	Directive 2000/60/EC of the European Parliament and of the Council
2001	
Directive on national emission ceilings for certain atmospheric pollutants	Directive 2001/81/EC of the European Parliament and of the Council
A sustainable Europe for a better world: A European Union strategy for sustainable development	COM (2001) 264
Gothenburg European Council Conclusions (15-16 June 2001)	http://www.europarl.eu.int/summits/pdf/got1_en.pdf
6th environmental action programme	Decision No 1600/2002/EC of the European Parliament and the Council (of 22 July 2002)
Biodiversity Action Plan for Natural Resources	COM (2001) 162 (02)
Biodiversity Action Plan for Agriculture	COM (2001) 162 (03)
Towards a Thematic Strategy on Air Pollution	COM (2001) 245
2002	
Towards a Thematic Strategy on Soil Protection	COM (2002) 179
Towards a Thematic Strategy on the Sustainable Use of Pesticides	COM (2002) 349
2003	
Towards a Thematic Strategy on the Sustainable Use of Natural Resources	COM (2003) 572 final
Proposal for a directive of the European Parliament and of the Council on the protection of groundwater against pollution	COM (2003) 550

Note: This list excludes agricultural legislation as it mainly helps to implement environmental objectives and standards**.**

proposals. Currently it is not clear whether specific targets will be included in these documents.

4.3.1.2 Water

Political statements related to the prevention of further deterioration of the quality and quantity of water resources caused by certain agricultural activities refer mostly to the proper implementation and enforcement of water related legislation — the Nitrates Directive (91/676/EC) and the Water Framework Directive (2000/60/EC).

The nitrates directive has the general purpose of 'reducing water pollution caused or induced by nitrates from agricultural sources and preventing further such pollution' (Art.1). Moreover, the directive demands of the Member States to carry out monitoring of nitrates in waters, the designation of Nitrate Vulnerable Zones (NVZs) and the drafting of action programmes and codes of good agricultural practices. The standard regarding the content of nitrate in ground and surface freshwaters for identification of waters affected by pollution and waters which could be affected by pollution if no appropriate action is taken is 50 mg/l. A further objective of the directive is to avoid the (risk of) eutrophication of freshwater bodies, estuaries, coastal waters and marine waters.

The water framework directive (WFD) is the most substantial piece of Community water legislation to date. Its principle objective is to achieve good ecological and chemical status for surface water, and good chemical and quantitative status for groundwater by 2015. Good ecological status is defined in Annex V of the directive in terms of the quality of the biological community, the hydrological characteristics and the chemical characteristics. The directive sets out several obligations with clear deadlines for Member States. To meet the objective of the WFD, River Basin Management Plans, including programmes of measures must be produced by 2009 and made fully operational by 2012. To prepare the implementation of the WFD several working groups, including one on agriculture, have already been established at EU-level.

Moreover, as part of the obligations under the water framework directive to ensure good status of all waters in the EU, the European Commission adopted a proposal for a Groundwater Directive (COM (2003) 550) in 2003. At the time of writing, this was being discussed in Council and Parliament. It establishes specific measures aiming to prevent and control groundwater pollution. These measures include among others the development of threshold values and assessment methods of the chemical status of the groundwater. Moreover, quality standards are proposed for nitrates (50 mg/l) as well as pesticides (0.1 mg/l in groundwater).

4.3.1.3 Air pollution and climate change

Agriculture affects the quality of the air mainly through emissions of ammonia (NH_3), nitrous oxide (N_20) and methane (CH_4). Ammonia contributes to eutrophication and acidification, and to the formation of secondary particulate matters which are particularly adverse for health. Nitrous oxide and methane are important greenhouse gases, which contribute to a global warming effect leading to climate change.

In 1996, the UN/ECE started negotiating a new multi-effect, multi-pollutant protocol on nitrogen oxides and related substances. This was aimed at addressing photochemical pollution, acidification and eutrophication. The 'Protocol to Abate Acidification, Eutrophication and Ground-level Ozone' was adopted in Gothenburg in December 1999. The multi-pollutant protocol incorporates several measures to facilitate the reduction of emissions. Emission ceilings are specified for sulphur, nitrogen oxides, NH_3 and NMVOCs. The so-called Gothenburg Protocol forms a part of the Convention on Long-range Trans-boundary Air Pollution.

Within the EU, the National Emission Ceilings Directive (2001/81/EC) was adopted in 2001. This directive sets emission ceilings for 2010 for each Member State for the same four pollutants as in the Gothenburg Protocol. While no specific target relating to agriculture (or any other sector) has been set, agriculture is the main source of ammonia emissions (more than 90 per cent). The general targets for this pollutant can therefore be understood as an obligation to be fulfilled mainly by the agriculture sector. The national emission ceiling directive will be reviewed in 2006 in order to meet the new environmental and health objectives set up in the thematic strategy on air pollution as adopted by the Commission in September 2005 (COM (2005) 446) ([5]).

([5]) The thematic strategy on air pollution takes forward the objectives for improving air quality that were set out in Commission Communication COM(2001) 245 ('Towards a thematic strategy on air pollution').

This thematic strategy establishes interim objectives for air pollution in the EU and proposes appropriate measures for achieving them. It recommends that current legislation be modernised, be better focussed on the most serious pollutants and that more is done to integrate environmental concerns into other policies and programmes, including in the agriculture field. It is accompanied by a proposal to simplify and update current EU legislation on air quality, including an exchange of information.

Within the international arena, the EU has also signed the Kyoto Protocol in 1997 and the subsequent 1998 EU Burden Sharing agreement, where it commits itself to achieving an 8 % reduction in emissions of greenhouse gases by 2008–2012 compared to 1990 level. This reduction target is, however, also a general target for all sectors, and it is left to the Member States to decide how (in which sectors) they want to make the necessary emission reductions (see IRENA No. 3).

4.3.1.4 Biodiversity

The interaction between biodiversity and agriculture may be considered mainly from two perspectives: negative and positive impact of agricultural activity on wild species and semi-natural habitats dependent on agricultural activity, and the genetic diversity of agricultural crops and breeds of domestic animals.

So far biodiversity is the only field of the natural environment for which a specific action plan related to agriculture has been developed at the EU level, namely the biodiversity action plan for agriculture 2001. Prior to the development of this action plan biodiversity protection was addressed in the 5th and 6th environmental action programmes (5th and 6th EAP) of the EU and EC biodiversity strategy. Specific legal requirements for biodiversity protection that also affect the agriculture sector were established with the EU Habitats Directive (92/43/EEC). Some of the biodiversity issues related to the CAP were also addressed in the biodiversity action plan for natural resources.

The 5th EAP set a target of covering 15 percent of agricultural area in the EU with management contracts under the agri-environment schemes. This target has been met by 1998 and no further area target was set in the 6th EAP or following strategic documents, although an increase of both area covered and resources dedicated is stated as a strategic objective of the 2003 CAP reform.

The overall objective of the Community biodiversity strategy (1998) is 'to anticipate, prevent and attack the causes of significant reduction or loss of biodiversity at the source'. The objectives included in the strategy were (in cooperation with the Member States) to enhance conservation and the sustainable use of biodiversity outside protected areas, promotion of low-intensity farming, especially in the high nature value farmland areas, as well as protection and restoration of wetlands. In the area of genetic variety of crops and breeds, the strategy set the objectives, among others, of promoting the development of technologies to assess genetic diversity.

The biodiversity action plan (BAP) for agriculture was adopted in March 2001. The plan of action is mainly based on the Commission Communication 'Directions towards sustainable agriculture' and the Council strategy on the environmental integration and sustainable development in the CAP adopted by the European Council in 1999 (see Table 4.1). At a practical level it strongly links to the policy instruments established or confirmed with the Agenda 2000 CAP reform. The BAP for agriculture has provided an extensive list of objectives covering a relatively broad range of issues related to biodiversity and agriculture. The priorities of the plan are: the promotion and support of environmentally-friendly farming practices and systems (e.g. extensive livestock) which benefit biodiversity directly or indirectly, the support of sustainable farming activities in biodiversity-rich areas such as those of Natura 2000, and the promotion of measures related to genetic resources. The CAP instruments as shaped after Agenda 2000 provide the framework to integrate environmental, and in particular biodiversity considerations, into the EU agriculture policy. The BAP for agriculture also lists numerous indicators that should allow the assessment of progress. However, the document does not set tangible area, habitats or species related targets and concentrates instead on reviewing and improving effectiveness of the existing measures and the development of performance indicators.

Important references to the evaluation of the impact of the rural development measures are made in the BAP for natural resources. One of the targets of the action plan is to monitor the execution of rural development plans for 2000–2006 and to evaluate their impact. In addition, the action plan sets an objective of promoting the integration of biodiversity supporting measures into the programming of rural development measures co-financed by the EU.

4.3.1.5 Landscape

Landscape issues are hardly mentioned in the documents reviewed. The 6th EAP set an objective

of integrating landscape protection and restoration into agricultural and regional policy. The BAP for agriculture refers to maintaining landscapes and providing investment aid and capacity building programmes for landscape management under its objectives. Specific references to landscape are found in the Landscape Convention and the Pan-European biodiversity and landscape diversity strategy (PEBDLS). The Landscape Convention aims to 'promote European landscape protection, management and planning, and to organise European co-operation on landscape issues' (Article 3 of the Convention). However, neither of the two policies set specific targets nor have they well-defined instruments for enforcing compliance.

4.3.1.6 Use of pesticides

Existing Community legislation on pesticides (in the context of IRENA, only plant protection products are considered) mainly concentrates on the authorisation of products entering the market (Directive 91/414 concerning the placing on the market of plant protection products ([6]) and Directive 79/117/EEC concerning prohibited products ([7])) and on the control of residue limits in food and feedstuffs ([8]).

In July 2002, the Commission issued its Communication 'Towards a thematic strategy on the sustainable use of pesticides' in order to launch a stakeholder debate and prepare the actual thematic strategy. The thematic strategy is meant to cover the whole life-cycle of pesticides, by reviewing existing legislation and proposing new measures concerning the use phase of pesticides which is currently not sufficiently covered. The strategy, which is currently under preparation within the Commission, is intended to be adopted in 2006 and will probably include a range of requirements with various degrees of legal constraints.

4.3.2 Summary of the policy framework for environmental integration

The above review of Community strategies, Commission communications and environmental legislation relating to different environmental topics shows that the objectives and targets set in these documents can take a variety of forms. Strategy documents generally only state objectives but do not introduce specific targets, for example the Communication on 'Directions towards sustainable agriculture' calls for a reduction in the pressure exerted by agriculture on natural resources, but does not set clear targets (e.g. ... 'water pollution should be reduced to at least the levels compatible with sustainability'). Legislation is more likely to specify clear standards or quality targets to be achieved. Examples can be found in the nitrates directive (which sets a standard of 50 mg NO_3/l to identify areas where action is to be taken to prevent further nitrogen leaching in agriculture) or the proposed groundwater directive which defines a quality standard of 50 mg NO_3/l to be achieved in groundwater. Other documents point out the need for action in certain environmental areas, notably the 'Towards ...' Communications on the thematic strategies. In these documents one will find proposals for new policy instruments, e.g. introducing new or broadening the scope of existing legislation or economic instruments; the development of databases or other information systems providing baseline information on the state of environment; or better approaches for evaluating and monitoring the environmental effects of the use of existing instruments.

In many cases, the chosen objectives are difficult to verify; they propose the direction of change for policy but do not set quantifiable targets. In some cases deadlines are set for the development of new action plans or legislation, but their precise scope or ambition is not specified. Nevertheless, they can all contribute to the development of environmental policy and the integration of environmental issues in sectoral policies. After all, even general commitments are an indication of environmental issues for which policy makers have identified a need for action.

IRENA No. 3 'Regional levels of environmental targets' looked for environmental targets at national level and identified associated national action plans. In line with the findings at EU level, many countries have strategies relating to environmental issues, for example biodiversity and management of soil resources and landscapes, but few have set specific targets for addressing them. Nevertheless, for certain areas, including organic agriculture, water management, climate change, and air, individual Member States have created action plans and set

([6]) Council Directive 91/414/EEC of 15 July 1991 concerning the placing on the market of plant protection products. OJ L 230, 18.08.1991, p. 1.

([7]) Council Directive 79/117/EEC of 21 December 1978 prohibiting the placing on the market and use of plant protection products containing certain active substances. OJ L 033 , 08/02/1979, p. 36.

([8]) Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin and amending Council Directive 91/414/EEC. OJ L 70, 16.3.2005, p. 1.

targets (often based on EU initiatives and guidelines). However, not all are focused on the agriculture sector.

4.4 CAP instruments for environmental integration in the agriculture sector

4.4.1 Introduction: the approach to integration in the CAP

The Commission Communication COM (2000) 20 on agri-environmental indicators included several indicators related to the 'policy response' domain. Those indicators translate the CAP instruments for environmental integration as shaped after the CAP reform of 1999 (under 'Agenda 2000'). This is therefore the framework for analysing integration, even though the CAP 'tool box' for environmental integration has been enlarged and reinforced afterwards. Thus, political commitments to environmental integration have been translated into a wider range of agriculture policy instruments as well as environmental legislation. The design of legislation and policy instruments and their implementation at national level determine their overall effectiveness and efficiency and, ultimately, the success of environmental integration.

Several EU directives tackling environmental and nature conservation problems in the EU are either directly addressed at the agriculture sector (e.g. the nitrates directive) or have significant implications for it. This is due to the fact that a substantial proportion of the territory is covered by agricultural land (e.g. birds and habitats directives). The requirements placed on farmers by regulation can influence key driving forces such as input use and management practices and will, in turn, partly determine pressure, state and impact processes on the environment. At the same time, CAP policy instruments build on or support the implementation of environmental legislation through a variety of economic means (financial support, positive and negative incentives, advice etc), thereby influencing farmer behaviour in relation to the environment. CAP policy instruments are briefly described and evaluated with regard to their potential for addressing agri-environmental problems in the following sections.

As stated in Chapter 2, it is difficult to distinguish the specific effects of the CAP on the agricultural 'driving forces' (i.e. changes in input use, land use, farm practices, specific regional trends in the agriculture sector) from those of other factors (technological change, change in market demand, other policies, etc) and, consequently, also its impact on environmental change. However, understanding the agri-environmental dynamics in progress and how policy may have affected these dynamics is an essential step for drawing conclusions with respect to whether, and how, the CAP has to be adjusted in order to meet requirements of environmental integration. Despite evident difficulties, therefore, this is a critical challenge in monitoring the integration of environmental concerns into the CAP.

Figure 4.3 shows the policy mix that underpins the current approach to integration in the CAP. Changes in market support, certain rural development measures and environmental legislation are combined to provide positive and negative incentives to farmers. Farmers must observe a minimum reference level of environmental management (linked to good farming practice and environmental legislation — reinforced by cross-compliance) as a condition for benefiting from certain support regimes. However, where environmental management goes beyond the reference level farmers provide an environmental service that needs to be remunerated in relation to the resulting cost (and/or loss of income). Monitoring and evaluation are part of the policy tools supporting environmental integration as they are essential in assessing the effectiveness of individual measures, or a given policy mix. It should be noted that Figure 4.3 does not aim to provide a comprehensive (CAP) policy framework but focuses on measures that support environmental integration.

4.4.2 CAP instruments

The measures set out to address the integration of environmental requirements into the CAP encompass environmental requirements integrated in the market policy as well as targeted environmental measures forming part of rural development policy (see also Figure 4.3).

4.4.2.1 CAP market support

Environmental protection requirements

The concept of cross-compliance refers to the setting of conditions (in several domains) which farmers have to meet to be eligible for public support. It has been discussed in the EU since the early 1990s, and various reforms of the CAP have increased the importance of cross compliance as a policy tool for environmental integration.

In order to address some of the changes in farming practices which affect negatively the state of the environment, the CAP reform of 1999 (Agenda 2000) introduced for the first time the principle of compliance with environmental requirements. The

'Horizontal Regulation' (Article 3 of Regulation 1259/99, covering all payments granted directly to farmers) gave an option to Member States to introduce cross-compliance conditions relating to one or more environmental issues. Section 5.2.2 reviews in what way Member States made use of this possibility.

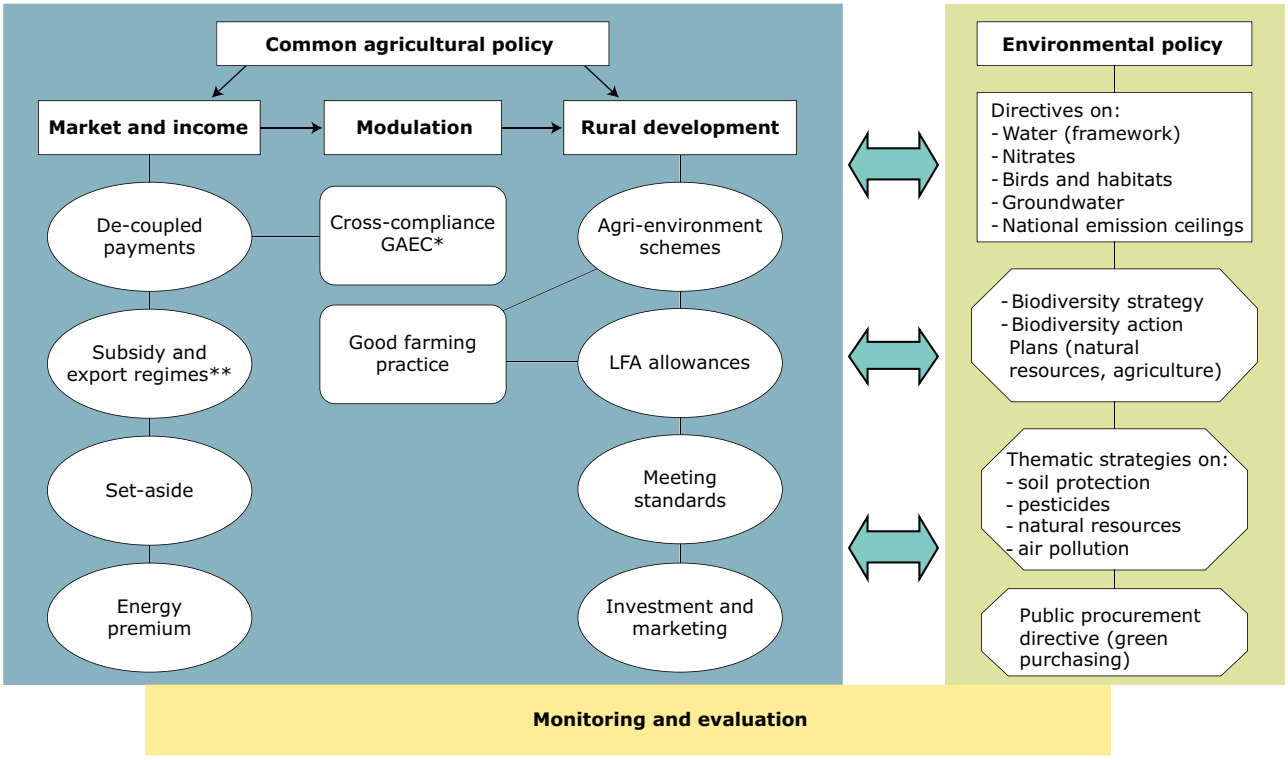
With the 2003 CAP reform, cross compliance has become compulsory. From 2005 onwards, farmers in receipt of CAP direct payments will be required to respect a set of statutory management requirements set out in Annex III of Council Regulation (EC) No 1782/2003. They also have to meet minimum requirements of good agricultural and environmental condition (GAEC), to be defined by Member States, on the basis of a Community framework given in Annex IV of the same regulation.

The statutory management requirements refer to 19 pieces of Community legislation in the areas of: public, animal and plant health; environment and animal welfare. Cross-compliance covers five pieces of environmental legislation, including the nitrates, birds and habitats directives. Cross compliance is therefore a means of further enforcing existing Community environmental legislation. Within the IRENA set of indicators, there is, however, no indicator covering the cross-compliance policy instrument.

4.4.2.2 Rural development measures

The so-called 2nd pillar of the common agricultural policy provides co-funding for a wide range of rural development measures. The current measures are all based on Council Regulation (EC) 1257/1999 — the rural development regulation (RDR) — and its amendments, which remains in

Figure 4.3 Agricultural and environmental policy instruments relevant to policy integration (July 2003)



* GAEC stands for 'good agricultural and environmental condition'.

** Not all market and income support is fully decoupled, e.g. in the sugar regime. Import tariffs and export subsidies remain part of the overall CAP support system.

Note: At the time of writing a new regulation on rural development was being prepared. This will introduce new relevant policy instruments, e.g. payments in Natura 2000 areas, cross-compliance in place of good farming practice (GFP), but will only be applied from 1 January 2007 onwards.

force to 31 December 2006. The RDR provides a menu of 22 measures (extended to 26 after the 2003 CAP reform), from which Member States, or their regions, can choose when designing Rural Development Plans (RDPs). These measures can be used to, for example, help farm businesses restructure, improve the processing and marketing of food, encourage environmentally sensitive land management and support farmers in less favoured areas.

It is possible to incorporate some environmental objectives into all measures within the RDR, but the measures where the environmental objectives are made most explicit, are the following:

- agri-environment measures;
- compensatory allowances for less favoured areas and areas with environmental restrictions;
- training programmes;
- support for investments in agricultural holdings (which includes environmental investments);
- protection of the environment in connection with agriculture, forestry and landscape conservation for the development of rural areas (Article 33);
- support to improving the processing and marketing of agricultural products.

According to the principle of subsidiarity, the selection of measures incorporated into the rural development plans is at the discretion of the Member States/regions concerned. All programmes have to include agri-environment measures, but the Member States/regions decide their scope, and the participation by farmers is voluntary.

Good farming practice

The rural development regulation requires that farmers entering into agri-environment schemes, or receiving less favoured area (LFA) payments, respect the usual standards of good farming practice (GFP) ([9]), across the whole of their farm. In addition, the GFP also acts as the baseline under agri-environment schemes for the calculation of additional costs and income foregone, which are meant to be compensated by the agri-environmental support. Member States shall set out verifiable standards in their rural development plans, which as a minimum must comply with general mandatory environmental legislation. The principle of GFP has the potential for shaping the behaviour of farmers towards meeting certain standards set out by existing legislation (e.g. the nitrates directive), or going beyond.

Agri-environment measures

Since the 1999 CAP reform, agri-environment programmes are the only obligatory measure that Member States must include in their rural development programmes and are seen as a key measure for environmental policy integration. Participation by farmers or other land managers in agri-environment schemes is voluntary.

Support is granted to farmers who commit themselves for a period of at least five years to use agricultural production methods designed to protect the environment or maintain landscape features. The RDR lists types of activities that can be supported under such schemes:

- ways of using agricultural land which are compatible with the protection and improvement of the environment, the landscape and its features, natural resources, the soil and genetic diversity;
- an environmentally-favourable extensification of farming and management of low-intensity pasture systems;
- the conservation of high nature-value farmed environments which are under threat;
- the upkeep of the landscape and historical features on agricultural land;
- the use of environmental planning in farming practice.

Member States are free to determine priorities they wish to address through such schemes in their territory, specify the farming methods and activities they require, and choose the geographic coverage of each scheme. As a consequence, there is a wide range of agri-environment measures in different Member States.

Support for less favoured areas

The compensatory allowances for less favoured areas (LFAs) were introduced in 1975 to ensure the continuation of farming in areas where natural handicaps caused lower agricultural productivity and farming was becoming vulnerable. Over time, this instrument has evolved into a measure that is important both for ensuring continued agricultural land use and supporting agricultural income in

([9]) Good farming practice will be replaced with cross-compliance rules from 1 January 2007 onwards.

vulnerable rural areas. It also helps maintain the landscapes and habitats that depend on farming.

Farmers applying for support have to commit to continue their farming activity for at least five years, and are obliged to adhere to the standards of Good farming practice as defined by the Member State or region concerned.

Support to areas with environmental restrictions

Special provisions of Article 16 of the rural development regulation allow Member States to establish a separate category of LFAs in areas where farmers are subject to restrictions on the use of agricultural land as a result of the implementation of the birds and habitats directives, i.e. in the areas designated under the Natura 2000 network. The system of payments can be set up by a Member State if, and in so far as, such payments are necessary to solve the specific problems arising from the implementation of those directives.

Training

Member States may include support schemes aimed at the improvement of vocational training for farmers based on Article 9 of the rural development regulation. According to the Regulation such support schemes shall contribute to the improvement of the occupational skill and competence of farmers and other persons involved in agricultural activities and forestry activities. It serves among others such objectives as preparing farmers for a qualitative reorientation of production, the application of production practices compatible with the maintenance and enhancement of the landscape, as well as the protection of the environment. EU expenditure for training measures incorporated into the RDPs and in the period 2000–2006 was set at 0.7 per cent of total Pillar II funds. Some information on environmental training measures can be found in the fact sheet for indicator No. 6 (Farmers' training levels).

Investments in environmental protection

The rural development regulation gives Member States two opportunities to support investments targeted on protecting the environment: investment in agricultural holdings and under Article 33, which covers support for any other measures relating to farming activities and their conversion. An objective of preserving and improving the natural environment is clearly stated as one of the objectives for investment in agricultural holdings. The objectives specified for Article 33 measures encompass a broader protection of the environment in connection with agriculture, forestry and landscape conservation. Related articles also allow for investments in agricultural water resources management and support for marketing of quality agricultural products. Eligibility of farms for investment support is dependent on the respect of minimum environmental requirements.

Promotion of the processing and marketing of agricultural products

The rural development regulation provides Member States with an opportunity to support measures aimed at improving the competitiveness of farmers and the food sector by improving the processing and marketing of agricultural products. Together with the provisions of Article 33, Member States can choose to support marketing of quality products, produced *inter alia* in ways compatible with the objectives of environmental protection. Organic farming or certain traditional low-input farming systems are examples where support for the processing or marketing of their products can help in achieving environmental objectives.

4.5 Review of the potential of policy instruments for environmental integration

The description of the policy instruments above shows that many of these appear to have considerable potential to meet environmental objectives in relation to soil, air, climate change, water, biodiversity and landscapes. Table 4.3 offers a simple overview of the potential — high, medium or low — of each tool to address broad environmental issues such as soil, air and water protection. This assessment is necessarily derived from expert judgement but provides a first indication of environmental relevance.

An important point to consider regarding the potential effectiveness of policy instruments is that they do not operate in isolation. For example, the requirements of a number of pieces of environmental legislation may apply to the same area of farmland at the same time. In addition, many measures can be seen to be complementary to each other. Agri-environment schemes, for example, build on GFP by requiring farmers to undertake farming practices that go beyond the baseline requirements defined by GFP at national or regional level. The overall environmental impacts of policy instruments acting in combination may therefore be far greater than

when considered in isolation. However, such effects are difficult to assess and evaluate.

On the basis of the information presented above, it can be said that considerable progress has been made in the framework of the CAP to develop policy instruments with the potential to meet environmental objectives and targets identified earlier. However, the degree of effective environmental policy integration is determined by implementation at Member State level. In the case of many policy instruments, Member States have a considerable amount of national discretion (according to the principle of subsidiarity) for using them. Decisions concerning the degree of targeting of instruments on environmental problems and their relative performance at farm level influence the overall impact. The subsequent response of farmers to policy instruments ultimately determines the environmental impacts witnessed on the ground.

The overall effectiveness of policy instruments is therefore a combination of the existing possibilities, in the context of the rules and regulations at EU level, the decisions on implementation taken at Member State level and, finally, farmers' responses to mandatory requirements and voluntary measures. Member State implementation of policy instruments is described in Chapter 5. Farmers' responses to policy instruments and measures are covered where information is available, for example with regard to the uptake of agri-environment schemes.

Table 4.3 Environmental potential of selected CAP policy instruments (status of 2003)

Policy measure	Soil	Air	Climate change	Water	Biodiversity	Landscape
Cross compliance	+++	+	+	+++	++/+++	+
Good farming practice	+	++	+	++	+	++
Agri-environment measure	++	+/++	+	+++	+++	+++
Less favoured areas (LFAs)	-	-	-	-	++	++
LFA — Areas with environmental restrictions (linked to the birds and habitats directives)	-	-	-	+	++/+++	++
Training	+/++	+	+	+/++	+/++	+/++
Investment support	+/++	+/++	+/++	+/++	+/++	+/++
Marketing and processing support ([10])	+/++	+	+	+/++	+/++	+/++
Energy crop payment	-	+	+	-	-	-

Key: -/+/++/+++ = the measure has no/low/medium/high potential to deliver environmental protection and enhancement. Low/medium/high potential are estimated by considering the potential area or share of farmers covered by the instrument, the degree of management change induced or required by its application, and the likelihood of inducing change that would otherwise not have happened.

Note: The ultimate impact of all policy measures depends on their implementation at the national or regional level.

([10]) The positive impact of support to the marketing and processing of products is estimated in relation to production methods which are beneficial to the environment (e.g. organic farming, certain traditional farming methods and land use systems).

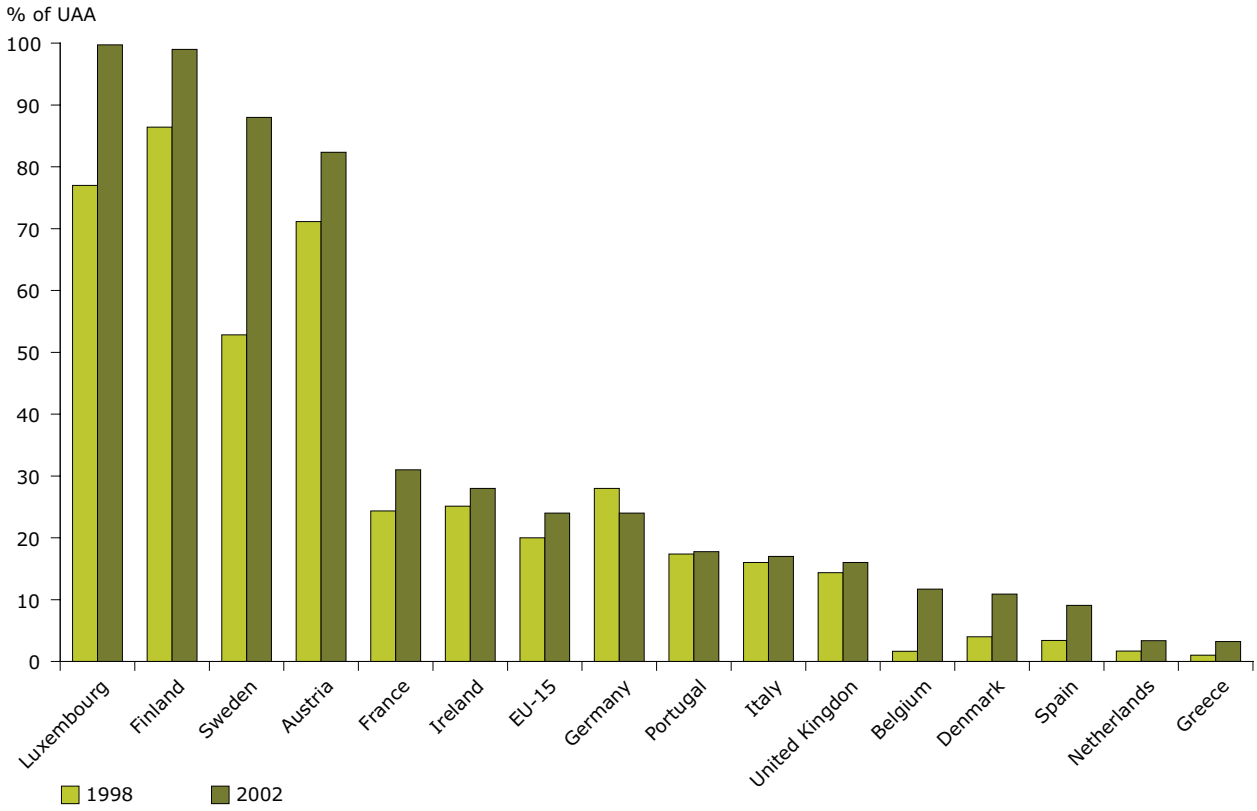
5 Assessing environmental integration in EU agriculture policy

5.1 Introduction

Chapter 4 has shown that there is a wide range of environmental legislation and CAP policy instruments with the potential to meet environmental objectives and targets established at EU and national level. Understanding how these policy instruments have been implemented at Member State level, and farmers' responses to them, is critical to evaluating the overall progress towards environmental integration in EU agriculture policy.

The first part of this chapter describes the implementation of various policy instruments at Member State level showing different implementation patterns (Section 5.2). Information on the implementation of policy instruments at Member State level has been drawn from a wide range of sources, such as the IRENA indicators themselves, Member State reports, and published evaluations and studies. The policy instruments considered in this chapter are, firstly, those for which IRENA 'response' indicators exist: Agri-environment schemes (IRENA No. 1) and Good farming practice (IRENA No. 2). Secondly, other relevant CAP instruments are considered to give a fuller reflection of how the evolved CAP framework provides further opportunities for integrating environmental

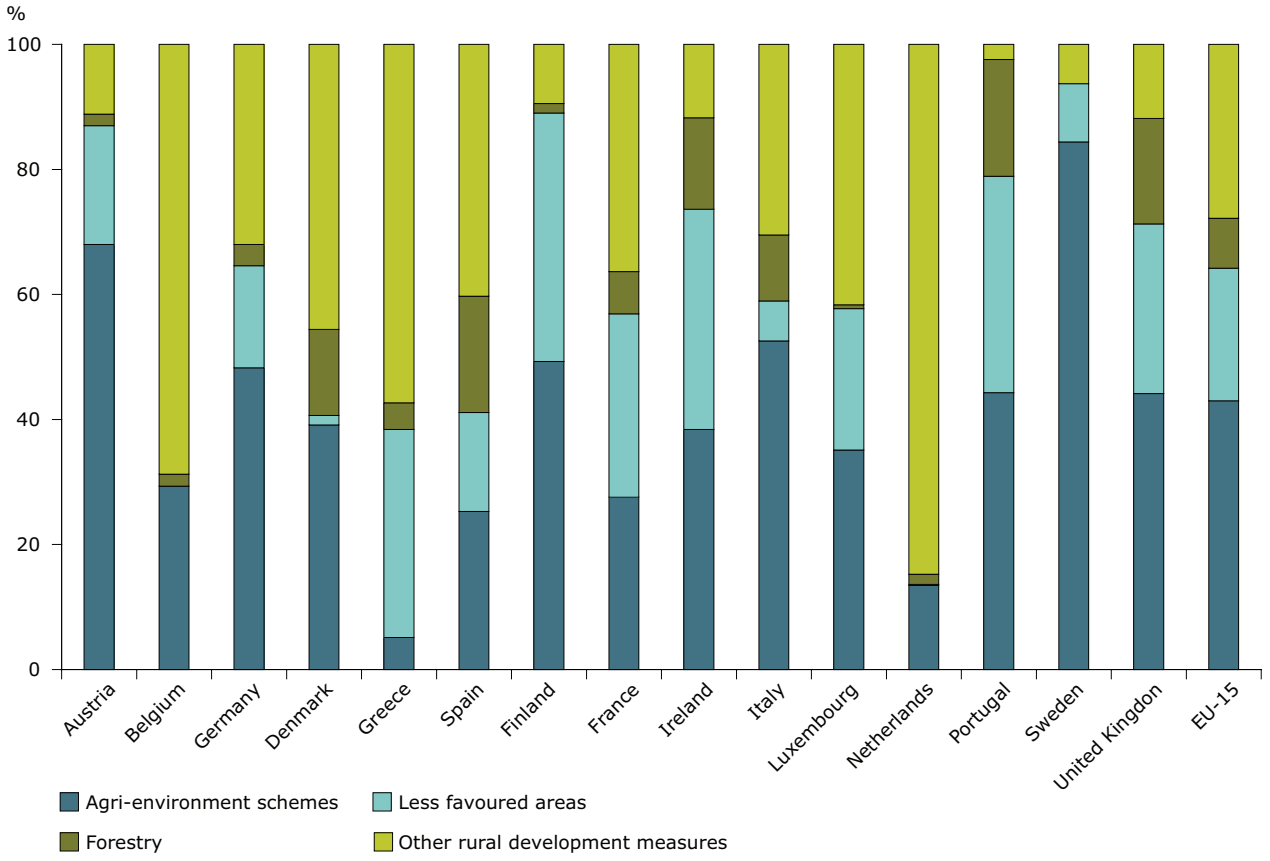
Figure 5.1 Share of agricultural area (UAA) enrolled in agri-environment schemes (1998–2002)



Source: DG Agriculture and Rural Development (DG AGRI), Common indicators for monitoring the implementation of rural development programmes, 2002, and DG AGRI — Working document VI/7655/98.

Note: The data include agri-environment contracts under the predecessor Regulation (EC) 2078/1992 and contracts signed in 2000-2002 under the current Regulation (EC) 1257/1999.

Figure 5.2 Total EAGGF-Guarantee expenditure by type of rural development measure (2003)



Note: The EAGGF-Guarantee fund provides most but not all EU support for rural development measures. Consequently, the share of agri-environment schemes and LFA payments is smaller when compared to total EU rural development spending.

Source: European Commission, 2004.

concerns. These include cross compliance and less favoured areas.

Where possible, data on the geographical implementation of each measure in all EU-15 Member States is presented. It has not been possible however to find information covering all EU-15 Member States for all measures. Furthermore, it was not possible to gather information on the national (or regional) design and environmental impact of the different policy instruments analysed.

The second part of this chapter (Section 5.3) presents two case studies: nutrient management and the conservation of farmland biodiversity. An assessment of progress towards policy integration in relation to these issues is made drawing on the IRENA indicators and information on implementation patterns. Case studies draw out lessons for the appropriate design and mix of agri-environmental policy instruments.

5.2 The implementation of policy instruments by Member States

5.2.1 Assessment of IRENA indicators

5.2.1.1 Agri-environment schemes

IRENA No. 1 shows that the importance of agri-environment measures has increased over time. In 1998 approximately 20 percent (25.2 million hectares) of the utilised agricultural area (UAA) of the EU-15 was covered by management contracts. This had risen to 24 percent (30.2 million hectares) in 2002. A wide range of uptake levels in different Member States contributes to this average. Coverage goes beyond 75 percent in Finland, Luxembourg, Sweden and Austria. However, it reaches less than 10 per cent in Greece, Spain and the Netherlands. A range of factors, including national budgetary resources, contributes to these differences. Figure 5.1 illustrates the development in the proportion of

UAA covered by agri-environment management contracts between 1998 and 2002. The Community expenditure on agri-environment measures has increased significantly from less than 50 million EUR in 1993 to reach nearly 2 012 million EUR in 2003.

In terms of overall funding, many Member States spend significant proportions of the Community contribution to rural development on agri-environment schemes (about 40 % under EAGGF-Guarantee). The compensatory allowances for LFAs are the second largest measure, taking up about 20 % (Figure 5.2). The total EU rural development budget includes the EAGGF-Guidance fund, which does not co-finance these two measures. In terms of the total EU rural development budget agri-environment schemes and LFAs have a share of 30 % and 11 %, respectively.

However, IRENA No. 1 shows that at EU-15 level the average annual agri-environment expenditure is 16 EUR per ha UAA from the Community budget. The national co-financing has to be added to this figure. From 1992 to 2003, the EU budget financed up to 50 % (in regions outside Objective 1) or 75 % (within Objective 1 regions) of the total expenditure. The level of the agri-environment expenditure varies considerably between (and within) Member States. Eight Member States (Austria, Finland, Sweden, Luxembourg, Ireland, Italy, Germany and Portugal) show annual agri-environment expenditure per ha UAA above the EU-15 average, often to a large degree. It ranges from 20 EUR/ha UAA in Portugal to 90 EUR/ha UAA in Austria. The other seven Member States only reach a maximum of 8 EUR/ha UAA expenditure per year, ranging from 3 EUR/ha UAA in Greece to 8 EUR/ha UAA in Belgium.

The issues that agri-environment schemes most frequently address are ([11]):

- reduction of inputs, including support for integrated production, and extensification of farming (11.4 million hectare, 40 % of the total agri-environment area across the EU-15);
- support for conversion to and continuation of organic farming (2 million ha, 7 %);
- management aiming at the protection or enhancement of biodiversity and landscapes, including conversion from arable land to permanent grassland (8.1 million ha, 30 % of area covered);
- support for maintenance and increase in numbers of rare breeds of livestock, and less frequently traditional crop varieties.

In some countries and regions measures to prevent soil erosion and reduce water use are addressed via agri-environment programmes.

Uptake and expenditure levels do not give any indication of the environmental effects of the programmes, but do indicate the general level of attention to agri-environment values or problems in the Member States or regions concerned. The effective targeting of the measures is likely to be a critical factor for their success. However, data on the spatial distribution of different types of schemes and geographic targeting of environmental issues is lacking, making further assessment difficult. Greater attention to the monitoring and evaluation of the environmental effects of agri-environment schemes is needed overall. The conclusions from IRENA No. 1 are that the great diversity of implementation shows that agri-environmental measures can be adapted well to the very diverse agricultural conditions across the EU and are targeting the main environmental issues of concern. The compulsory nature of the measure has also helped to ensure a wide application throughout the EU agricultural area. However, a substantial effort is needed to improve data collection on agri-environment schemes, particularly concerning their spatial distribution and environmental focus, and the monitoring and evaluation of their environmental effects.

5.2.1.2 Good farming practice

IRENA No. 2 aimed to understand the extent to which codes of Good farming practice cover the most important 'driving forces' of environmental concerns. The key messages from this indicator are as follows (see also Table 5.1):

- Member States have chosen a variety of approaches to defining codes of good farming practice (GFP) ranging from a fairly limited selection of requirements to a broad coverage of categories of agricultural practices. In most Member States, mandatory standards of GFP consist of existing EU, national and/or regional legal obligations. Only a few countries define standards at farm level going beyond legislation, or covering issues such as biodiversity and landscape.

([11]) These figures only refer to the period 2000–2002. Many national agri-environment schemes are included in the broad category 'other', which covers a wide range of issues and can include sub-measures for organic farming, for example.

- The codes of Greece, Portugal and the United Kingdom are the most comprehensive with a high coverage of agricultural practices considered as having particular relevance for the environment. France, Luxembourg, the Netherlands, Sweden and Finland have the most targeted codes for certain agri-environmental issues covering less than half of the total number of agricultural practices.
- Most Member States have defined standards in the field of fertilisation and pesticide management. However, there is a clear emphasis on these aspects in Austria, Denmark, Germany, Italy, the Netherlands and Luxembourg. All the countries include requirements for plant protection while these are particularly detailed and strict in Germany and Ireland.
- Many standards for soil management have been included in the codes of Portugal and Greece. Good farming practices in relation to irrigation methods and equipment are addressed in the codes of all Mediterranean countries. The United Kingdom and Ireland place high emphasis on practices relative to pasture management, field boundaries, biodiversity conservation and landscape elements. Limits on stocking density to avoid overgrazing and undergrazing are also set out in Spain, Portugal, Greece and France. Moreover, some recommendations for maintaining uncultivated strips in field boundaries and hedgerows are provided in Portugal, Greece and Luxembourg.
- Greece and Portugal have followed an advisory approach in drafting their codes, with half of the good farming practices not being legally binding. On the other hand, the codes of some of the Member States where the whole territory is designated as zones vulnerable to nitrate pollution (Austria, Denmark, Finland, Germany, Luxembourg and the Netherlands) mainly consist of legally binding standards. In Sweden and the Flanders region of Belgium, existing legislation has also been chosen as the basis for GFP. Italy (region Emilia-Romagna), Spain, France, Ireland and Germany have chosen a mixed regulatory/ advisory approach and their codes also include standards going beyond legislation (in the form of recommendations or verifiable standards).

The different approaches for drafting the codes of GFP show how Member States have taken advantage of the flexibility offered to them and developed GFP appropriate to national/ regional situations. They suggest that Member States have used this measure in a targeted way in as much as standards are being set for specific environmental issues, which focus on those of concern. Overall, the codes of GFP are considered to be of value in guiding farm environmental management and the development of agri-environment measures. However, information on the choice of GFP standards does not suffice to understand environmental outcomes due to a lack of data regarding change at farm level and the geographic targeting of different standards.

Table 5.1 Assessment of environmental issues covered by national codes of GFP

Farming practices	BE-Fl	BE-Wa	DK	DE	GR	ES	FR	IE	IT-ER	LU	NL	AT	PT	FI	SE	UK
Soil management	□	■	□	□	■	□	—	□	□	—	—	□	■	□		□
Water use: Irrigation	—	—	—	—	■	■	■	—	—	—	—	—	■	—	—	—
Fertiliser management	■	■	■	■	□	□	■	■	■	■	■	■	■	■	■	■
Pesticide management	■	■	■	■	□	■	□	□	■	■	■	■	□	■	■	■
Waste management	—	□	□	—	□	□	□	□	□	□	□	—	□	□	—	□
Pasture management	—	□	—	—	□	□	■	■	—	■	—	—	□	—	—	■
Biodiversity and landscape	□	□	□	—	■	□	□	■	—	□	—	□	□	□	□	■

■ Priority issue — Issue not covered □ Issue addressed

Note: In Sweden, the mandatory requirements aiming at biodiversity and landscape conservation are eligibility criteria exclusively for the specific agri-environment measures aiming at the conservation of biodiversity and cultural heritage. Austria, Sweden and Germany have national legislation on waste, not included in the codes of GFP.

Source: Based on assessment of national/regional codes of good farming practice included in rural development programmes (period 2000–2006).

5.2.2 Other policy instruments

5.2.2.1 Environmental requirements for market support

The information presented below is based on the national implementation of environmental requirements in accordance with Article 3 of the 'Horizontal Regulation' (direct support schemes). Article 3 required Member States to take appropriate measures to ensure that agricultural activity within the scope of the 'Common Rules Regulation' was compatible with 'environmental protection requirements' (see Section 4.4.2.1).

A review of the application of Article 3 for the period 2000–2004 (European Commission, 2004b) shows that most Member States introduced (limited) cross-compliance conditions for farmers to comply with environmental protection requirements as a condition for benefiting from market support. These were mostly conditions attached to arable/set-aside payments and, to a lesser extent, livestock payments, with few countries defining general mandatory environmental requirements.

Additional implementation patterns include the following:

- Two countries (Germany and Sweden) chose the option of establishing general mandatory environmental requirements. These Member States have applied sanctions in case of infringements proportionate to the seriousness of the environmental consequences. However, the granting of support has not been linked to the respect of the environmental provisions.
- The remaining Member States chose the option of setting out specific environmental requirements (standards to be applied by farmers) as a condition for direct payments.
- Austria, the Netherlands and France set up environmental requirements for arable crops and/or set-aside areas. France implemented standards for irrigated arable crops.
- Denmark, Spain, Italy, the United Kingdom, Ireland and Finland introduced requirements for crops and livestock. Ireland and Finland have laid down requirements aiming at biodiversity protection. Ireland is the only country having provisions on landscape (protection of features of historical/archaeological interest and

Table 5.2 Overview of the use of cross-compliance under Regulation 1259/1999 to address environmental issues in Member States

Member State	Soil	Water quality	Use of water (irrigation)	Climate change/ air pollution	Biodiversity/ landscape
Austria		X			
Belgium		X			
Denmark		X			
France			X		
Finland	x	X			x
Germany		x			x
Greece	x				X
Italy	x	x			
Ireland	X	x		X	X
Luxembourg					
Netherlands	X	x			x
Portugal					
Spain	X	X	X	X	
Sweden	X	X			x
United Kingdom	X				x

Source: IEEP, 2004 ([12]).

Note: The small and large 'x' indicate the expected impact of the measures introduced on the issue in question. The term 'soil' covers erosion, loss of organic matter, pollution and protection of soil-based habitats. Where regulations concerning pesticides were cited in national cross-compliance conditions it was assumed that the substances covered have an effect on biodiversity and water quality.

([12]) Further information on the implementation of cross-compliance policy can be found on the following website: http://www.ieep.org.uk/projectMiniSites/crosscompliance/index.php.

maintenance of the visual appearance of the farm) and animal welfare.

The uneven implementation of the cross-compliance option of article 3 among Member States was one of the factors that led to the establishment of compulsory cross-compliance in the 2003 CAP reform.

By the end of 2004, some countries had used Article 3 to address specific environmental problems, e.g. irrigation in France, control of overgrazing in the United Kingdom, limits on pesticide use on maize in the Netherlands, but this has not been the case in all Member States. Table 5.2 shows which environmental issues were addressed by Member States when applying the cross-compliance options of Article 3.

5.2.2.2 Less favoured areas

Compensatory allowances in less favoured areas (LFAs) is an optional measure within the rural development regulation (RDR) used by all Member States except for Belgium. However, in Denmark and the Netherlands it is an insignificant element of expenditure. This wide range of implementation can be expected as a result of variation in the factors affecting soils, altitude and climate. It also reflects differing national priorities for the use of RDR funds.

More than half of the UAA in the EU-15 is designated as LFA, but there is great variation between countries, from 1 percent in Denmark to 98 percent in Luxembourg. Nine countries (Sweden, Finland, Austria, Portugal, Luxembourg, Italy, Ireland, Spain and Greece) have more than 50 % of their total UAA designated as LFA.

In general, LFA support is used more in the northern countries and less in the Mediterranean area, where investment in farm structures and improvement of productivity appear to be the priority objectives. Member States define the objectives of their LFA policy within the framework of their national RDP, but there are differences of emphasis. In Austria, where maintenance of mountain farming is vital for the rural economy and also the tourist industry, there is a clear objective to reward farmers for the public goods they produce. In France, the LFA allowances aim at maintaining farming in each region and favouring smaller farms. Flexibility applied to the varying objectives and budget priorities in different Member States has resulted in a very wide range of implementation models.

Member States apply the criteria for defining LFAs set up in the RDP within their own territory. For land at risk of abandonment (which represents nearly two thirds of the EU-15 total LFA area) the criteria are poor land productivity, poor economic performance and a low or dwindling population dependent on agriculture. However, these indicators need only be compared to other agricultural areas within the Member States, not with EU standards. The area designated as LFA has grown steadily since 1975 and the European Court of Auditors has called for an improved targeting of the LFA measure by Member States (European Court of Auditors, 2003).

5.2.2.3 Areas with environmental restrictions

Support for areas with environmental restrictions was the least prevalent of all rural development measures in 2001. It was implemented only in some regions of Germany, Italy and Spain covering a total of 58 000 hectares on 4 156 holdings (95 % of these were in Germany). Delays in designating the Natura 2000 sites and the related management plans may have played a certain role in the limited take-up of this measure.

5.2.3 Summary

Four policy instruments were presented in this section: agri-environment schemes, good farming practice (GFP), cross-compliance and less favoured area payments. The first three are most clearly designed for improving environmental management whereas for LFA allowances this appears to be a side benefit of their principal objective of ensuring the continuation of farming in marginal areas of the EU. The exception is the measure for areas with environmental restrictions. Agri-environment schemes and LFAs provide incentive or compensation payments while GFP and cross-compliance introduce minimum standards farmers have to comply with to be eligible for different types of subsidies. Evidence for improved environmental management by farmers as a result of the application of a policy instrument is strongest for agri-environment schemes, but even in this case monitoring and evaluation procedures have to be improved.

5.3 Case studies on the integration of environmental concerns into EU agriculture policy

Assessing progress towards the integration of environmental concerns into EU agriculture policy is a challenging task. So far, this report has identified agricultural driving forces that lead to impacts on the environment. Commitments made at EU and

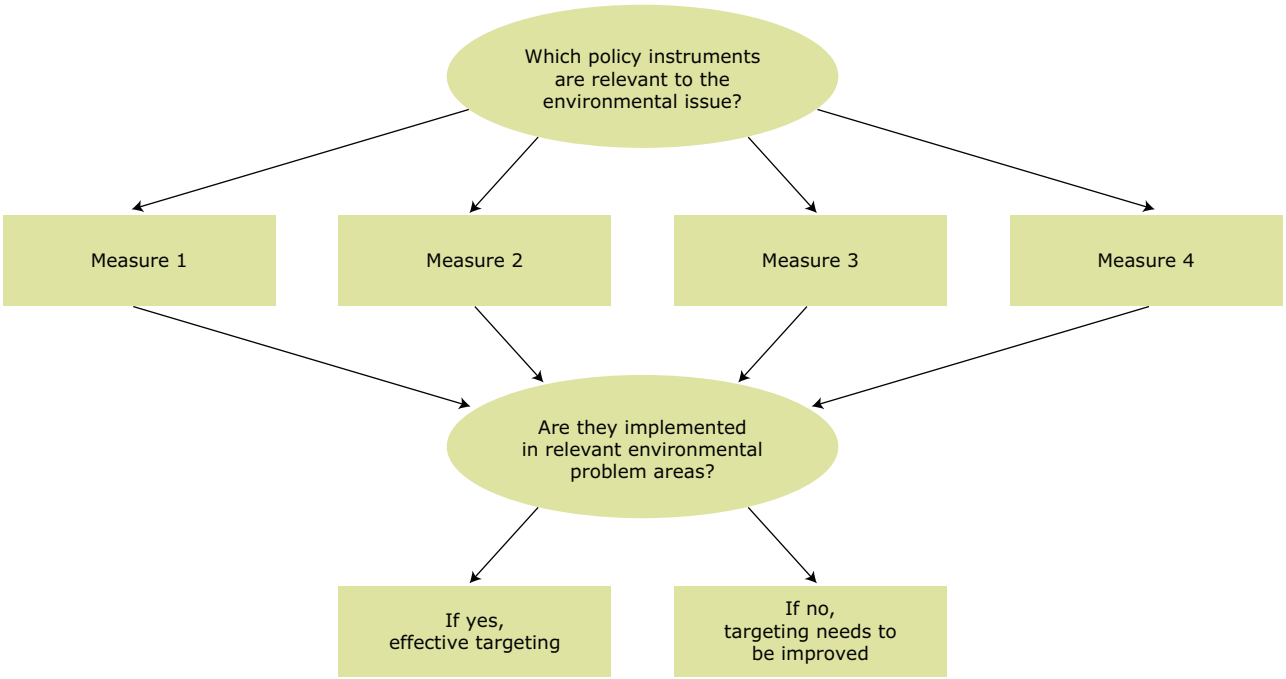
national level to resolving environmental problems have been identified and the potential of various policy instruments to help resolve such problems has been assessed. The use of some of these policy instruments at Member State level has been reviewed and patterns of implementation described. It is clear from this work that, in general, progress has been made in integrating environmental concerns into EU agriculture policy, particularly its rural development pillar. Environmental concerns in relation to agriculture have been identified, commitments to resolving those problems have been made, and policy reforms have resulted in the design of agri-environmental policy instruments with the potential to address them. The IRENA indicators, as well as other information gathered, show variable policy implementation patterns in EU Member States.

However, this task does not allow evaluating the extent to which policy instruments are being used effectively to target specific environmental issues. The remainder of this section attempts, therefore, to assess more comprehensively the extent of policy integration by using two case studies. The environmental issues of biodiversity protection and nutrient management have been chosen to analyse the degree to which policy instruments are being used to address these issues. Comments on the usefulness of the 42 IRENA (sub-)indicators in this process are made and the availability of other information relating to policy implementation is assessed. In particular, the extent to which policy instruments are being used in a targeted way is considered, including examples of best practice.

Geographic or spatial targeting is only one element in the effective use of (agri-environmental) policy instruments in tackling environmental issues. In the context of this report it was not possible, however, to gather information on the national (or regional) design and environmental impact of the different policy instruments analysed. Some points regarding these issues and appropriate policy mixes are drawn out in selected examples of good policy practice.

Figure 5.3 explains the approach taken in analysing policy targeting. As a first step relevant policy instruments are reviewed (building on previous chapters). Then we consider, as far as possible, whether they are applied in areas where environmental management needs to be improved. Using statistical analysis it is thus possible to determine whether relevant policy measures are targeted on areas of environmental concern. To use the NUTS 2/3 level information that is available for many IRENA indicators we constructed 68 regions for the EU-15 as common denominator between the indicators employed. This allows a more differentiated targeting analysis than is possible with national data. As no regional data on agri-environment schemes were available for France

Figure 5.3 Approach to targeting analysis



and Sweden, these countries were excluded from the statistical analysis due to the large variation in agronomic and climatic conditions across their national territories.

5.3.1 The protection of farmland biodiversity

5.3.1.1 Analysis of IRENA indicators in relation to biodiversity protection

Section 3.6.1 has revised relevant indicators for assessing agriculture's impact on biodiversity. The following analysis focuses on IRENA Nos. 1, 2, 4 and 7, which provide data on the extent to which different policy instruments contribute to the protection of farmland biodiversity and hence to policy integration.

IRENA No. 1 (Area under agri-environment support) is particularly important in as much as agri-environment schemes are specifically aimed at achieving positive environmental management. Two sub-indicators showing protection effort were constructed. These are the total agri-environment expenditure per ha UAA, and the share of agri-environment area under nature and landscape schemes per ha UAA. There is considerable variation, both between and within Member States, in terms of annual expenditure per ha of UAA as well as in terms of the agricultural area enrolled in agri-environment measures. In itself, this indicator does not provide direct information about the environmental effectiveness of agri-environment schemes, nor whether schemes are targeted at those areas where biodiversity protection is most needed (IRENA No. 4 and No. 26 are relevant here). It does, however, give some indication of the policy response at regional or Member State level. Low levels of expenditure per ha of UAA and low coverage of schemes in some countries, especially in southern Europe, suggest that the potential of this policy instrument for protecting farmland biodiversity is not being fully realised.

IRENA No. 2 (Regional levels of good farming practice) shows the extent to which Member States have defined good farming practice standards for biodiversity protection. All countries apart from Germany, Italy (Emilia Romagna), the Netherlands and Finland include standards in GFP that relate to biodiversity protection. In some countries, such as Greece, Sweden and the United Kingdom, such standards appear to be a priority in relation to other environmental issues. While the indicator gives some sense of whether biodiversity standards are a priority or not, it is not sufficiently detailed to show what aspects of biodiversity protection are included.

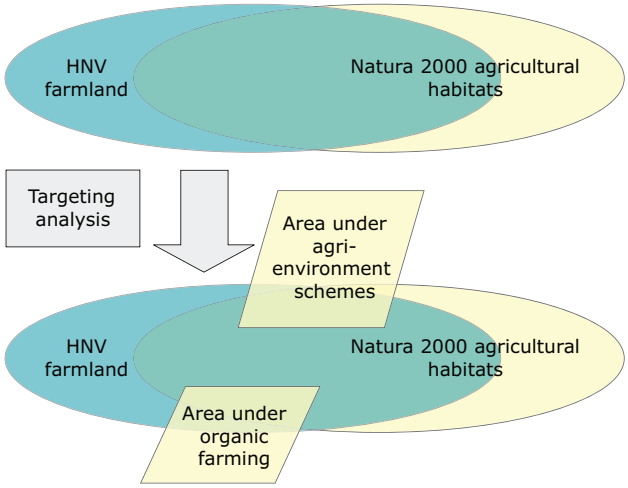
IRENA No. 4 (Area under nature protection) shows the proportion of Natura 2000 sites covered by targeted habitats (those included in Annex 1 of the habitats directive) that depend on a continuation of extensive farming practices, such as hay-making or extensive grazing. The share of targeted agricultural habitats within Natura 2000 ranges from 0 to 82 % for 381 administrative regions of the EU-15 with an average of 17 %. The United Kingdom, the western part of the Iberian peninsula, most of Italy and southeast France as well as the northern part of Scandinavia have high proportions of Annex 1 habitat types in their Natura 2000 sites. These are areas where high proportions of extensive agricultural habitat types are protected under the habitats directive. In order to maintain these areas of conservation importance, appropriate management regimes — primarily extensive farming practices — need to be maintained or introduced. This indicator shows the degree of importance Member States place on the protection of farmland biodiversity in as much as they are prepared to designate important sites using the habitats directive. However, it does not provide any information on the management of such sites or on the extent to which biodiversity is actually protected.

IRENA No. 7 (Area under organic farming) shows the area under organic farming and the share of organic farming area in the total utilised agricultural area. In 2002, the organic farming area reached 3.7 % of the total UAA for the EU-15, up from 1.8 % in 1998. Austria, Italy, Finland, Sweden, Denmark and Germany had a higher share than the EU average. In itself, organic farming is not a specific biodiversity protection measure but rather a system of farming that results in general environmental conditions that have been shown to be beneficial for biodiversity (IRENA No. 7, Hole *et al.*, 2005). The area covered by organic farming is therefore only an indirect indicator of farmland biodiversity protection. The currently available information does also not allow a site-specific analysis of whether organic farming is promoted in, or targeted on, specific areas of conservation concern.

5.3.1.2 Analysis of the spatial targeting of policy instruments using IRENA indicators

Having evaluated the four IRENA indicators above, data on the spatial distribution of three of them (No. 1, No. 4, and No. 7) were cross-linked to see whether they show spatial overlap, i.e. are 'targeted' on each other. Figure 5.4 explains the approach

Figure 5.4 Concept of the targeting analysis for biodiversity



taken for the targeting analysis. The 'biodiversity hotspots' to be primarily addressed by relevant policy response measures can be represented by IRENA indicators 4 and 26 ('Area under nature protection' and 'High nature value farmland'). The targeting analysis investigates whether selected policy responses ('Area under agri-environment schemes' and 'Area under organic farming') show a geographical overlap with the 'biodiversity hotspots'. An effective policy targeting is likely to occur if the 'hotspot' regions would have a larger area under agri-environment or organic farming management than other regions.

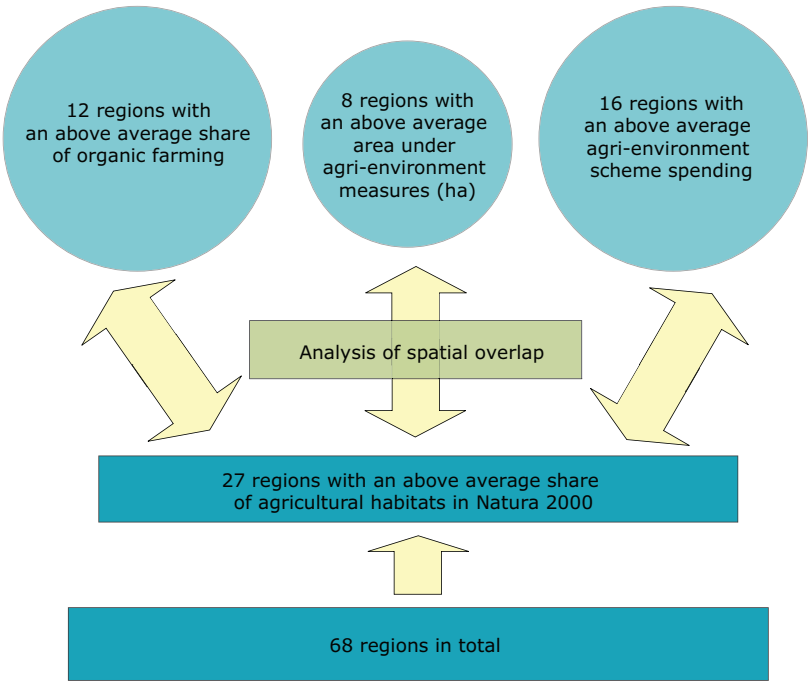
For this purpose the geographical information was aggregated to the reporting level of IRENA No. 1, excluding Sweden and France for which no regional data could be obtained. This resulted in 68 regions in the remaining EU-15 territory. The degree of implementation of agri-environment measures (IRENA No. 1) and organic farming (IRENA No. 7) in the targeted agricultural areas identified by IRENA No. 4 was analysed (no geographical data were available for IRENA No. 26).

IRENA No. 4 identifies agricultural habitats within Natura 2000 sites that require maintenance via extensive agricultural management. 27 regions of the 68 have a significant share (above 17 %) of these targeted agricultural habitats. Of these 27 regions:

- 16 regions have an above average regional expenditure on agri-environment schemes (2000–2003 average);
- 8 regions have an above average regional area (ha) under landscape and nature related agri-environment measures;
- 12 regions have an above average share of organic farming.

A comparison of the number of the 27 regions selected for IRENA No. 4 that also have above average values for the other indicators showed that there was no good geographical match between the indicators. A good match would be indicated if the indicators chosen for comparison had a similarly high number to that of IRENA No. 4. However, of

Figure 5.5 Outcome of the targeting analysis for biodiversity



the 27 regions selected for high values in indicator No. 4 only 12 had a high share of organic farming area. Equally, only 16 (8) regions with a high share of Natura 2000 agricultural habitats also had a high share of agri-environment scheme area (or nature and landscape oriented agri-environment contracts), respectively (see Figure 5.5).

To draw clearer conclusions, two statistical tests were carried out (ANOVA and chi square test). These showed that there is no statistically significant relationship between regions with a high share of targeted Natura 2000 habitats and any of the other three indicators. There is therefore no evidence of spatial targeting of the selected policy measures on regions with a large biodiversity resource to be protected on the basis of IRENA No. 4.

5.3.1.3 Positive examples of agri-environment schemes

The environmental effectiveness of agri-environment schemes does not only depend on their spatial targeting but also on the design of the scheme prescriptions. It is not possible to provide an in-depth review of such aspects within this report — see Kleijn and Sutherland (2003) for further details with regard to biodiversity. However, to give adequate regard to the important issue of effective implementation three national agri-environment scheme examples are reviewed. These show how good design and implementation of policy instruments can support policy integration objectives. The following paragraphs describe approach and results of selected schemes in Germany, the United Kingdom and Spain.

Germany

The German land Baden-Württemberg has introduced a floristic field method in its agri-environment scheme (the 'MEKA programme') to additionally reward farmers according to the plant diversity of grassland sites. The method, co-initiated by BirdLife Germany, ensures that farmers receive extra agri-environment payments for grassland sites that contain at least four plant species or genera from a catalogue of 28 species. To simplify identification, the catalogue includes only herbal species but no grass species since these are more difficult to identify. The farmers receive a leaflet with colour pictures of all mentioned species in order to identify these themselves. A reward of 50 EUR per hectare is given if at least four of the species are found along a diagonal transect (one metre wide) of the plot, which has been divided into three pieces (each piece must contain the species). The site can also be divided into smaller plots according to natural boundaries. The farmers submit the information on their species-rich grassland in the frame of their scheme applications. However, a control system with spot checks is maintained by the regional authorities. In spite of initial scepticism among farmers and authorities, the new approach has been introduced successfully and effectively encourages farmers to better incorporate nature conservation objectives into their grassland management (Oppermann and Gujer, 2003).

United Kingdom

The arable stewardship pilot scheme (ASPS) was established in 1998 and ran for three years. The objective was to assess different arable management options for conserving and enhancing farmland biodiversity. The scheme's particular aims were to provide feeding and breeding sites for declining farmland birds, to encourage the establishment of a range of arable plants (as well as improving plant diversity), and to provide habitats for a wide range of mammals, insects and spiders. The pilot scheme was launched in the West Midlands and East Anglia (to test areas with different soil and farming systems). It offered payments to participants, through either five or six-year agreements, to manage arable land under five main options that aim to encourage wildlife. Options included overwinter stubbles, undersown spring cereals, beetle banks and wildlife seed mixtures. Despite some limitations, monitoring results indicated that the pilot scheme was delivering biodiversity benefits, and selected options have now been incorporated within the England wide Countryside Stewardship scheme (Evans *et al*., 2002). This shows a good example for using scientific evidence from pilot studies in final scheme design.

Spain — The cereal steppe programme in Castilla-Leon

The application of this regional agri-environment programme started in 1993. The objective was the introduction of agricultural practices compatible with the conservation of the habitat of steppe birds. In the beginning, the programme was designed around four types of contracts. The two first (1 and 2) were offered in different sub-regions of the programme but were largely identical. The last ones (3 and 4) aimed at the long-term set-aside of land and at the conservation of rare crop varieties. In 1997, an extension of programme to 2002 was approved and the action areas were unified and the basic contracts (1 and 2) simplified in one (Azcárate, 2004).

The results of this agri-environmental programme have been significant. In 2000, the last year where

new applications were admitted, the number of type 1 and 2 contracts was 2 614 with a total area of 215 000 ha (close to the 13 % of potential area), and a total cost of 21.4 million EUR. In the same year, the number of type 3 and 4 contracts was 287 with an area of 4 465 has and a total cost of 0.94 million EUR (Azcárate, 2004).

In 1998, a first evaluation of the programme showed a change in production trends on the farms under agreements, with increases of fallow (13 %) and legumes and grassland (5 %), and a decrease of cereal area (17 %). The reduction in the use of fertilizers was estimated to be 29 % and the area treated with chemical products was reduced by 13 % (Azcárate, 2004).

A study by Alonso *et al.* (2003), which looked at the status and trends of the great bustard (Otis tarda) population in the Iberian peninsula, showed that Castilla y León, with a total of 10 680 great bustards, contains more than 40 % of the total estimated population. Based on a regional census, the study demonstrated an increase in the great bustard population during the last 10–15 years, which among others factors is ascribed to the regional agri-environment scheme. In general, it estimated that the cereal steppes programme had succeeded in improving habitat quality, changing the homogeneous landscape structure and achieving good conditions for the conservation of steppe bird populations (Paniagua, 2001).

5.3.1.4 CAP instruments relevant to biodiversity protection

Sections 4.4 and 4.5 have assessed the potential of policy instruments meeting environmental objectives and concluded that cross compliance and agri-environment schemes were important measures in the context of environmental protection. The establishment of good farming practice and support to less favoured areas are also potentially useful for responding to problems arising from agriculture's interaction with the environment. The introduction of these policy instruments since 1990 suggests gradual progress has been made in terms of environmental integration in EU agriculture policy, within both Pillar I and Pillar II of the CAP.

Section 5.2 described the implementation of those policy instruments at Member State level and highlighted differences in implementation patterns and the degree of targeting of instruments at environmental problems. From the data available it is difficult to draw clear conclusions on the targeting and therefore effectiveness of policy implementation at national level in relation to biodiversity protection. The existing IRENA indicators provide some, albeit limited, data on relevant policy instruments as discussed above. Additional information has been gathered for the purposes of this report on other policy instruments, such as cross compliance and LFAs. But given the lack of comprehensive monitoring and evaluation studies of policy implementation at national level it is difficult to fully assess the extent to which policy integration in the field of biodiversity protection is being achieved. Difficulties arising from the lack of data are discussed below.

We can conclude the following concerning the relevance of the policy instruments to the objective of biodiversity protection:

- Agri-environment schemes are highly relevant tools for the protection of farmland biodiversity but monitoring data is only available at Member States or NUTS 1 level. A geographic targeting analysis can be carried out for large regions but insufficient data is available to assess the site-specific targeting of agri-environment measures. In addition, more information is required on the environmental effectiveness of schemes in relation to biodiversity protection ([13]).
- The majority of Member States include standards for biodiversity within their national codes of good farming practice. This is a useful policy tool in this context and underpins participation in agri-environment schemes. It is not clear however if GFP largely maintains the status quo or leads to positive changes in farming practice and hence environmental improvements.
- Cross compliance is currently used to protect farmland biodiversity in six Member States with standards set in relation to preventing overgrazing, pesticide use, grassland management, and restrictions on mowing dates. As a result of the 2003 CAP reforms, the potential importance of this policy tool will increase as it becomes mandatory for Member States and helps to enforce several pieces of

([13]) An evaluation exercise is currently being carried out for DG Agriculture and Rural Development to analyse the environmental effectiveness of agri-environment measures. Results will become available in 2006.

environmental legislation with relevance to biodiversity.

- Little information is available on the environmental impacts of LFA support. However, this measure is applied to more than half of the farmland in the EU and farmers receiving LFA support must adhere to GFP standards. In terms of geographical targeting, LFA areas have a good overlap with both Natura 2000 sites and HNV farmland areas (Hoogeveen, 2004). Where LFA payments support extensive farming systems that would otherwise be abandoned or subject to intensification they also contribute to the maintenance of agricultural biodiversity. The support to areas where farmers are subject to restrictions on agricultural use due to national or Community biodiversity legislation (Article 16) has particular potential in this regard.

5.3.1.5 Geographic targeting as part of environmental integration

The schematic diagram of factors influencing policy integration (Section 4.4) shows the various levels at which information is required to make a proper assessment. The IRENA indicators provide data in a number of areas, such as the environmental situation, policy goals and driving forces. However, the indicators do not cover all relevant policy instruments and are therefore limited in this context. Further information has been gathered from various sources on policy instruments and implementation to supplement the IRENA indicators. However, the overall picture remains incomplete.

The existing indicators provide some data to allow a limited spatial analysis of the targeting of policy measures at areas of conservation importance. Real spatial targeting analysis would need to be underpinned by more detailed geo-referenced data for all the indicators concerned. It should also be noted that geographic targeting is only one element in ensuring a positive environmental outcome of applied policy measures.

Approaches to monitoring and evaluation of policy implementation at national level are often insufficient to enable an assessment of the environmental outcome of the measure concerned. Where evaluations do exist they are often general in nature, focusing on measuring policy outputs, e.g. the area of land covered by a particular policy measure or the number of farmers enrolled, as opposed to policy outcomes, e.g. the impact on biodiversity or water quality. As a result, it is difficult to judge the environmental effectiveness or success of different policy instruments.

5.3.2 Nutrient management

5.3.2.1 Analysis of IRENA indicators in relation to risk of nutrient pollution

The IRENA indicators provide data in relation to both driving forces and pressures that can influence the risk of water pollution by nitrates. Indicators No. 8 (Fertiliser consumption), No. 13 (Cropping/livestock patterns), No.14 (Management practices) and No. 15 (Intensification/extensification) are driving force indicators providing data on farming practices and patterns that can result in increased or decreased risk of nutrient leaching.

IRENA No. 18 shows that at EU-15 level, the gross nitrogen balance in 2000 was calculated to be 55 kg/ha, which is 16 % lower than the balance estimate in 1990 of 65 kg/ha. In 2000 the gross nitrogen balance ranged from 37 kg/ha (Italy) to 226 kg/ha (the Netherlands). All national gross nitrogen balances in Member States show a decline in estimates of the gross nitrogen balance (kg/ha) between 1990 and 2000, apart from Ireland and Spain (22 % and 47 % increase, respectively). The following Member States showed organic fertiliser application rates greater than the threshold of 170 kg/ha specified by the nitrates directive in 2000: the Netherlands (206 kg/ha) and Belgium (204 kg/ha). The general decline in nitrogen balance surpluses is due to a small decrease in nitrogen input rates (– 1.0 %) and a significant increase in nitrogen output rates (10 %).

The availability of regional gross nitrogen balances would provide a much better insight into the actual likelihood of nutrient losses to water bodies, when combined with data on farm management practices as well as climatic and soil conditions. Such an indicator could not be developed in the timeframe of the IRENA project, mainly due to the lack of important data at regional level (manure, fertiliser application, yield coefficients) and even at national level (particularly the uptake of nitrogen through fodder and pastures).

Among the response indicators, IRENA No. 1 (Area under agri-environment support), IRENA No. 2 (Regional levels of good farming practice) and IRENA No. 7 (Area under organic farming) are relevant.

IRENA No. 1 is important in as much as agri-environment schemes are specifically aimed at achieving positive environmental management.

As it has been said in the context of biodiversity, there is considerable variation both between and within Member States in terms of annual expenditure per ha of UAA as well as coverage of agri-environment measures. Low levels of expenditure per ha of UAA and low coverage of schemes in some countries suggest that the potential of this policy instrument is not being fully realised. In itself, this indicator does not provide direct information about the environmental effectiveness of agri-environment schemes in relation to reducing the risk of nutrient pollution. It does show, however, that the most important category of agri-environment scheme in terms of area covered was the one aimed at the reduction of inputs (including in most countries integrated farming) and the extensification of farming, including crop rotation. In 2002, this category covered 11.4 million hectares and represented 40 % of the total agri-environment scheme area across the EU-15. Both types of measures lead to changes in farming practice that are likely to have significant benefits in terms of reducing the risk of water pollution by nutrients. However, no data is available to show the extent to which such schemes are being targeted at specific areas where the risk of nutrient contamination is greatest, or applied more widely.

IRENA No. 2 shows the extent to which Member States have defined good farming practices that should help prevent nutrient pollution compared to standards for other environmental issues (see Table 5.1). All Member States have defined standards for fertilisation, which is regulated at EU level (through the 'nitrates' directive). This has the most wide-reaching effect in those Member States that have designated their whole territory as nitrate vulnerable zones (NVZs): the Netherlands, Luxembourg, Austria, Denmark, Germany, and Finland. Member States and regions have defined compulsory requirements in the framework of their nitrates actions plans for nitrate vulnerable zones. The United Kingdom, Sweden, the Walloon region of Belgium and Portugal have also defined fertilisation standards for farms outside the NVZs (e.g. recommended fertilisation rates, restrictions on timing for organic application, storage capacity), which are either recommendations or verifiable standards. Furthermore, France, Sweden and Denmark have addressed soil cover during autumn and winter in certain areas to avoid nitrate leaching.

In 2002, the organic farming area reached 3.7 % of the total UAA for the EU-15, up from 1.8 % in 1998 (IRENA No. 7). Austria, Italy, Finland, Sweden, Denmark and Germany had a higher share than the EU average. A comparison with gross nutrient balances is not very meaningful as it hides too much regional variation. However, as organic farming is usually not practised on intensive livestock farms and covers only around 4 % of UAA, no substantial effect on nutrient leaching risk would be expected.

5.3.2.2 *Analysis of the spatial targeting of policy instruments for nutrient management using IRENA indicators*

At this stage of the development of the relevant IRENA indicators it is not possible to undertake any spatial analysis of the targeting of policy responses to the areas at greatest risk of water pollution by nutrients, e.g. the nitrate vulnerable zones designated under the nitrates directive. Further development of indicator No. 1 is required to provide data on specific agri-environment schemes that relate to nutrient leaching and their spatial targeting.

Again it is not only spatial targeting, however, that determines the effectiveness of policy effort with regard to nutrient pollution, but also the appropriate mix, choice and implementation of policy instruments at national level. Two examples of agri-environment policy approaches that effectively target nutrient leaching are given below for Denmark and Sweden.

Denmark

Since 1985, a number of national action plans have been implemented in Denmark to reduce nitrate leaching from agriculture. The main instruments to ensure the objectives of the Danish action plans are met are: 1) Mandatory fertiliser and crop rotation plans at farm level, with limits set on the nitrogen amounts that can be applied to different crops, and 2) statutory norms that set maximum values for the utilization of nitrogen in manure assumed to be plant available. These two instruments have been reinforced several times, for example with the 1991, 1998 and 2000 restrictions of the norms for the utilization of nitrogen in manure. In addition, a large effect has been achieved through improved feeding regimes, which has had a remarkable effect on the utilization of animal feedstuffs. Throughout the period, N-regulations were designed in close dialogue with researchers and farmers' associations, and were followed-up by information campaigns, extension services and education. Also, extensive strategic research programmes have been supported. The ability to design the regulatory approach to nitrogen use in a manner whereby crop and animal production is affected as little as possible is a main achievement of this bottom-up approach of continuous dialogue (Mikkelsen *et al*., 2005).

To account for the development in nitrogen losses from the agricultural system, three national indicators are defined: Nitrogen (N) surplus, nitrogen efficiency and nitrate leaching. For the period in question, both the N-surplus and N-leaching were reduced significantly in the period, while the N-efficiency rose. N-surplus decreased from 490 000 t N in 1985 to 313 000 t N in 2002. N-efficiency increased from 27 % to 36 % in the same period, while N-leaching was reduced by 48 % from about 311 000 t N to about 168 000 t N.

Environmental monitoring programmes have shown a decrease in nitrogen concentration in water leaving the root zone, in rivers and in coastal waters. In Danish coastal and open marine waters there has been a significant decrease in N-concentrations. In the open waters N-concentration is much lower, but a decrease can also be detected. The biological response to the changed N-concentrations is less clear (Ærtebjerg *et al*., 2004).

Mikkelsen *et al*. (2005) conclude that the Danish approach to regulating nutrient losses from agriculture has proven successful, but with a delay concerning the environmental effect. It is based on research programmes and dialogue between authorities and the agricultural community. Until now regulations have been applied at a national scale. A more regional or local approach is believed to be necessary in the future.

Sweden

Sweden has a wide range of agri-environment schemes including measures for nutrient leaching. It is one of the countries in Europe that has the largest share of area under agri-environment schemes (86 %). Cultivation of catch crops and delay of soil cultivation until spring are two measures to reduce nutrient leaching within the Swedish Environmental and Rural Development Plan.

Norell and Sjodahl (2005) have discussed the best combination of targeted measures among a wide range of instruments. In the case of nitrogen leaching, various measures are applied, such as environmental regulation, taxes on fertilizers, and agri-environmental support. One needs to take into account that even measures that are well-targeted on an environmental issue are not automatically justified from a policy efficiency perspective. Their cost effectiveness must be evaluated, which the authors did for the nitrogen leaching measures applied in Sweden.

Their analysis shows that the agri-environmental support for spring tillage and catch crops complements the fertilizer tax and statutory requirements (e.g. rules on the handling of manure). In principle, taxes and fees have the advantage that they do not place administratively determined restrictions on farm activities. One advantage of agri-environmental support over fertilizer fees is, however, that it can be targeted to regions and crops where nitrogen leaching is a problem.

With regard to nutrient leaching, the effect of the agri-environment scheme is estimated to be 1 850 tonnes of leached N avoided, at a budgetary cost of 155 million SEK (17 million EUR). The efficiency of the measures expressed as budget cost per kg reduced nitrogen leaching (root zone leaching) is 80 SEK (9 EUR) per kg. Even though a systematic comparison with alternative measures has not been done, efficiency seems to be well on par with that of other agricultural measures and with the efficiency of measures in other sectors. For instance, the cost per kilogramme for reducing nitrogen by establishing wetlands on agricultural land was estimated to be 107–180 SEK (12–20 EUR) (Svensson *et al.* 2004, in Norell and Sjodahl) and 60 SEK (7 EUR) for improving purification plants (Swedish Board of Agriculture, 2000, in Norell and Sjodahl).

One reason for the fairly high efficiency is that the agri-environment scheme is targeted at land where it has a significant effect and it mainly covers land where farmers' costs are low. In addition, the annual cost to farmers may be lower than the budget cost, since the level of support corresponds to the cost for the farmer with the highest compliance cost. Hence, the use of budget cost leads to an overestimation of aggregated compliance cost. On the other hand, the calculations do not include administrative cost, but this is expected to be low when compared to total cost. However, continuous evaluation of the measures is necessary, since economic conditions may change, not least in connection with reforms of the CAP.

5.3.2.3 CAP instruments relevant for improving nutrient management

Section 5.2 described the implementation of policy instruments at Member State level and highlighted differences in implementation patterns and the degree of targeting of measures to environmental problems. The existing IRENA indicators provide some, albeit limited, data on relevant policy instruments as discussed above. Additional information has been gathered for the purposes of

this report on other relevant policy instruments, such as cross compliance. But given the lack of comprehensive monitoring and evaluation studies of policy implementation in many Member States it is difficult to fully assess the extent to which policy integration in the field of water protection, including nutrient leaching, is being achieved. Difficulties arising from lack of data are discussed below.

Section 5.2.1.1 reviewed the national implementation of agri-environment schemes. The farming practices that agri-environment schemes most frequently encourage include a number that may reduce the risk of nutrient leaching. These are:

- reduction of inputs (mainly fertilisers and pesticides), including support for integrated production;
- extensification of existing management (e.g. reducing stocking rates); and
- support for conversion to and continuation of organic farming.

In some countries or regions, soil erosion is also addressed through agri-environment schemes. However, lack of data on the spatial distribution and geographic targeting of these agri-environment measures and of their environmental impacts makes it difficult to assess if the current agri-environment policy response is effective in terms of reducing nutrient leaching.

There is, in any case, a question as to whether agri-environment schemes (incentive measures) are the most appropriate policy tool to meet resource protection objectives or whether greater emphasis needs to be given to the 'polluter pays principle' in supporting policy integration (e.g. EEA, 2005a). Environmental legislation, such as the nitrates directive, or the use of economic instruments, e.g. a tax on fertilisers, are other relevant policy tools for achieving input reduction and reducing the risk of nutrient leaching. OECD papers review the use of different policy instruments highlighting some of the costs and benefits of different approaches such as regulations versus incentives and other economic instruments such as manure quotas. However, there is no fully efficient single instrument for addressing nutrient pollution problems. A mix of policy tools is likely to be the most effective in terms of addressing this — as well as other — agri-environmental problems (OECD, 2001).

In this context, GFP and cross compliance are relevant policy tools. Section 5.2.1.2 reviewed the implementation of GFP by Member States. GFP standards set a baseline management requirement for agri-environment or LFA support in all Member States. However, lack of data on the geographic targeting of GFP standards and on their enforcement makes it difficult to assess the efficacy of this policy tool in terms of achieving environmental integration compared with, for example, agri-environment schemes.

Section 5.2.2.1 reviewed the implementation of cross-compliance by EU-15 Member States. In broad terms, the majority of Member States have defined standards that address resource protection issues, especially in relation to soil and water. But, like GFP, a lack of monitoring and evaluation means that it is not feasible to assess the efficacy of cross-compliance so far in terms of reducing the risk of nutrient leaching. However, its introduction as a compulsory measure following the 2003 CAP reforms is an important step as regards integration. The requirement for Member States to make direct support conditional on the respect of statutory management requirements based on legislation as well as establish good agricultural and environmental conditions relating to soils is likely to result in changes in farming practice that can be expected to reduce the risk of nutrient leaching.

5.3.2.4 Assessing integration success in relation to nutrient management

Data from the pressure, state and response IRENA indicators and information on policy implementation and targeting is insufficient at this stage to assess the effective integration of nutrient management concerns into the CAP. Various policy responses such as agri-environment measures, GFP and cross compliance all require farmers — to varying degrees and in different ways — to undertake practices that may reduce the risk of nutrient leaching. However, relatively little is known about the exact nature of these requirements, their spatial and geographic targeting, enforcement and the environmental outcomes. It is therefore currently impossible to judge the efficacy of these policy tools and to use this information as proxy measure for the success of policy integration in relation to nutrient leaching risk.

6 Summary and conclusions

6.1 Key results of the indicator-based analysis

a) Environmentally relevant trends in agriculture are driven at least as much by market, socio-economic and technological factors as by the CAP policy framework (IEEP, 2002). This has to be taken into account in any policy integration assessment.

b) Soil erosion remains a significant concern in the EU-15 and appears to be concentrated in the Mediterranean region. Soil organic carbon content varies significantly across the EU-15 and is crucial for a series of important soil functions. In addition, it is an important factor for determining whether agricultural soils act as a sink or source of CO_2. Insufficient information is currently available to determine which trend is more important.

c) Due to decreased livestock numbers and mineral fertiliser consumption, greenhouse gas and ammonia emissions from agriculture have declined by about 9 % since 1990. According to current projections (which discount the 2003 CAP reform) a continuation of these trends will not be enough to meet 2010 ammonia emission reduction targets.

d) The irrigable area in EU-12 increased by 12 % from 1990 to 2000. The majority of this increase occurred in Mediterranean countries where water abstraction rates for agriculture are already highest. According to available data, the share of agriculture in water use in the EU-15 remained stable during the 1990s, at about 50 % in southern EU-15 Member States compared to only 7 % in northern EU-15 Member States.

e) Diffuse pollution from agriculture is a major concern for the quality status of ground and surface waters. Gross nutrient balance data and nitrate concentrations in rivers show that this is a particular problem for north-western Member States. Large gross nutrient balances appear to be linked to high livestock densities but regional balances have to be developed for a more differentiated spatial analysis of the problem in the affected countries.

f) Changes in agriculture are a key factor in the decline of biodiversity. This is both due to agricultural intensification as well as the abandonment or reduction of traditional land uses and farm practices. Current farm trends do not appear to favour the maintenance of high nature value farmland and of agricultural habitats in Natura 2000 areas. Relevant agri-environment schemes and other policy measures should be more targeted on key biodiversity areas on farmland.

g) Currently available data and methodological approaches do not allow an indicator-based analysis of the state and trends of agricultural landscapes throughout the EU-15.

h) A wide range of environmental legislation and policy documents has set objectives, and to a lesser extent targets, for environmental management in the agricultural sector. However, most of these are not concrete enough to allow an assessment of whether they are reached or not.

i) Environmental policy integration under the CAP can be achieved through measures in market policy and rural development policy. Significant progress has been made in both pillars of the CAP since 1990. However, the achievement of positive environmental effects depends on a successful and targeted implementation of relevant measures in Member States.

6.2 Conclusions of the policy integration assessment

a) The approach taken in this report for assessing progress with environmental integration in the CAP built on the IRENA agri-environment indicator results. Information on the geographic distribution of agri-environmental issues

and of different policy measures was used to assess policy targeting as a proxy measure for policy integration. This was combined with an analysis of the implementation of some agri-environmental policy measures by Member States.

b) The targeting analysis as well as the presentation of positive case studies in policy mix and implementation focused on the areas of biodiversity protection and nutrient management.

c) The data available indicate the need for a better targeting of key policy responses (agri-environment schemes, organic farming) at areas of highest biodiversity concern in the EU-15. Attention needs to be paid to this issue in the future to ensure that the Natura 2000 network and other important farmland habitats remain under appropriate management.

d) The effectiveness of agri-environment schemes (and of other policy measures) depends not only on geographic targeting but also on appropriate scheme design and successful implementation. The case studies provide positive examples, but literature studies show that the effect of existing agri-environment schemes on biodiversity can be very uneven (see IRENA No. 1).

e) Implementation of relevant policy instruments at national level remains uneven and the potential for effective policy integration does not appear to be fully utilised in some EU Member States. The approaches presented in the case studies from northern and southern EU-regions show, however, that innovation and integration success are feasible.

f) Gross nitrogen balance is the best indicator of nutrient leaching risk in agriculture but this indicator is currently not developed at regional level. A spatial targeting analysis is therefore not feasible for nutrient management issues. The (cost-)effectiveness of agri-environment schemes with regard to nutrient leaching could not be investigated. However, economic analysis suggests that other policy measures, such as regulation or taxes, can be effective instruments in dealing with nutrient pollution. Sweden shows a positive case study on the use of agri-environment schemes for nutrient management, in combination with other measures. Effective policy action in this field is likely to include elements of environmental regulation and the polluter pays principle.

g) The complex political, socio-economic and technical background that underlies the process of improving environmental integration in agricultural policy limits the possibilities for drawing firm conclusions. Policy targeting remains only a proxy indicator for the positive environmental outcome that is to be achieved via policy integration. These problems are reinforced by a lack of 'policy-off' reference areas (where the measure in question is not applied), comparative or longer-term studies.

h) Other important questions in agri-environment policy, such as value for money, free rider issues, change or maintenance of agricultural practices, could not be addressed at all. This needs to be done in detailed research projects that focus specifically on such issues.

6.3 Usefulness of the current indicator framework for integration analysis

a) The IRENA indicator set provides a useful basis of information for environmental analysis. The availability of regional information for many IRENA indicators allows some differentiation of environmental issues and environmental pressures across the EU-15. Thus association analysis can be carried out between indicators for assessing policy targeting. This shows some interesting results, e.g. in the area of biodiversity.

b) Nevertheless, pressure, state and policy response indicators are insufficiently underpinned by geo-referenced data to carry out a detailed spatial targeting analysis. Currently available data are too coarse to provide fully satisfactory results.

c) Several key state/impact indicators are reliant on modelling approaches. Models can be very useful tools for environmental analysis as long as the required input data are of sufficient quality. Quality input data are, however, not available for all models employed for IRENA indicators. In this case, the relevant indicators need to be regarded as a first solution only.

d) Deficiencies in indicator data sets (in terms of data accuracy and/or insufficient geographic coverage) limit the possibilities for establishing a link between the driving force, pressure and state indicators. In addition, there is only a weak link or feedback mechanism from the response indicators back to the DPSI indicators. This hampers the evaluation of policy responses, which is further complicated by the complexity

of agri-environmental and physical processes as well as the lack of data or knowledge to underpin (suspected) causal links.

e) The current list of indicators does not cover all relevant CAP policy instruments. Policy integration has moved beyond the 2nd pillar to the 1st pillar (e.g. modulation, cross-compliance). The progress with environmental integration in the CAP would need to be reflected in any future indicator framework to underpin its analysis. Relevant potential policy response indicators include: share of rural development in the total CAP budget, promotion of renewable energy, implementation of cross-compliance, and share of environmental measures in the total rural development budget.

f) Environmental integration is a complex process that involves not only the design of appropriate policy measures and their implementation, but also institutional factors, issues of administrative culture, monitoring and evaluation procedures etc (EEA, 2005c). Many of these issues cannot be covered with an indicator-based approach and are not represented in the IRENA list of indicators.

6.4 Recommendations for future monitoring and evaluation of agri-environment policies

a) Adequate resource investment in monitoring and evaluation is necessary to assess whether policies supporting environmental integration are effective and/or efficient. Monitoring and evaluation have to be supported, therefore, to ensure a better return from the budget allocated to major (agri-environmental) policy measures.

b) Data sets that underpin state/impact as well as policy response indicators have to be developed at regional level to allow spatial targeting analysis. In addition, a number of the current indicators require further methodological development.

c) Indicator-based analysis alone is not sufficient to judge the effect of efforts at policy integration. Indicators that allow an overview of agri-environmental issues at EU-15 level, such as that provided by the IRENA Operation, have to be complemented by targeted monitoring and evaluation approaches for different policy measures at local and regional level.

d) The results from research and targeted monitoring can be used to develop proxy measures of agri-environmental policy success. Spatially referenced uptake figures for certain land management measures, such as set-aside, conversion of arable to grassland or the sowing of green cover crops, can be meaningful proxies for environmental impact. This is possible where the relationship between the measures and their environmental effect is well-documented.

e) The monitoring and evaluation of the effectiveness of agri-environmental policy measures has to be improved and strengthened. This requires more relevant resources at all administrative levels. Well-designed policies and effective implementation are critical factors for achieving environmental integration.

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Annex 1: List of IRENA indicators

DPSIR	No.	IRENA indicator
Responses	**1**	Area under agri-environment support
	2	Regional levels of good farming practice
	3	Regional levels of environmental targets
	4	Area under nature protection
	5.1	Organic producer prices
	5.2	Agricultural income of organic farmers
	6	Farmers' training levels
	7	Area under organic farming
Driving forces	**8**	Fertiliser consumption
	9	Consumption of pesticides
	10	Water use (intensity)
	11	Energy use
	12	Land use change
	13	Cropping/livestock patterns
	14.1	Farm management practices- tillage
	14.2	Farm management practices- soil cover
	14.3	Farm management practices- manure
	15	Intensification/extensification
	16	Specialisation/diversification
	17	Marginalisation
Pressures	**18**	Gross nitrogen balance
	18sub	Ammonia emissions
	19	Emissions of methane (CH_4) and nitrous oxide (N_2O)
	20	Pesticide soil contamination
	21	Use of sewage sludge
	22	Water abstraction
	23	Soil erosion
	24	Land cover change
	25	Genetic diversity
	26	High nature value farmland
	27	Production of renewable energy (by source)
State	**28**	Population of farmland birds
	29	Soil quality
	30.1	Nitrates in water
	30.2	Pesticides in water
	31	Ground water levels
	32	Landscape state
Impact	**33**	Impact on habitats and biodiversity
	34.1	Share of agriculture in GHG emissions
	34.2	Share of agriculture in nitrate contamination
	34.3	Share of agriculture in water use
	35	Impact on landscape diversity

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