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Environmental signals 2002

Benchmarking the millennium

European Environment Agency regular indicator report

European Environment Agency

NOTE

A great deal of information on the European Union is available on the Internet. It can be accessed through the Europa server (http://europa.eu.int).

Cataloguing data can be found at the end of this publication.

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Foreword

This, the third of the European Environment Agency's *Environmental signals* reports - Benchmarking the Millennium, provides an insight into the state of Europe's environment and is targeted at high-level policy makers in EEA member countries and the European Union, as well as the wider public. The publication of this report demonstrates that the annual routine of reporting on the state of the environment, and above all the progress that has been made, is now well established.

These yearly assessments are a key benchmark for monitoring the integration of the environment into economic and sectoral (e.g. agriculture, energy, transport, tourism, etc.) policies and progress towards sustainable development. The provision of environmental information and a firm understanding of the environment is essential if policies, and other initiatives, are to be reviewed, re-orientated and improved to ensure they contribute to the ultimate goal of a more sustainable Europe.

There is still a long way to go to ensure environmental issues are accorded due weight in the decision-making process alongside economic and social considerations. Until now, the short-term (yearly) and medium-term (governed by four-five year political mandates) reviews of policies have been traditionally determined by socio-economic factors.

The 'Synthesis' or 'Spring' report was presented by the European Commission to the Barcelona Summit in March 2002. The report, which included progress on the 36 'structural indicators', and the conclusions of the Summit showed that socio-economic factors are still the main drivers for action. However, the reports to Heads of State and Government began incorporating meaningful and powerful indicators and related targets for environmental sustainability – though not much considered yet. These included energy intensity and the share of renewables, greenhouse gas emissions, transport volume and modality, air quality and waste production / disposal. It will, therefore, be difficult in the future to ignore lack of progress on these issues and, essentially, to consider the related impacts of the highest priority socio-economic issues.

Until very recently, the validity of producing relevant annual environmental reports was questioned; this had resource implications for the Agency. The success of the earlier annual reports means that their value is now widely accepted and their production is an established routine.

Reports such as these provide for a more consistent and comprehensive review of European policy progress and prospects and are being developed for delivery on an annual basis in a number of related areas:

- environment – The European Commission will produce annual policy reports from June 2002 onwards;

- economic and sectoral areas – The Councils responsible for the 9 sectors covered by the 'Cardiff Process' (e.g. energy, agriculture, transport, etc.) called for specific strategies and indicators for sector integration and sustainability. This process was initiated in 1998, with EEA producing annual reports on transport since 2000 ('TERM' report) and now expanding this approach into the other sectors;

- sustainable development – The presentation by the European Commission of a ‘Spring’ or ‘Synthesis’ report to every Spring Summit that presents progress on the 36 structural indicators (seven of them on environmental sustainability). This provides Heads of State and Governments with a comprehensive simultaneous view of progress, trends and challenges on the three dimensions (social, economic, environmental) of more sustainable development. This allows decisions to be taken on an informed (‘knowledge based’), consistent (‘mutually supporting’) and accountable (‘indicators and targets’) basis. The first exercise was for the March 2002 Barcelona Summit and this highlighted the many improvements that must be made. More space needs to be given to the environmental dimension and improvements are necessary in the quality and relevance of the environmental data and information provided by the Agency. Environmental data need to be more up-to-date and should show trends and links with the socio-economic dimensions.

This third annual edition of *Environmental signals* again tests how far we have come and details urgent improvements which are needed to make *Environmental signals* the primary tool for accountability and benchmarking progress at EU and Member States level. This report is a valuable input to the reviews of environmental, sectoral and socio-economic policy (the ‘three corridors’ of EU policy). We are developing a real Agency ‘brand’ that, together with the multi-annual reports (published every five years), provide a comprehensive view of the present and a partial insight, through the use of scenarios, into the medium-term (10-20 years) future.

What do we see with this third annual report?
We must recognise that annual reviews of the state of the environment do not generally reveal dramatic changes. Their value lies in the identification of underlying trends, which may be positive or may provide ‘early warnings’ of potential concerns. Above all, we need to know whether the conditions for change are emerging. These may be related to reducing environmental pressures, the exploitation of natural resources or the decoupling of environmental impacts from socio-economic development.

However, we must also look further upstream in the system, to see whether basic conditions for more sustainable (or less unsustainable) economic and sectoral activity are being established. These may include: providing for reduced and more efficient energy consumption; a shift towards more environmentally-friendly transport modes; greater agriculture diversity and food quality; better land management; less damaging subsidies and greater internalisation of costs; and, more, a sustainable fiscal system. We are also watching for any ‘vital signs’ or positive signals that may presently have little effect (e.g. increase in some renewable energies, organic farming, greener fiscality, cycling, car sharing) but are growing fast and the successes need to be recognised and encouraged. This is what information on changes or real improvements to the state of the environment should be concerned with.

In particular, this report demonstrates that:

- the dematerialisation process (higher quality of life with reduced consumption of energy and materials), which was anticipated with the transition to a service economy, has not yet been fully exploited. Some environmental pressures continue to be closely coupled with development in certain sectors, such as greenhouse gas emissions from transport (and tourism), or waste generation, space and territorial degradation, and energy and resource consumption from households, and reduction of stocks from fisheries. Other pressures, such as mining and industrial waste, are growing more slowly than GDP (relative decoupling), but are still growing in absolute terms;

- generally, as an EU average, we are using energy more efficiently (less energy per unit of GDP or economic output). However, we are still not reducing our energy consumption in absolute terms (absolute decoupling) or reaching our targets. Most importantly, while some countries have shown that the targets can be achieved (e.g. Germany or Ireland), energy efficiency in others is deteriorating (e.g. Spain or Portugal). This negatively affects the overall successful story of renewable energies ('a vital sign'), the contribution of which is being undermined by the overall increase in energy consumption (particularly electricity);

- households are often overlooked in integration policies. As levels of consumption continue to rise in parallel with disposable income, the need to help consumers to make informed choices becomes increasingly important. Eco-labelling and information dissemination (e.g. campaigns to encourage energy savings) are increasing but their use remains marginal.

This report and the experience of the March 2002 Barcelona Summit show that there is still a long way to go in improving the direct use of annual indicator-based reports. Reliable and up-to-date information on progress towards sustainable development and the underlying factors influencing social developments are fundamental to delivering the EU Sustainable Development Strategy and achieving the EU's goal (Articles 2 and 6 of the Treaty) of more sustainable development. This is why, as a natural progression of this work, the Agency has given top priority to supporting the development of the Commission's Communication, or 'Synthesis' report, to the Spring European Summits which requires up-to-date indicators and assessments to be produced.

An immediate challenge for the Agency (and Eurostat) will be to provide more up-to-date or timely environmental information in order to produce a picture as close as possible to that of the present day. In many cases we need to go beyond 'consolidated statistics' (via extrapolation or modelling) to what may be referred to as 'now casting', and provide trends or projections, 'forecasting', using scenarios based on predictions of change or stasis. Since the Agency began this work we have made enormous progress in our annual reports. Now, in early 2002, we are generally producing consolidated information from 1999 (which is only one year behind in statistical terms) and in many areas we are predicting future trends that adds to the policy relevance of the information.

But we can and must do better. In fact, for all seven environmental structural indicators we already had information for 2000 (but not consolidated at national level and not formally communicated and thoroughly checked at Community level). It is not difficult to anticipate 2001 data, and even make some adjustments for 2002, on the basis of the latest developments, as was done by the Agency for the 4 March 2002 Environment Council, however it requires two things:

- firstly, the purpose. The need for relevant and updated environmental (sustainability) information as the basis for effective and efficient policy decisions is clearly established and prioritised. In addition to consolidating the monitoring and statistical bases, more resources are needed for further developing prospective (and necessarily less accurate but still adequate) approaches;

- secondly, the adequate allocation of resources. This does not necessarily require increases in total budget or personnel. Resources at national and Community level need to be concentrated on delivering relevant and, if possible, independent information. Resistance to the production of certain information may occur if it is seen to be politically inopportune or incorrect, which is a challenge the Agency is continuingly working to overcome.

I have had the personal pleasure of seeing the *Environmental signals* maturing and also experienced the (Spanish) anxiety about them not maturing quickly enough! However, it is my feeling that they have developed in an organic and sustainable way and that the conditions have been created for continuous improvement.

Environmental signals represents a collective effort by dedicated EEA staff and experts in the European Topic Centres; the system is put to work, with efficiency and high professionalism. The quality of the information would not be attained without a similar dedication from the contacts points in the EEA network: the National Focal Points and Reference Centres, the European Commission services (DG Environment and Eurostat in particular) and the EEA Scientific Committee members (the assessment soundness). Finally, the dissemination and impacts of the information owes a lot to the will and commitment of countries, such as Spain, Sweden, Austria, to provide an enhanced access and service through appropriate products in their language. Let me thus sincerely thank those who have enabled the progress we have already achieved and also thank in anticipation those who will make it a continuing success.

Domingo Jiménez-Beltrán
Executive Director

1. Introduction

The European Commission's Communication to the March 2002 Barcelona EU summit, *The Lisbon strategy —making change happen*, is an important milestone on the way to ensuring sustainable development in Europe. Reliable and up-to-date information on progress made towards sustainable development, and the underlying factors that influence the way society develops, is obviously of fundamental importance if the sustainable development strategy agreed by the European Council last year is to deliver real results.

To support the environmental dimension of the strategy, as well as the sixth environmental action programme (6EAP) and the 'Cardiff process' of sectoral environmental integration, the European Environment Agency, as the key information provider on environmental issues at the European level, has been developing regular indicator-based reports for several years. The Agency's showcase products in this field are *Environmental signals* and the annual TERM report, which tracks progress in integrating environmental considerations into the transport sector. Starting with the 2003 editions, these reports will also cover in a consistent way the new EEA member countries in central and eastern Europe and the Mediterranean basin. Later this year the Agency will publish indicator-based environmental reports following a similar approach on energy and tourism. It is also beginning work, together with the Commission services, on an indicator-based environmental report on agriculture. Eurostat is an important data provider for all these reports.

The nature and format of the *Environmental signals* series allows each edition to address an appropriate selection of environmental problems, based on their particular relevance and timeliness to the policy debate and the need to update issues at different intervals, some yearly (e.g. greenhouse gas emissions), others every few year (e.g. impacts of tourism). Each report in the series is not intended to be comprehensive. In this report Chapters 2–7 focus on economic sectors and Chapters 8–15 on some major environmental issues. For comprehensive background information on European environmental problems, readers should refer to other EEA products such as state-of-the-environment reports or thematic monographs, all available on the EEA web site (http://eea.eu.int). That site also provides a gateway to individual indicator and related environmental information at European, EU and national levels. Its data service gives access to many of the statistics on which the indicators in this report are based.

1.1. The EU policy agenda and the need for indicators

Over the past few years, the EU Council has paid considerable attention to the major policy goals underlined in the Amsterdam Treaty, namely sectoral integration and sustainable development:

- The 1998 Council Cardiff Initiative stimulated the integration of environment and other policies, and as such put the integration process and sustainability thinking on a faster track.

- The 1999 Helsinki summit discussed the first sectoral integration strategies, and placed these in the framework of the development of an overall sustainability strategy and of the 6EAP. At the same time the summit set in place a cycle for revisiting progress in sectoral integration at the European Council level.

- The Lisbon summit, in March 2000, set a new strategic goal for the next decade: to become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion.

- The Stockholm summit, in March 2001, signalled the need for joining the Lisbon strategy with the sustainable development strategy and expressed the intention to review progress in all dimensions of sustainable development in the context of the annual Spring European Council.

- The Gothenburg summit, in June 2001, agreed a strategy for sustainable development. Building on the proposal for the 6EAP and on the sectoral strategies for environmental integration, the Council identified a number of objectives and measures in four priority areas: climate change, transport, public health and natural resources. Therefore, the summit established a completely new approach to policy making focused on all three aspects of sustainability.

- The Laeken summit, in December 2001, welcomed the adoption of the key indicators to be used to assess the implementation of the Strategy for sustainable development at its meeting in March 2002 in Barcelona (see Table 1.1).

Table 1.1. **Environment indicators for the Barcelona Spring European Council**

Environmental aspects of sustainable development
1. Greenhouse gas emissions
2. Share of renewables in electricity generation
3. Volume of transport (tonne- and passenger-km) relative to GDP
4. Modal split of transport
5. Urban air quality
6. Municipal waste
7. Energy efficiency (in the general indicators section)

- The Barcelona summit, in March 2002, however, did not address further the processes of environmental integration into economic and sectoral policies, or in sustainable development.

The Commission, in October 2001, proposed that the following additional environmental indicators should be developed in the near future:

- consumption of toxic chemicals
- disability-free life expectancy
- biodiversity
- resource productivity
- recycling rate of selected materials
- generation of hazardous waste.

The Council proposed more indicators for the future in December 2001 (European Council, 2001). However, few indicators are currently available at the interfaces between environment, society and economy because multiple causes are generally difficult to capture, unless more 'systemic' indicators are used. Such systemic indicators, such as efficiency-of-use indicators, should focus on higher level actions rather than on the individual consequences that arise from, for example, the use of energy, materials and chemicals.

1.2. The EEA contribution

The general function of the European Environment Agency is to serve the various policy processes with consistent and targeted sets of indicators and assessments.

Support to the sixth environmental action programme

The EEA supports environmental policy by providing sets of indicators for each of the issues and by developing the *Environmental signals* report as a multi-purpose tool to report on the overall progress on issues and sectors. The thematic indicator reports serve to maintain a high level of knowledge and attention on specific environmental issue policies.

Support to the Cardiff integration process
Following the success of the transport and environment reporting mechanism (TERM), the EEA, with its partners, is developing similar indicator-based reporting on environment and energy, environment and agriculture, environment and tourism and, if resources are available, a report on fisheries.

Support to the sustainable development strategy
The process of regular reporting to spring European Councils is a unique opportunity for the EEA to deliver key indicators and assessments on environmental aspects of sustainable development, including progress towards integration of environment in sectoral activities.

Through its *Environmental signals* report the EEA will provide the Commission and other parts of the Community with the main indicators for the 'Synthesis' report.

1.3. Presentation of the indicators

Indicator framework and types
The assessments in this report are based on indicators that cover the most important aspects of the socio-economic and environment framework (**D**riving forces, **P**ressures, **S**tate of the environment, **I**mpacts, and societal **R**esponses – the so-called DPSIR assessment framework), including eco-efficiency indicators. Analysis of the indicators can be found in detailed fact sheets on the EEA's web site. The key indicators presented in this report illustrate the most important trends in each policy domain. 'Smiley faces' indicate progress, or lack of it, for each indicator.

Within this framework, indicators are presented in a standard format. Firstly, at an international level, totals are shown for EU Member States or EEA member countries. This is particularly relevant where there are international agreements on action to tackle continental or global problems (e.g. greenhouse gas emissions).

Progress on the development of indicators to support the 6EAP and thematic strategies — Table 1.2.

6EAP themes	Status of EEA developments
Climate change	emission indicators
	climate indicators planned under 2002 work programme
Nature and biodiversity	indicators under development in co-operation with DG Environment
Accidents and disasters	no activities planned
Soil protection	indicators under development
Marine ecosystems	indicators under development with Marine Conventions
Environment and health and the quality of life	co-operation with WHO on definition and development of indicators on human health and environment
Air pollution	indicators under development
Water quality	indicators under development
Chemicals and pesticides	headline indicator-development by Eurostat
Noise	no activities planned
Urban environment	support to indicator initiatives in co-operation with DG Environment
Natural resources and waste	indicator under development

Note: priority themes of 6EAP are in bold

Progress on the development of indicators to support the Cardiff process — Table 1.3.

Transport	TERM regular report: 2000, 2001. 2002 report to focus on Accession Countries
Energy	first report June 2002
Agriculture	joint project with Commission to start in 2002 towards a first publication in 2003
Fisheries	EEA activities starting
Tourism	pilot version in December 2002
Industry Development Internal market Ecofin & General affairs	no EEA activities yet

Note: Tourism is not one of the sectors included under the Cardiff process. Nevertheless, the European Commission is developing several activities for the integration of environment.

Country groupings used in this report:

EU: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the UK

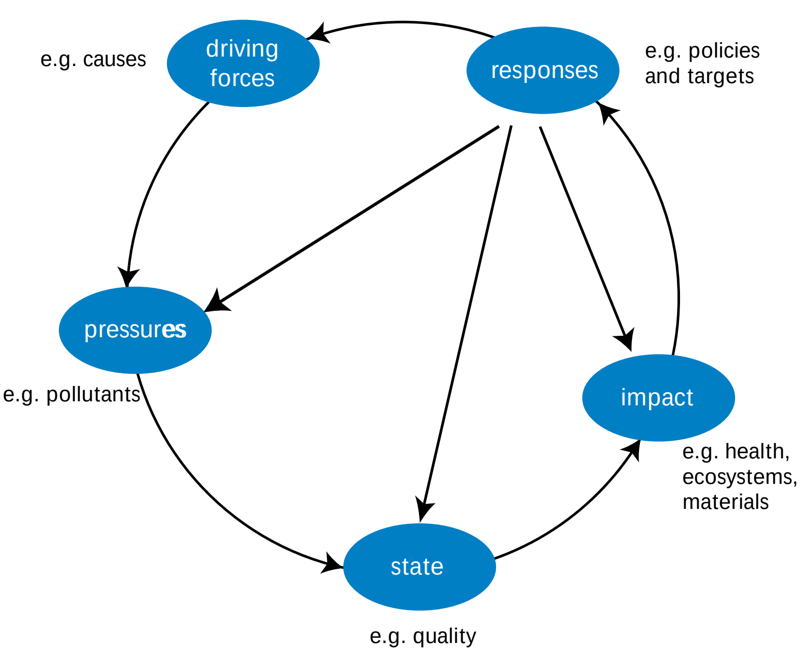
EEA: EU + Iceland, Liechtenstein and Norway

Nordic countries: Denmark, Finland, Iceland, Norway and Sweden

Central Europe: Austria, Belgium, Denmark, Germany, Ireland, Liechtenstein, Luxembourg, the Netherlands and the UK

Southern Europe: France, Greece, Italy, Portugal and Spain

Figure 1.1. **DPSIR assessment framework**



Source: EEA

Secondly, where possible and relevant, national breakdowns are provided for benchmarking national environmental performance and highlighting the differences between countries.

Quality of the information

Each indicator presented in the report is subject to a simple scoring based on the quality of information upon which it is derived. The overall score of 'high', 'medium' or 'low', indicated by the number of stars (with three representing high), is derived from adding, with equal weights, the scores for relevancy and accuracy, as well as comparability over time and geographical area. A short explanation is provided in annex to highlight issues related to the source information or the indicator calculation method.

The smiley faces in the boxes next to each indicator aim to give a concise assessment of the indicator:

positive trend, moving towards target

some positive development, but either insufficient to reach target or mixed trends within the indicator

unfavourable trend

Unless explicitly stated, the assessment is based on the whole period covered by the indicator.

1.4. The next report in the series

The development of indicator-based reporting in support of important European policy processes (see Section 1.1) provides a particular focus for the EEA's work. For example, the European Commission, Eurostat and the EEA, in cooperation with Member States, will produce an analytical report to support the Council decision (European Council, 2001) to adopt seven environmental indicators; a complementary list of 34 environmental sustainability indicators to be further scrutinised and developed are also included. The policy relevance of the indicators, over time and space, and the updating of information are among the numerous elements to be taken into account in this analysis.

For the 2003 reports, efforts will be made to ensure data is as up-to-date as possible; this has almost been achieved for greenhouse gas emissions, with data for 2000 fully validated in March 2002. Efforts will also be made to show current trends through extrapolations (the technique of 'nowcasting'), thereby making the environmental data as up-to-date as the economic data.

The continuity in the scope and aims of the *Environmental signals* series is an important asset for the consistency and usefulness of environmental information. Synergies and complementarities with indicator-based reporting by the European Commission (e.g. 'Synthesis' report, Annual environment policy report) should streamline the development of the series, as well as its consolidation. The next report in the series will cover the accession countries to reflect the Council request for their inclusion in the 'Synthesis' report. In addition, upon a request from the European Commission, the 2003 edition will mark the merging with the Eurostat publication on 'Pressure indicators'.

Topics covered and focus of indicators in the EEA environmental signals series Table 1.4.

	Environmental signals 2000	*Environmental signals 2001*	*Environmental signals 2002*
Energy	• energy intensity, consumption by fuel type and supply sector eco-efficiency • emissions from electricity generation • share of renewables/CHP • prices and taxes	• energy intensity, consumption by fuel type and supply sector eco-efficiency • emissions from electricity generation • share of renewables/CHP • nuclear waste and oil spills	• energy intensity, consumption by fuel type and supply sector eco-efficiency • emissions from electricity generation • share of renewables/CHP • prices and taxes
Transport	• transport eco-efficiency • passenger and freight transport modal split • prices and taxes	• transport eco-efficiency • travel distance • passenger and freight transport modal split • prices and taxes	• transport eco-efficiency • passenger and freight transport modal split • clean technology and fuels • prices and taxes
Agriculture	• agricultural eco-efficiency • livestock numbers and fertiliser / pesticide consumption • irrigated land • organic farming	• agricultural eco-efficiency • agricultural intensity and environmental management • nutrient surpluses • CAP expenditure • organic farming	• agricultural eco-efficiency • agricultural intensity and farmland birds • nutrient surpluses • CAP expenditure • organic farming
Industry	• eco-efficiency		
Tourism		• travel by transport modes • tourism intensity and expenditure • energy use • eco-labelling	
Households		• number, size and expenditure • energy consumption • eco-labelling	• eco-efficiency • water and energy consumption • eco-labelling
Fisheries			• size of fleet • fish stock status • aquaculture
Climate change	• emissions of GHGs • mean temperature	• emissions of GHGs • mean temperature	• emissions of GHGs • mean temperature
Stratospheric ozone depletion	• ozone layer • ozone depleting substances • UV radiation		
Air pollution	• emissions (acidifying gases, ozone precursors) • limit value exceedances (atmospheric ozone, particulates) • crops/forest ozone exposure • acidification/eutrophication	• emissions (acidifying gases, ozone precursors, particulates) • limit value exceedances (ozone, particulates) • acidification/eutrophication	• emissions (acidifying gases, ozone precursors, particulates) • limit value exceedances (ground-level ozone, particulates, SO_2, NO_x) • crops/forest ozone exposure
Waste and material flows	• municipal waste generation • waste disposal (landfilling and incineration) • packaging waste • total material requirement	• municipal waste generation • waste disposal (landfilling) • sewage sludge	• municipal waste generation • waste disposal (landfilling and incineration) • packaging waste • hazardous waste • total material requirement
Water quantity	• water exploitation index • water use by sector		• water exploitation index • water use by sector
Water quality (inland and marine)	• nutrient sources • nutrient concentrations in rivers, groundwater, lakes and coastal waters • urban wastewater treatment	• nutrient concentrations in rivers • organic pollution and urban wastewater treatment • hazardous substances in marine waters and biota	• nutrients in rivers and coastal waters • organic pollution and urban wastewater treatment • bathing water quality • marine oil pollution
Land and soil		• soil contamination • soil remediation	• soil sealing • land take • fragmentation of habitats
Biodiversity	• wetlands (degree of protection, pressures; impacts on species)	• grasslands (degree of protection, pressures, impacts on species)	• forests (area and naturalness, felling, condition, level of protection)
Environmental taxes	• proportion of total tax revenue		• proportion of total tax revenue • use of environmental taxes • effectiveness

2. Progress in the integration of sectors and the environment

The integration of environmental considerations, as called for by Article 6 of the Amsterdam Treaty, is a prerequisite for sustainable development. Progress in integration has been slow, although initiatives such as the 'Cardiff process' have the potential to speed it up. This called for all Council groups to develop strategies for integrating environmental concerns into policies and to propose mechanisms based on indicators for reporting progress. To date, all but one of the nine Council groups have submitted integration strategies. The exception is the Fisheries Council, which is not expected to submit a strategy until the European Commission has put forward proposals for reforming the Common Fisheries Policy.

Eco-efficiency, a measure of the degree to which economic growth is 'decoupled' from environmental impact, is improving in the transport, energy and agriculture sectors although progress is relatively slow and improvements are partly being outweighed by the growth of these sectors. In the household sector little progress has been made in reducing environmental impact.

Integration policy should be aimed primarily at the driving forces behind environmental degradation (i.e. rather than addressing the symptoms of environmental decline it should address the 'upstream' underlying causes). The principal determinants of sectoral change are economic parameters directly linked to sectoral activities. These include levels of pricing (of energy or transport, for example), disposable household income, financial subsidy and technological innovation. To effectively integrate environmental considerations into sectoral policies and activities requires an understanding of the means by which these key drivers can take account of environmental concerns.

As levels of consumption rise in line with levels of disposable income, the need to help consumers to make informed choices becomes increasingly important. Mechanisms to increase consumer awareness include eco-labelling and information dissemination (e.g. campaigns to encourage energy savings). Potentially harmful subsidies can be addressed at source and either abolished or re-oriented towards less environmentally-damaging activities (e.g. agri-environment schemes as part of the Common Agricultural Policy). Continued technological innovation is a prerequisite for further improvements in eco-efficiency and therefore sustainable economic development. Such innovation can also be encouraged through initiatives such as environmental taxation that provide an incentive to find new means to reduce costs.

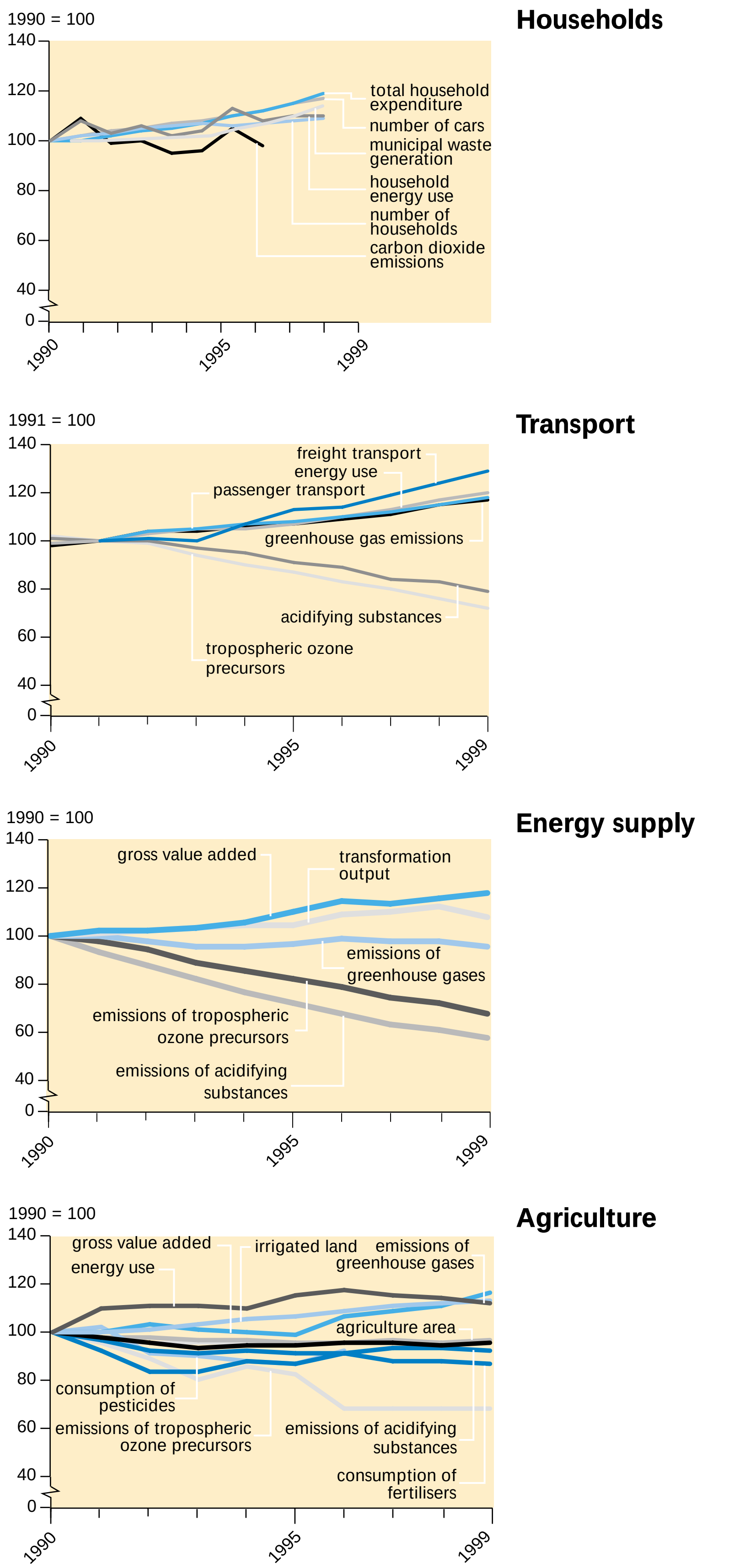
Ideally, the price of a product should reflect any adverse costs borne by the environment through its manufacture and use. Correct pricing reflects the full internalisation of external costs and confronts consumers with the true price. The recent European Council summit in Barcelona acknowledged the intention of the European Commission to accelerate work on the preparation of a framework Directive on infrastructure charging to ensure that by 2004 different modes of transport better reflect their costs to society. The Council also stated a wish to see agreement reached on the adoption of an energy tax Directive by December 2002. Environmental taxation represents a further means of internalising environmental costs and ensuring that they are properly reflected in prices (see Chapter 15). If externalities are not sufficiently reflected in prices, they create distortions in the market place by encouraging activities that are costly to society as a whole even though the benefits to the individual may be substantial. By bringing 'externalities' into prices, environmental taxation gives expression to the 'polluter pays principle'.

2.1. Eco-efficiency

Eco-efficiency is the relationship between economic activity and the associated negative environmental effects. A major goal of sustainable development is to break or 'decouple' this link. Decoupling involves a reduction in the amount of physical emissions or natural resource use per unit of economic output, from either increased efficiency through technological change or a shift to a less environmentally damaging product. Unfortunately, in some sectors, the increase in the scale of economic activity, such as growth in the number of cars or households, has lead to growing environmental pressures. For some pollutants, this has overtaken any gains in reduced damage per unit of output, so that total environmental damage caused by the sector has risen overall. The key question for the future is whether technological developments and product shifts will be rapid enough to keep pace with demands for higher standards of living.

The concept of eco-efficiency can also be applied to households, with the increase in the number and expenditure of households being used a proxy for economic growth (see Chapter 3). Households are an important part of the economy, and are also important as a source of environmental pressure and resource use. However, as a target group, households are often overlooked in integration policies, compared with other groups such as producers. Household energy use, waste generation and car ownership increased during the 1990s, in line with the increase in household numbers and the rise in household expenditure. These trends are likely to continue unless progress is made in reducing the impact of household resource consumption and expenditure.

Indicators of eco-efficiency Figure 2.1.



As a consequence of the growth in transport, and the shift to road and aviation, carbon dioxide emissions from the transport sector are continuing to grow (see Chapter 4). Cleaner technologies, notably the introduction of three-way catalysts, resulted in an absolute decoupling of the emissions of acidifying substances and ozone precursor substances from transport development. However, there is an approximately ten year time lag for technological improvements to have an effect on reducing environmental pressures. Transport is the fastest-growing energy consumer in the EU and whereas there have been very slight improvements in the energy efficiency of passenger transport, there have been no similar improvements in freight transport.

Emissions to air from the energy supply sector have fallen, while the sector's economic and physical output has increased during the 1990s (see Chapter 5). This is due mainly to increased use of abatement techniques, and the switch from coal to gas. However, the current rate of improvement is not sufficient to accommodate predicted economic growth and the reductions required to reach emission targets.

There has been some slow improvement in agricultural eco-efficiency. Energy use and irrigation increased during the 1990s in line with productivity (gross value added), although both are currently staying constant (see Chapter 6). While there has been some reduction in the use of fertilisers and pesticides, nitrate pollution and eutrophication remain serious. Emissions of greenhouse gases, acidifying substances and tropospheric ozone precursors have fallen, but emissions of acidifying substances, and in particularly ammonia, remain a concern.

Table 2.1. **Overview of sectoral trends relevant to changes in pressures on the environment**

	Households	**Transport**	**Energy**	**Agriculture**
Scale of consumption/production	☹ energy use is increasing in line with the rise in household expenditure	☹ car ownership rising rapidly ☹ growth in passenger and freight transport ☹ growth in air transport	☹ final energy consumption is increasing	😐 slight reduction in agricultural area ☹ increase in intensification
Efficiency gains	☹ waste generation per capita increasing 😐 slight decrease in water consumption (due to metering and pricing)	😐 current fuel prices do not encourage fuel-efficient driving	😐 overall efficiency by which primary energy is converted to final energy remained constant ☺ reduced emissions of CO_2, NO_x and SO_x (due to abatement technologies and switch to gas)	😐 slight reduction in fertiliser and pesticide use
Shift to less damaging products or services	😐 growing awareness of environmentally-sound products	☺ shift to unleaded petrol ☺ introduction of clean technologies ☹ low penetration of alternative fuels	☹ renewable energy sources increasing, but contribution remains very low and substantial growth is required to meet target	☺ increasing share of organic products ☺ increase in agri-environment measures

2.2. Conclusions: mechanisms to deliver integration

The EU Sustainable Development Strategy sets the challenge of ensuring that sustainable development is at the core of all sectors and policies. The integration of sustainable development, and environmental concerns in particular, into sectoral policy-making and activity can be encouraged through a variety of measures:

- **Coercive measures** — include moves to ban or restrict certain activities or the sale of certain products that are harmful to the environment. For example, the European Commission has proposed a ban on the use of phthalates in children's toys.

- **Regulatory measures** — include legislation, standards, targets and licensing to control the activities of particular sectors. For example, Directive 2000/76/EC on the incineration of waste now requires all incineration plants with a nominal capacity of more than two tonnes per hour to publish an annual report including information on emissions.

- **Fiscal measures** — include environmental taxation, tax-breaks or subsidy reform, which aim to change the price signals in the market place in favour of more environmentally-friendly products. For example, the Dutch government has removed tax on returns from green investment funds and the Irish government has recently introduced a tax on plastic bags from supermarkets (see Chapter 15). The application of environmental taxes is developing into a broader ecological tax reform to realise a range of objectives, including reductions in direct labour taxes and/or social security contributions.

- **Voluntary measures** — include voluntary agreements with economic sectors on future environmental performance and the adoption of environmental management systems. For example, the EU Eco-Management and Audit Scheme (EMAS) was adopted in 1993 and allows voluntary participation in an environmental management scheme, based on lines and principles harmonised throughout the EU.

- **Information measures** — include campaigns to raise awareness and help consumers make informed choices, such as the promotion of energy-saving measures, household waste recycling or environmentally-friendly products. For example, the Danish Environmental Protection Agency ran a campaign in 2001 to promote the EU Flower and Nordic Swan eco-labels (see Chapter 3).

- **Assessment measures** — include specific tools, such as environmental assessment, designed to integrate environmental considerations into conventional deliberations. For example, Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (the 'Strategic Environmental Assessment Directive') could be one important instrument for integrating environmental concerns into different sectors.

In practice, a combination of instruments and measures tends to be used. These may enhance the effectiveness or reduce the unwanted side-effects of single instruments, or be politically most expedient. The environmental effectiveness of measures to deliver integration is the subject of increasing study (EEA, 2001). However, it can be difficult to disentangle the contribution of each instrument within a policy package and both data and methodological problems can arise. Effectiveness can be better evaluated if new measures are accompanied by an evaluation procedure that runs alongside the instrument's design and implementation.

3. Households

policy issue	indicator	assessment
reducing the pressures of the household sector	household eco-efficiency	☹
reducing household water and energy consumption	water consumption	😐
- " -	energy consumption	☹
foster purchase of ‘green’products	purchase of eco-labelled products	😐

There is emerging evidence that consumer behaviour is changing towards the use of more environmentally-sound products, in part due to eco-labelling. However, overall, consumption volume and intensity continue to grow, so that improvements in the efficiency of resource use within the household sector have been undermined by the growth in the number of households and changes in consumer demand and expenditure patterns.

While the transport, energy and agricultural sectors have begun to break the link between environmental impact and continued growth (the process of decoupling), the household sector has been relatively unsuccessful, with energy consumption, waste generation and car ownership increasing in line with the number of households. The EU integrated product policy could serve as one important starting point to tackle unsustainable consumption patterns; this has singled out reduced sales tax on eco-labelled products as a key instrument for action.

Households are an important part of the economy, and are also important as a source of environmental pressure and resource use. Still, as a target group, households are often overlooked in integration policies, compared with other groups such as producers. The importance of the household sector lies in its demand for resources, the waste generated through the consumption of those resources and its capacity to influence industrial and commercial activities through its spending power. Several factors determine the overall impact of the sector on the environment. These include population growth, an ageing population, the number of households and household size, the growth in disposable income and consumer spending, and the greater availability, affordability and sophistication of items available for purchase.

Policy measures that can address household resource consumption and consumer spending include integrated product policy, coercive measures such as restricting or banning the sale of certain products, financial incentives such as tax breaks for less harmful products (see Section 3.3 and Chapter 15), information and training (e.g. campaigns to encourage energy efficiency in the home), institutional instruments such as schemes to promote the separation and collection of recyclable components of domestic waste (see Section 13.3), and territorial planning policies (see Chapter 13).

An increasing number of policy instruments employed at EU and national levels aim to influence household resource consumption and consumer behaviour. For example, the EU has sought to address domestic energy consumption through voluntary agreements with manufacturers that set out minimum energy efficiency standards for domestic appliances. In addition, the EU sixth environmental action programme emphasises the need to implement measures, including the use of fiscal incentives where appropriate, to encourage the uptake of eco-labels that allow consumers to compare environmental performance between products of the same type (see Section 3.3).

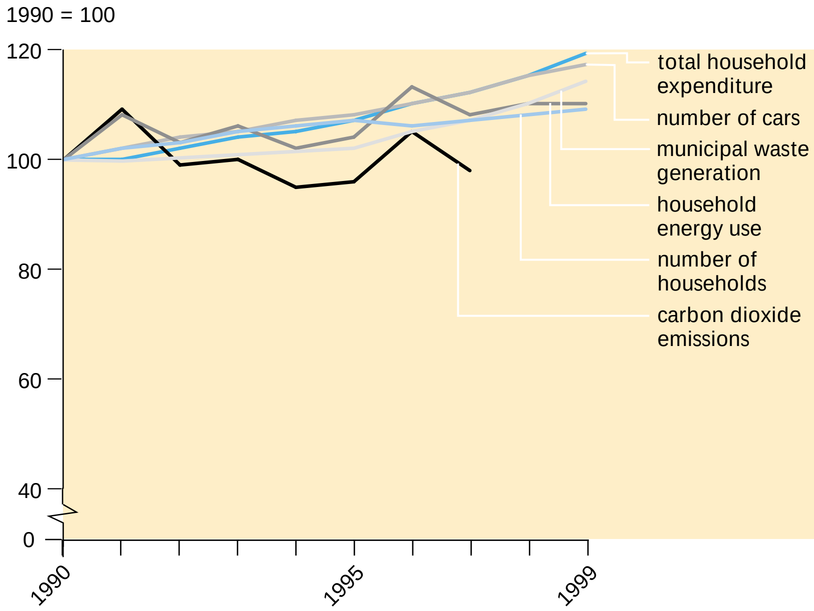
3.1. Indicators of household eco-efficiency

While a number of sectors (including energy and agriculture) have begun to sever the link between continued growth and environmental impact, the household sector has largely unsuccessful, with energy consumption and waste generation rising in line with household expenditure and the number of households (see Sections 5.2 and 6.1). Crucially, these trends may continue as the number of households increases, unless progress can be made in reducing household consumption and the impact of household expenditure (see *Environmental signals 2001*, Chapter 3).

Levels of car ownership have increased in line with the number of households. Between 1980 and 1999 the number of cars per 1 000 inhabitants grew by 17 % and this growth is expected to continue (see Section 4.4). Levels of municipal waste are also rising in line with the number of households. Around 70 % of municipal waste collected originates from households and the total amount of municipal waste collected in the EU rose from an average of 479 kg per person in 1991 to 545 kg per person in 1999, an increase of 14 %. The EU's 2000 target for municipal waste was 300 kg per person per year (see Chapter 12).

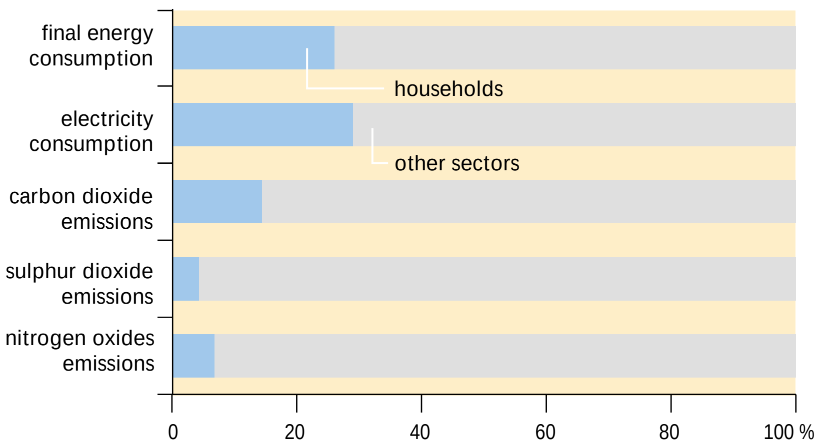
Carbon dioxide emissions from the household sector in 1997 were close to the 1990 level with the increase in the number of households largely offset by improvements in energy efficiency and the switch from coal and oil to natural gas (see Chapter 5). Overall, households account for around 14 % of total carbon dioxide emissions and a relatively low proportion of nitrogen oxides and sulphur dioxide emissions. However, households account for almost a third of final electricity consumption, and electricity generation is responsible for a significant proportion of total emissions. The contribution of households to indirect pressures such as these are likely to be significantly greater than the direct pressures.

Indicators of eco-efficiency of the household sector, EU — Figure 3.1.



Note: Carbon dioxide emissions from fossil fuel use. Base year for expenditure and waste is 1991
Sources: EEA; Eurostat

Share of selected pressures from the household sector, EU — Figure 3.2.



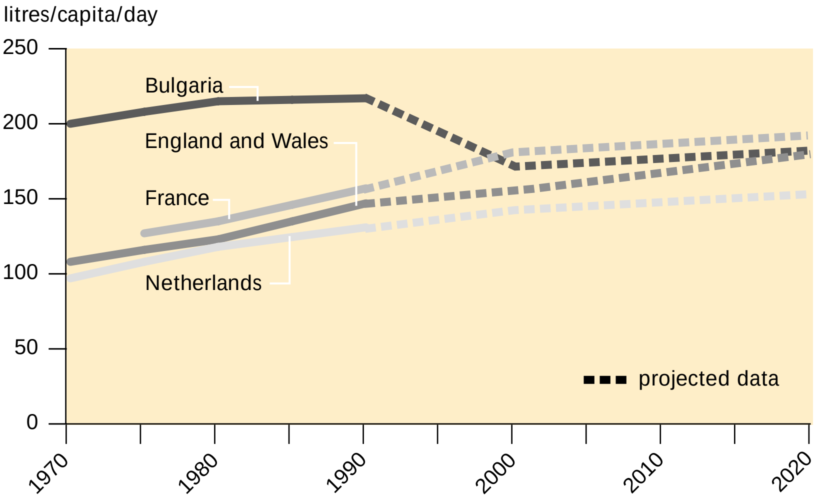
Sources: Eurostat; NTUA

Household energy use, waste generation and car ownership increased between 1990 and 1999 in line with the increase in household numbers and the rise in household expenditure. These trends are likely to continue unless progress is made in reducing the impact of household resource consumption and expenditure.

Quality of information ☆☆

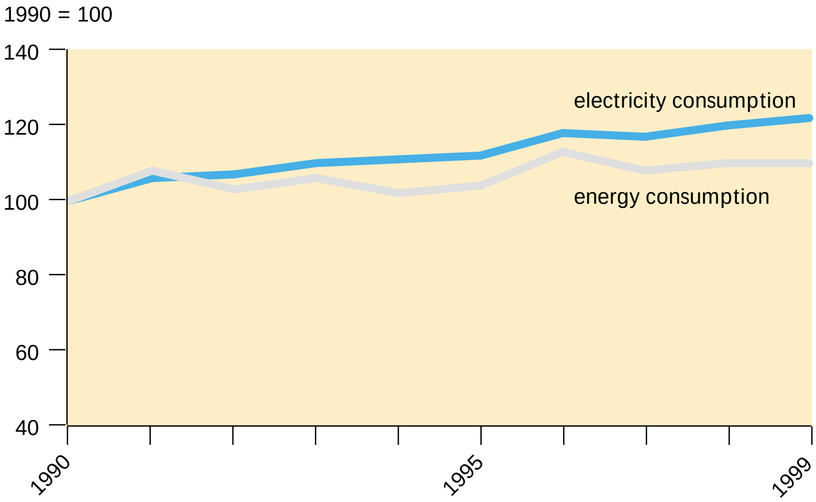
http://themes.eea.eu.int/Sectors_and_activities/households/indicators

Figure 3.3. **Water consumption in households**



Note: data for 2000 and 2020 are based on forecasts.
Source: ICWS

Figure 3.4. **Household energy and electricity consumption, EU**



Source: Eurostat; NTUA

Household water consumption decreased slightly during the 1990s. The potential to increase the efficiency of household water use is considerable and can be encouraged through various policy instruments (e.g. water metering) and the uptake of new-generation household appliances.

Over the same period, while there has been an increase in energy standards for houses and more efficient electrical appliances and heating installations have been introduced, this has not led to a decrease in total energy and electricity consumption by households.

Quality of information ☆☆

hppt://themes.eea.eu.int/Sectors_and_activities/households/indicators

3.2. Water and energy consumption

Households account for about 10 % of total water consumption in the EU. Most of the water used in households is for toilet flushing, bathing and showering, and washing and dishwashing. The proportion used for drinking and cooking relative to other uses is minimal (see Section 11.1).

The potential to improve the water efficiency of common household appliances (e.g. toilets, taps and washing machines) is considerable. For example, taps may be fitted with air devices (that introduce bubbles into the water and increase its volume and thus reduces the flow) or infra-red sensors (that only allow water to flow when an object is placed beneath them). It has been estimated that water-saving devices such as these and low flush toilets could achieve reductions in water use of around 50 % (EEA, 2001). The EU has established conditions governing the manufacture and sale of dishwashers and washing machines (see section 3.3).

Other means for encouraging efficient water use include water metering. Immediate savings from the introduction of metering are estimated to be about 10–25 % of consumption (EEA, 2001).

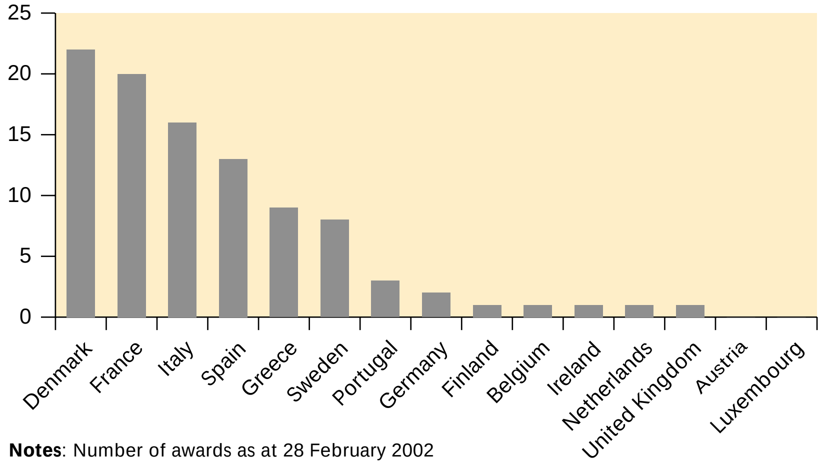
The household sector remains one of the largest users of energy. Consumption by the sector in the EU increased during the 1990s by 10 %, with energy used for space heating falling slightly and electricity consumption rising by about 22 %. The overall increase was due to the increase in number of households, with consumption per household remaining nearly constant (see *Environmental signals 2001*, Chapter 3 for further details). Electricity consumption has also paralleled the increase in household numbers and this trend threatens to undermine the progress made in manufacturing more efficient electrical appliances (see Chapter 5).

3.3. Purchase of eco-labelled products

The European eco-label award scheme was launched in 1992 and, to date, 98 manufacturers, retailers and service providers are eligible to use the flower logo, with awards having been granted for more than 400 products. However, the overall number of awards is low and, moreover, they are concentrated in a number of product groups and a few Member States. For example, textile products and indoor paints and varnishes account for 36 % and 28 % of the awards, respectively. However, the profile of the EU Flower could rise dramatically under a three-year promotional plan recently adopted by the European Commission. The plan aims to achieve a 'minimum level of visibility' for the label across the EU. This is not quantified, but a longer-term goal is to reach between 1 % and 30 % of market share depending on product type. Such targets are ambitious: currently less than 0.1 % of paint and varnish products carry the Flower label. Other aims include an increase in the number of product groups for which the EU Flower is available from the current 17 to between 25 and 35 within five years.

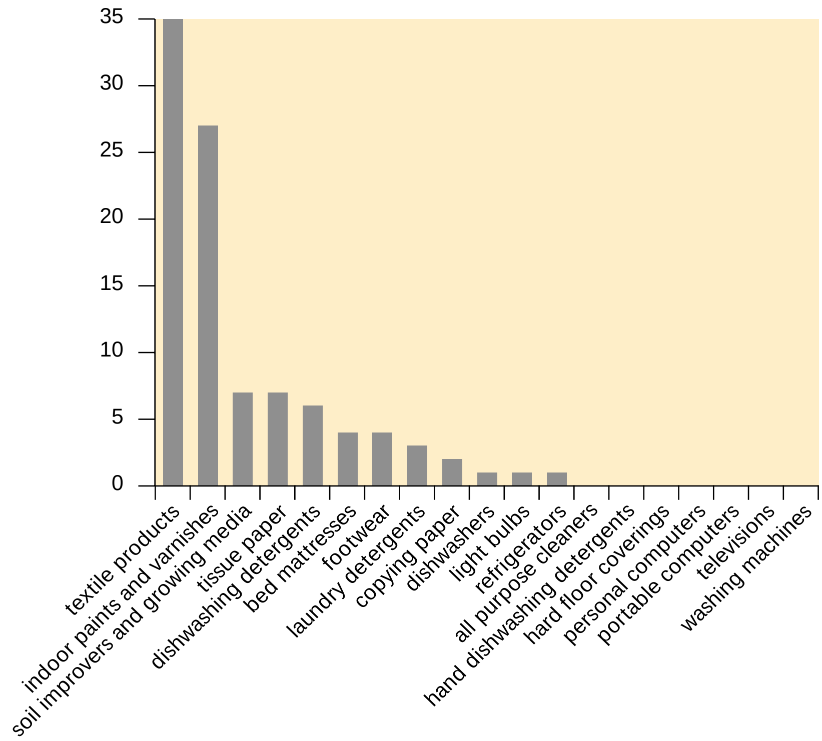
Other examples of eco-labelling schemes are: Germany's Blue Angel, which was introduced in the 1970s and can now be found on over 3 000 products; the Nordic Swan which has a high level of recognition among Scandinavian consumers; and two Dutch eco-labels (EKO-keur and Milieukeur) which are used for several food and non-food products although the market share is still small with 10 % of dairy products and 5 % of fresh fruits and vegetables having the largest share of EKO-keur. Other eco-labels used in the EU include the Energy Star for energy-efficient office equipment (which originates from the United States) (see also Chapter 5 on domestic appliances) and the European Commission logo for organic farm products, which provides consumers with a guarantee they are purchasing organically-farmed products (see Section 6.5).

Number of EU Flower awards by country, EU Figure 3.5.



Notes: Number of awards as at 28 February 2002
Source: European Commission

Number of EU Flower awards by product group, EU Figure 3.6.



Notes: number of awards as at 28 February 2002.
Source: European Commission

The number of products awarded the EU Flower is low and the awards to date are concentrated in only a few product groups and a few Member States. However, a promotional plan recently adopted by the European Commission aims to increase its profile. Other European eco-labelling schemes have been more successful and in Scandinavia and Germany a significant number of products carry the Nordic Swan and Blue Angel eco-labels, respectively.

Quality of information ☆☆☆

http://europa.eu.int/comm/environment/ecolabel
http://europa.eu.int/comm/environment/ipp/home.htm

4. Transport

policy issue	indicator	assessment
decoupling transport volume growth from economic growth	passenger-km per GDP	☹
- " -	tonne-km per GDP	☹
shifting the balance between transport modes from road to rail and inland waterways	modal split of passenger transport	☹
- " -	modal split of freight transport	☹
reducing use of resources and emissions that damage the environment	transport eco-efficiency	😐
shifting to improved technologies and fuels	uptake of cleaner technologies and fuels	☺
internalising external costs	differentiation of transport taxes and charges	😐
stimulating fuel efficiency	real changes in fuel prices	☹

Current trends are away from achieving the EU's recently-announced objectives of breaking the link between economic growth and growth in transport, and bringing about a shift in transport use from road to rail, water and public passenger transport. Alongside greater use of cars and planes, passenger transport is growing at a rate close to gross domestic product (GDP), while freight transport is growing faster than GDP.

These traffic trends, combined with little improvements in energy efficiency, result in growing energy use and greenhouse gas emissions. Transport is thus offsetting other sectors' efforts to reach the Kyoto targets. Advances in vehicle technology and fuels have resulted in a significant decrease in emissions of acidifying gases and ozone precursors, though in many cities air quality still poses health risks and further improvement is needed.

Several Member States are now moving towards tax structures that differentiate between the various transport modes in ways that reflect their environmental costs, but there remain significant barriers to implementation.

At its June 2001 summit in Gothenburg, the European Council singled out the transport sector as one of the four priority areas where sustainability policy development must be put on a faster track. The sector is also high on the agenda of the EU's sixth environment action programme and Sustainable development strategy. The recently published White Paper European Transport Policy for 2010: Time to Decide (European Commission, 2001a) proposes an action plan of sixty or so measures around four main themes:

- shifting the balance between modes of transport (improving the quality of the road sector, revitalising rail, controlling air transport growth and adapting maritime and inland waterway transport systems, linking up of transport modes);
- eliminating bottlenecks (developing the trans-European transport network);
- placing the users at the heart of transport policy (improving road safety, fair and efficient pricing through infrastructure charging and harmonisation of fuel taxation);
- managing the globalisation of transport (linking the future Member States to the trans-European transport network).

The proposed action programme aims mainly at stabilising the modal shares at

1998 levels by 2010. The White Paper suggests that this would also result in decoupling transport growth (in terms of vehicle-km) from GDP growth. However, no evaluation has been made of the effectiveness of the proposed measures, nor of their environmental gains. In 2002, the Commission intends to issue a communication with quantified targets for transport. An assessment of the implementation of the action programme and its socio-economic and environmental impacts will be made in 2005. Meanwhile, the transport and environment reporting mechanism (TERM) will continue to monitor the progress of the transport and environment integration process (EEA, 2001).

As stated above, the White Paper also identifies enlargement of the EU as one of the major transport policy challenges for the next ten years. Assessing the future impacts of enlargement first requires a good overview of the current status in the accession countries as well as in the EU; EU developments have been reported in previous TERM reports. This is a first step into gearing in the new countries into the TERM information system. A next step will be to report on the effects of enlargement in both regions.

In joining the European Union, the accession countries will also share the objectives of its Treaty. The new countries should therefore be actively involved in implementing the main policies such as the EU sustainability development strategy and the sixth environmental action programme, which both have transport as one of the priority concerns. The integration of environmental concerns in sectoral policies, which was initiated by the Cardiff Council in 1998, has become a major policy pillar of the SDS. The EU Transport Council therefore invited the accession countries 'to follow the integration principle as it is being developed in the Community when formulating national and local strategies during the pre-accession period' (European Council, 1999).

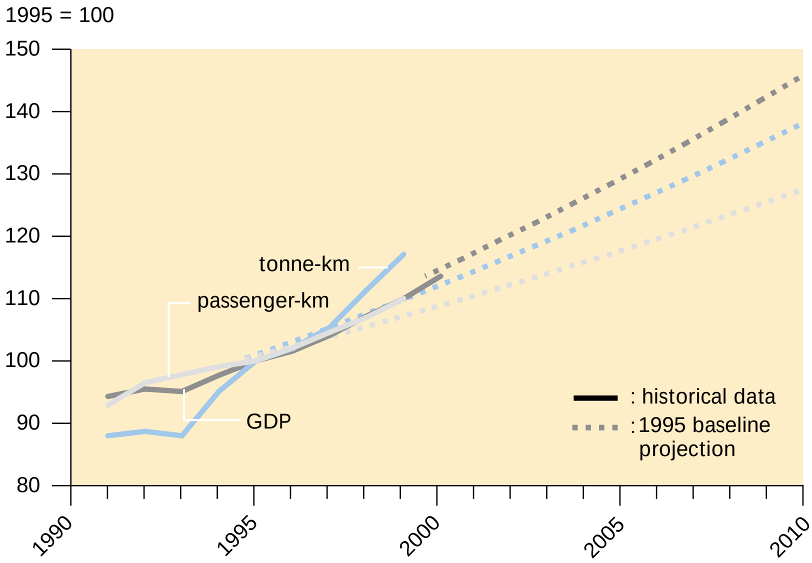
The Marco Polo programme

The Commission proposal for a Parliament and Council Regulation setting up the Marco Polo programme was announced in the White Paper (European Commission, 2001a) and adopted on 4 February 2002. The main goal of the ten-year Marco Polo scheme is to reduce road congestion and improve the environmental performance of the transport system by shifting freight from road transport to short sea, rail and inland waterway transport. The Commission proposes a budget of 115 million euros (2003 – 2007) to achieve this goal.

Taking into account the principle of subsidiarity, the programme will focus on international, rather than national, projects. Marco Polo funds would be offered to reduce the start-up costs of new, international non-road freight services and to stimulate co-operative behaviour in the freight logistics market. The programme will also be able to fund actions involving countries, which are candidates to accession to the European Union. It is envisaged that the Marco Polo programme will be fully operational by 2003.

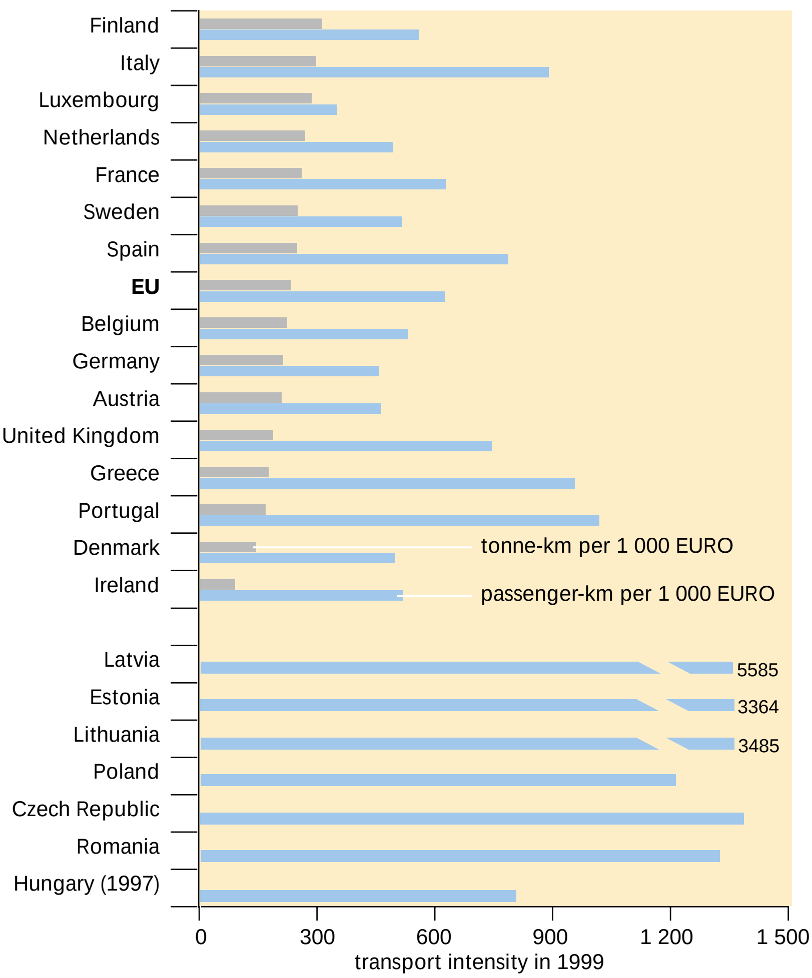
Source: http://europa.eu.int/comm/transport/themes/land/english/lt_28_en.html

Figure 4.1. **Passenger and freight transport and GDP, EU**



Note: Passenger transport includes road, rail and domestic, intra- and extra-European flights. Motorcycle and inland waterway transport are excluded due to lack of historical data, and tram/metro are not included since these modes are not included in the projection model PRIMES. Freight transport includes road, rail and inland waterways. Short-sea shipping and air freight transport are not included as these are not covered by the PRIMES projections.
Source: Eurostat, 2002; European Commission, 2001b

Figure 4.2. **Passenger and freight transport per GDP, 1999, EU and some accession countries**



4.1. Passenger and freight transport volumes

Passenger transport in the EU grew at the same rate as GDP (i.e. at an annual rate of 2.4 %) between 1995 and 1999 (slightly faster than GDP before 1995). Air and road transport are the fastest growing modes (with average annual growth of 6.9 % and 1.8 % respectively between 1991 and 1999). Leisure trips, commuting and shopping account for the vast majority of car trips. Distances to basic services increase as a result of spatial planning decisions (e.g. urban sprawl) (see Chapter 13). Car ownership, a main driving force for passenger car transport growth, has increased by 17 % between 1990 and 1999, closely linked to growing incomes and the increasing number of households (see Chapter 3). Another worrying trend is the rapid increase of powered two-wheelers, for which stricter emission standards come into force only in 2003.

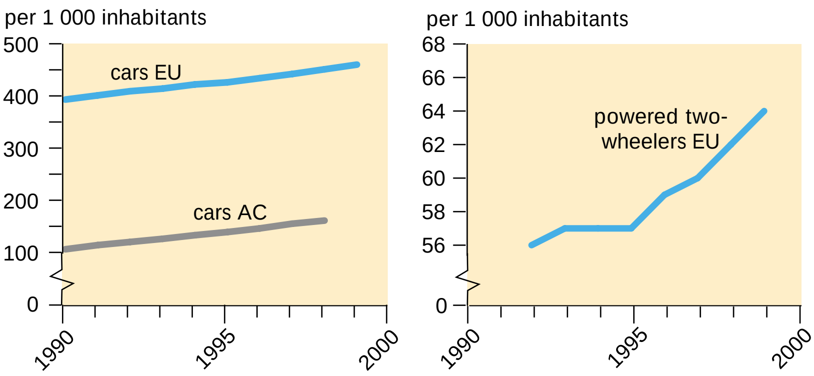
Tonne-km in the EU increased by almost 30 % between 1991 and 1999 (an annual average of 3.3 %) and thus grew much faster than GDP (1.9 % annually over the same period). Road haulage is the fastest growing mode of freight transport (4.7 % per year), followed by short-sea shipping (2.9 %). The globalisation of the economy and the liberalisation of the internal market result in more complex production and trading networks, and thus greater distances and more trips. Freight transport costs are often low compared to other production costs (e.g. storage costs and the benefits of timely delivery). This also encourages the shift of stocks from warehouses to roads.

Note: Passenger transport includes passenger car, bus/coach, rail, tram/metro and domestic aviation. Freight transport includes road, rail, inland water and oil pipelines. Short sea shipping and intra- and extra-European flights are excluded due to a lack of some country breakdown data. Accession countries: 1998 data.
Source: Eurostat, 2002; UNECE, 2001

According to 1995 baseline projections, future passenger travel is expected to decouple slightly from economic growth. The reasons for this include limits on the average travelling speed (due to safety concerns and congestion) and the expected saturation of car ownership in the Member States. The main assumption for the projected decoupling of freight transport demand and economic growth is a gradual shift away from industry towards a knowledge-based economy. However, the above-mentioned factors could counterbalance any benefits from this shift, as appears to be happening in most recent years (tonne-km grew faster than originally projected between 1995 and 1999).

EU enlargement is expected to increase transport flows within and between the accession countries and the EU significantly. The rapidly growing car fleet in accession countries, which grew by 52 % between 1990 and 1999 (UNECE, 2001), and the decline in rail and public transport which is observed in some countries (a decrease of 18 to 30 % in passenger-km), are indications of drastically growing car transport. Freight transport intensity dropped in almost all accession countries, but is still much higher than the EU average. After an initial decrease in the early 1990s, following structural changes in the economy and recession, freight volumes in the accession countries are now growing significantly. Increasing trade with the EU is expected to enhance this trend (IVM, 1998).

Number of passenger cars and powered two-wheelers, EU and accession countries Figure 4.3.



Source: European Commission, 2001b; UNECE, 2001

Teleworking is growing, and may help to avoid congestion

The European Commission intends to promote teleworking by accelerating investment in communications infrastructure and services (European Commission, 2001a). Currently, about 4 % of European employees are regular teleworkers, with the highest shares in the Scandinavian countries and the Netherlands. The UK and Germany are above the European average. Teleworking is lagging in Italy, France, Spain and Ireland.

The number of teleworkers is expected to rise to 11 % of the EU labour force by 2005. However, only a minority will use telework to reduce commuting trips ('telecommuting'). Other types of decentralised work like mobile telework are also important. Teleworking may affect location patterns, as it can lead to people moving to residences further away from work.

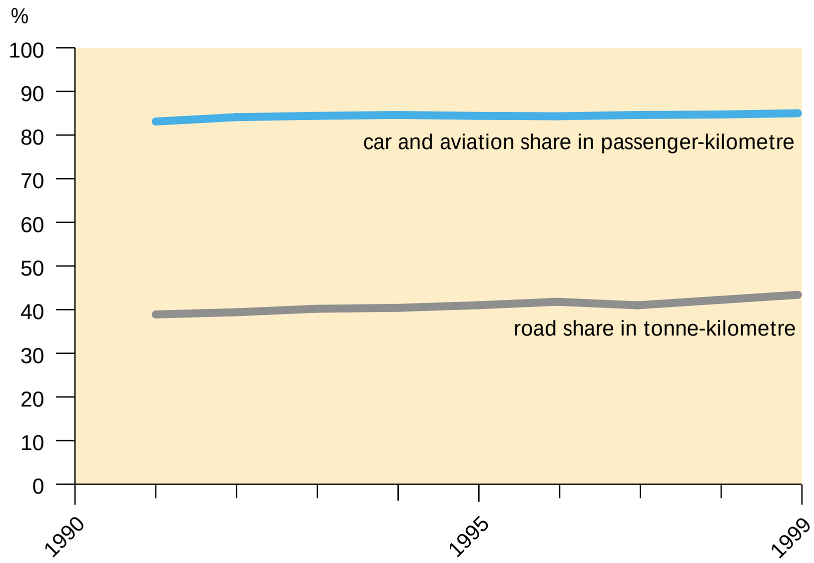
Source: EcaTT web site: http://www.ecatt.com/ecatt/

In the past decade, passenger transport volume has grown at the same rate as the economy, while freight transport growth outstripped it. By 2010, a slight relative decoupling is expected for passenger transport only.

Quality of information

http://themes.eea.eu.int/Sectors_and_activities/transport/indicators
http://europa.eu.int/comm/energy_transport/en/lb_en.html

Figure 4.4. **Shares of road and air in passenger and freight transport, 1991–1999, EU**



Note: Passenger transport includes passenger car, rail, tram/metro, bus/coach and domestic and intra- and extra-European aviation; freight transport includes road, rail, inland navigation and short-sea shipping.
Source: Eurostat, 2002 ; statistics on Danish oil pipelines taken from European Commission, 2001b

Passenger transport continues be dominated by the car (75 % of total passenger-km), but air transport is now the fastest-growing mode. The share of the more environmentally-friendly modes (i.e. bus/coach, rail and tram/metro) is declining slightly.

Quality of information ☆☆

http://themes.eea.eu.int/Sectors_and_activities/transport/indicators

4.2. Modal split in passenger and freight transport

As part of the Sustainable Development Strategy, the EU has set itself the goal of bringing about a shift in transport use from road to rail, water and public passenger transport. The White Paper aims at stabilising modal shares at 1998 levels by 2010, as a first step towards a shift in transport use from then onwards. The proposed measures include pricing, revitalisation of rail and inland waterways, promotion of inter-modality (through, for example, the Marco Polo programme) and investments in the trans-European transport network. However, it is unclear how far these measures will contribute to achieving modal stabilisation and the extent of the environmental gains that modal shifts will achieve.

Car transport, which is generally considered to be faster and more flexible than public transport, retains its dominant share of the passenger transport market. The slight drop in its share in passenger-km (from 77 % in 1991 to 75 % in 1999) is explained by the drastic increase in aviation, of which the share rose from 6 to 10 %, as a result of growth tourism and business travel. The share of public transport (i.e. rail, bus / coach and tram / metro) fell by 1 % in the period 1991–1999.

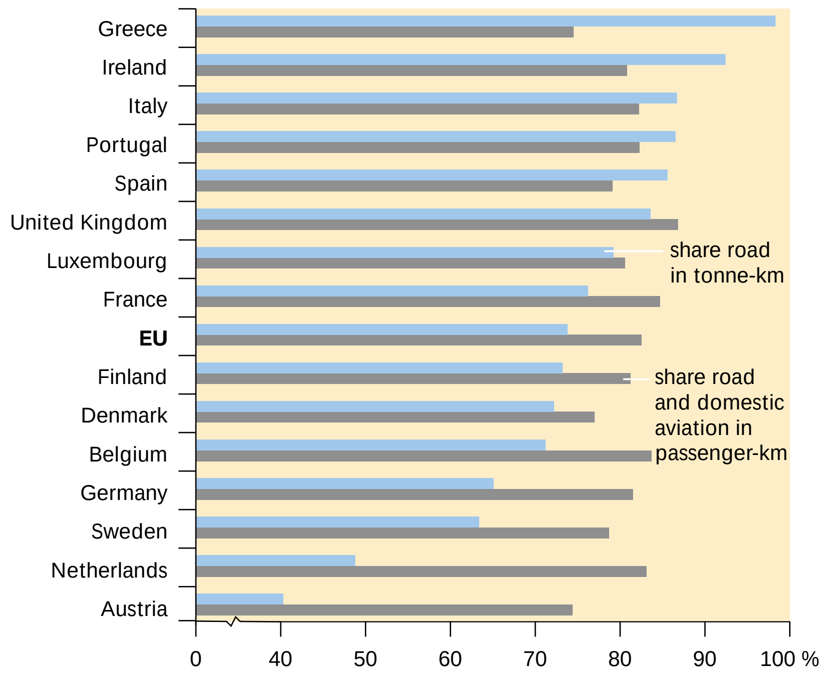
Between 1991 and 1999 the share of road in freight transport rose from 39 to 43 %. The shares of rail, inland waterways and oil pipelines have all decreased. The increase in road haulage can be explained by the requirements of modern production and trade patterns, which are geared towards ‘just-in-time’ delivery of goods, where transport speed and flexibility are essential. Furthermore, the road sector is liberalised to a great extent, while the rail sector is just starting to open up. In addition, the distance over which goods are transported by road is on average 110 km / tonne (European Commission, 2001b), a relatively short distance over which rail and inland waterways are less efficient.

For longer distances, short sea shipping has become quite successful in some parts of the EU. To revitalise the rail freight sector the Commission has recently made proposals dealing with the liberalisation of the rail freight market and the development of a dedicated rail freight network (European Commission, 2002). However, growing concerns are being expressed regarding the environmental performance of shipping (in particular related to its high emissions of acidifying substances) as well as rail (in particular related to noise).

Incorrect pricing (i.e. price structures that do not correctly reflect the real costs to society) has also contributed to the distortion of the transport market to the advantage of road use and aviation (see Section 4.5). Infrastructure investments have enhanced this imbalance; investment shares have remained almost unchanged since 1980, dominated by road (62 % in 1995) and rail (28 % in 1995) (ECMT, 1999). Public transport received only a small part of all investments, high-speed rail being a notable exception.

In the accession countries, rolling stock and infrastructure are deteriorating due to investment shortages and problems related to the restructuring of railway and public service companies. As a result, the share of rail in freight transport, which in 1990 reached almost two thirds in some countries, is falling rapidly. The greatest part of investments in new infrastructures is allocated to roads, partly reflecting a very limited initial road infrastructure endowment in these countries. The motorway network in accession countries has grown by 94 % since 1990. The second largest share is taken by rail, in order to upgrade the infrastructure to western European standards. The extension of the trans-European transport network (the 'TINA' process) is focusing on the links connecting accession countries with the EU.

Passenger and freight transport: shares of road and domestic aviation, 1999, EU — Figure 4.5.



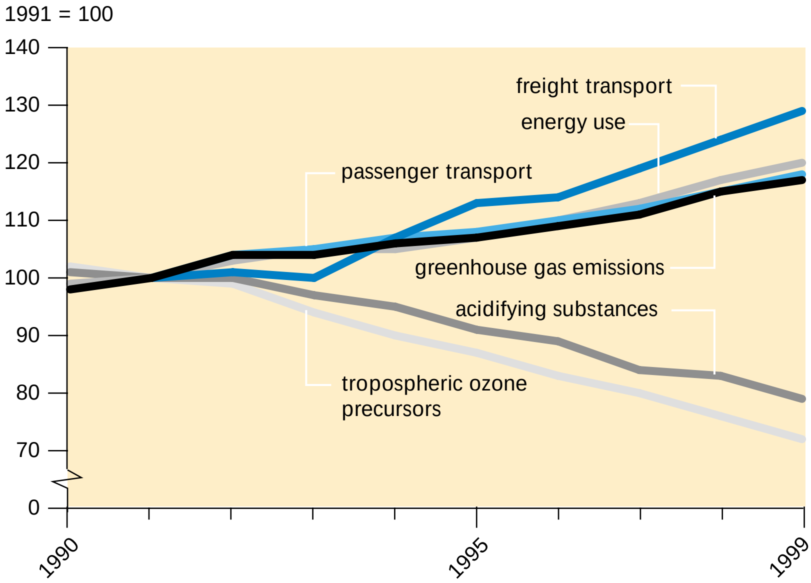
Note: Passenger transport includes car, bus/coach, rail and tram/metro, and domestic aviation. Intra and extra-European flights are excluded due to missing country breakdown of data. Freight transport includes road, rail, inland waterways and oil pipelines. Short sea shipping is excluded due to missing country breakdown of data.
Source: Eurostat, 2002

There is no sign as yet of a shift of freight from road to rail (rail's share fell from 10 % in 1991 to 8 % in 1999). Road haulage and short sea shipping remain the main freight transport modes, with a share of 43 % and 42 % of total tonne-km respectively.

Quality of information ☆☆

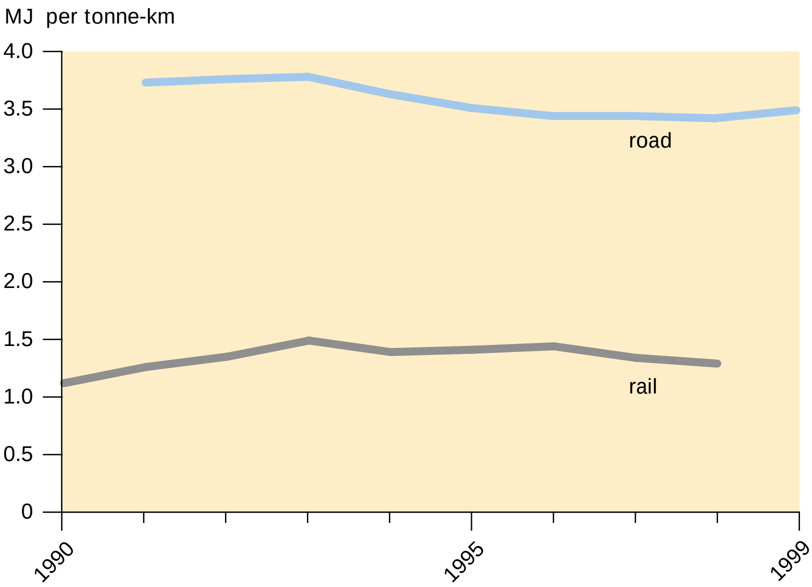
http://europa.eu.int/comm/transport/rail/index_en.html

Figure 4.6. **Eco-efficiency of transport, EU**



Note: Passenger transport includes car, bus/coach, rail, tram/metro and domestic, intra- and extra-European aviation. Freight transport includes road, rail, inland waterways short-sea shipping and oil pipelines.
Sources: EEA; Eurostat, 2002

Figure 4.7. **Energy efficiency in road and rail freight transport, selected Member States**



Note: Road based on weighted average of five Member States (Austria, Denmark, France, Sweden and the United Kingdom).
Source: ODYSSEE

4.3. Transport eco-efficiency

The energy efficiency of passenger car transport has improved slightly during the past decade, and as a result so has its average specific carbon dioxide emissions (EEA, 2001). The voluntary agreement with the car industry to reduce carbon dioxide emissions from new cars is making progress towards its target. Although the energy efficiency of rail has not been improved in recent decades, it remains the most energy-efficient mode of passenger transport. Despite technological progress during the 1980s, aviation continues to be the least efficient mode. The energy efficiency of road freight transport has not improved during recent years. Trucks consume significantly more energy per tonne-km than rail or ship transport.

The few gains in energy efficiency are offset by the growth in transport. Transport is the fastest-growing energy consumer in the EU; energy use since 1990 increased by 21 %, compared with 6.7 % for the remaining economic sectors. More than 30 % of final energy in the EU is now used by transport, which makes the sector a major source of greenhouse gas emissions. Transport is therefore one of the priority areas sectors for the Community's action plan to improve energy efficiency and the European Climate Change Programme.

Alternative and renewable energy sources for transport still have a low penetration. The European Commission aims at a 20 % substitution of diesel and gasoline fuels by alternative fuels (biofuels, natural gas and hydrogen) in the road transport sector by 2020 (European Commission, 2000a). Two Directives have been proposed recently: one setting a minimum level of biofuels as a proportion of fuels sold from 2005 (starting with 2 % and reaching 5.75 % of fuels sold in 2010); and the other providing a framework for reduced excise duties on biofuels. However, these plans have raised serious concerns, as the consequences on biodiversity can be detrimental and the impact on greenhouse gas and air pollutant emissions reduction remains uncertain.

In 1999, road transport contributed 25 % of total carbon dioxide emissions. Road transport is also a small but growing source of nitrous oxide emissions, a side-effect of the fitting of catalysts to passenger cars. Nitrous oxide emissions from transport more than doubled between 1990 and 1999 to 7 % of total emissions. A further substantial rise is expected by 2010. However, since transport is not a large source of nitrous oxide, this will not have a major impact on the overall trend of greenhouse gas emissions.

Between 1990 and 1998, EU greenhouse gas emissions from international transport (based on fuel sold in the EU to ships and aircraft engaged in international transport) increased by 33 %, to 5 % of total EU emissions. These emissions are not addressed under the Kyoto Protocol, but the International Civil Aviation Organisation and the International Maritime Organisation are currently examining options for their reduction.

Transport is also responsible for more than half of EU emissions of tropospheric ozone precursors and more than 20 % of emissions of acidifying substances. Technology and fuel improvements (in particular the introduction of catalysts and stricter emission regulations for diesel vehicles) have led to significant reductions in these emissions. Without these measures, nitrogen oxides emissions from traffic in the EU would have been 50 % higher in 1998. Extra efforts are however still needed, as urban air quality in most European cities remains poor (see Chapter 10).

Emissions from international shipping are currently not included in national inventories, but it is estimated that shipping in European waters contributed 24 % of total sulphur dioxide emissions and 22 % of total nitrogen oxide emissions from EU15 countries in 1998 (European Commission, 2000).

A large proportion of the population is exposed to traffic noise levels that can be annoying or harmful for health. The Environmental Noise Directive, which is expected to be adopted in 2002, would require countries to make noise maps for agglomerations, major roads, major railways and airports, by 2004. These would serve as a basis for the development of action plans to combat noise pollution. The expansion of infrastructure continues to take land from agriculture and urban use, affecting a wide range of designated natural sites and habitats (see Chapter 13).

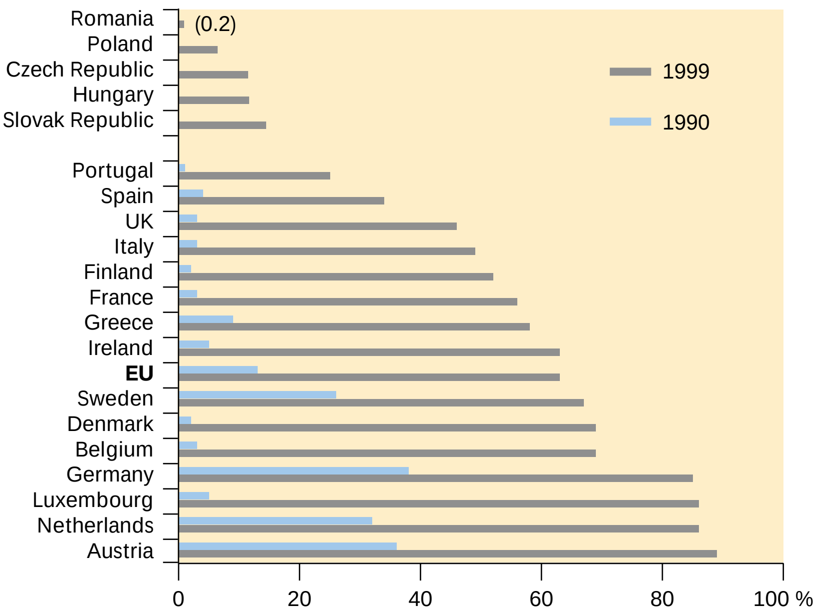
As a consequence of the major growth in transport, and the shift to road and aviation, carbon dioxide emissions from the transport sector are continuing to grow.

Cleaner technologies and fuels have led to significant reductions in emissions of local and regional air pollutants, but additional efforts are needed to reach targets

Quality of information ☆☆

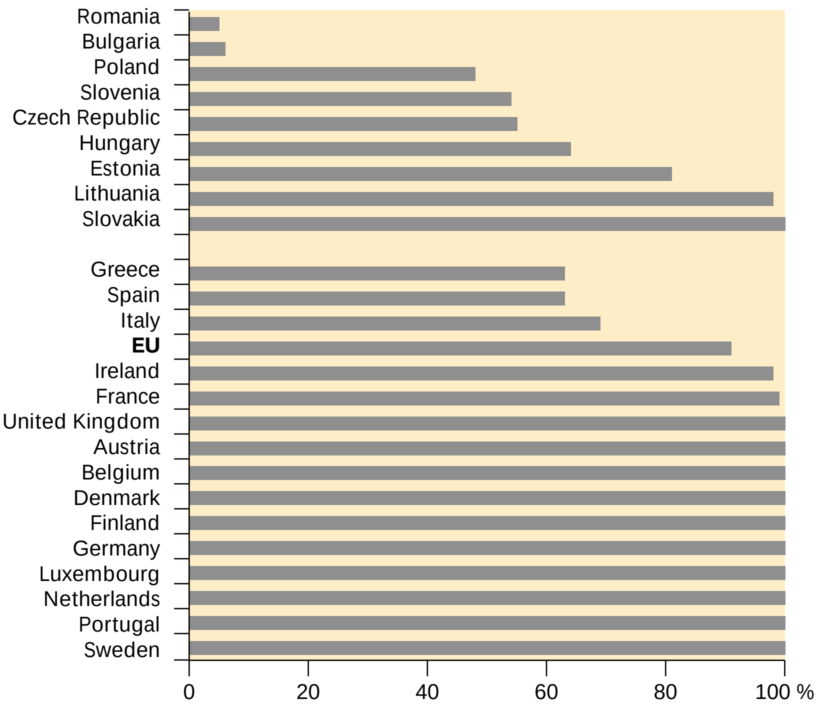
http://themes.eea.eu.int/Sectors_and_activities/transport/indicators
http://europa.eu.int/comm/environment/air/transport.htm

Figure 4.8. **Estimated share of petrol cars fitted with a catalytic converter, EU and selected accession countries**



Note: Accession countries 1996 and IRL, I, P, UK 1998
Source: Eurostat, 2002; REC,1998

Figure 4.9. **Share of unleaded petrol in total petrol deliveries, EU and accession countries**



Note: EU 1999 and accession countries 1996.
Sources: Eurostat, 2002; REC, 1998

Technology improvements, such as three-way catalysts, and cleaner fuels have made vehicles less polluting per transport unit.

Quality of information ☆☆

http://themes.eea.eu.int/Sectors_and_activities/transport/indicators
http://europa.eu.int/comm/environment/air/transport.htm

4.4. Uptake of cleaner technologies and fuels

Environmental regulation, through which vehicle emission standards have gradually been tightened and fuel quality improved, has been successful in reducing the emissions of certain air pollutants (see Section 4.3.). The penetration rate of new technologies is closely correlated with the average lifetime of vehicles and the average age of the fleet. Estimates based on the numbers of cars fitted with catalytic converters suggest that it takes at least ten years for a new technology to penetrate the entire car fleet.

In 1999, 63 % of petrol-driven cars had catalytic converters, although there were wide variations between Member States. The promotion of unleaded petrol, through a mixture of fiscal and regulatory instruments, is a major success story in the EU; it is expected that leaded petrol will be completely phased out by 2005 in the EU.

Compared to the EU, the car fleet in the accession countries has a high average age. In 1996, the share of passenger cars fitted with a catalytic converter in five accession countries ranged from zero to 14.5 %. The process of phasing out leaded petrol started five years later in the accession countries than in the EU, yet the Slovak Republic and Lithuania have already completed phasing it out. At the other end of the spectrum, in countries such as Romania and Bulgaria the share of unleaded petrol in 1996 reached only 5 %.

Currently a number of Member States are also promoting low or ultra-low sulphur fuels in advance of the EU standards in Directive 98/69, which comes into force in 2005. The main purpose is not to reduce sulphur dioxide emissions, which have already been substantially reduced in the past two decades, but to facilitate the introduction of advanced $DeNO_x$ and particulate filters.

4.5. Differentiation of transport taxes and charges

It is estimated that the external costs of transport amount to 8 % of GDP, with road transport accounting for more than 90 % of these costs (INFRAS / IWW, 2000). Accidents, noise, air pollution and climate change are the most important contributors. Costs of infrastructure and congestion are not included in this figure. The EU 'fair and efficient pricing' policy for the transport sector aims at the internalisation of external costs (European Commission, 2001a). This would encourage shifts to cleaner or safer vehicles or fuels, shifts of demand away from peak periods, safer driving, more efficient logistics, and increases in occupancy rates and load factors.

To be effective, internalisation instruments should be location-, time- and mode-specific, as social marginal costs differ for the various mode of transport, for various regions and times of the day and week. Shifting the burden from fixed taxes and charges, such as annual vehicle taxes or the annual ticket for motorway use, to variable taxes and charges, such as road cordon or kilometre pricing, is generally considered the most effective. Other tools can be modifications of existing taxes (e.g. differentiation of annual road tax according to energy efficiency) or the introduction, reduction or removal of subsidies. In 2002, the Commission will propose a framework Directive to establish the principles of infrastructure charging and a pricing structure for all modes of transport, including new regimes for road user charges, airport charges and air transport services charges (European Commission, 2001a).

Differentiated transport taxes and charges are currently applied mostly in the road sector on air pollution, and on aviation noise. Some schemes also exist for other modes. Finland applies track access charges on freight rail transport, differentiated according to marginal environmental and accident costs. Many EU airports raise a surcharge on landing fees that is differentiated according to noise levels. For some domestic flights, Sweden operates a surcharge on certain air emissions. Finland, The Netherlands, Portugal, Spain, Sweden and the UK have differentiated harbour fees favouring ships with a Green Award, or ships that have reduced nitrogen oxides and sulphur dioxide emissions.

Germany operates an annual vehicle tax differentiated by Euro class, as to emissions and noise. For passenger cars a variety of tools is in operation. Austria, Denmark and the UK have differentiated the annual road tax according to fuel consumption and carbon dioxide emissions. The Netherlands grants a reduction of the sales tax for the most fuel-efficient cars in their class.

Switzerland has introduced a distance-related fee for heavy duty vehicles on all roads effective from January 2001. In the Member States, road pricing schemes (other than road tolls on main highways) or kilometre charging have not yet been introduced, but systems are being developed in Germany, Austria and the Netherlands.

Fuel taxes can be used for internalising the external costs linked to carbon dioxide emissions, but are less well suited for internalising other externalities, as fuel taxes cannot be differentiated according to vehicle and trip characteristics (see Section 4.6). However, fuel tax differentiation has been used successfully in promoting a shift to from leaded to unleaded petrol. In road freight transport many countries have reduced the tax for low-sulphur diesel. A reduced tax on low-sulphur diesel is applied in The Netherlands and a reduced tax for clean petrol operates in Belgium and Denmark.

Table 4.1. Transport tax/charges differentiation in the Member States

		A	B	DK	FIN	F	D	EL	IRL	I	L	NL	P	E	S	UK
Non fuel-related taxes and charges																
Air pollution	Rail transport				✔											
	Aviation														✔	
	Water transport				✔							✔	✔	✔	✔	✔
	Road freight	✔	✔	✔			✔					✔			✔	✔
	Road passenger		✔	✔		✔	✔					✔			✔	
CO_2	Rail transport				✔											
	Aviation															
	Water															
	Road freight															
	Road passenger	✔		✔								✔				✔
Noise	Rail transport															
	Aviation	✔	✔			✔	✔			✔	✔	✔			✔	✔
	Water transport															
	Road freight	✔					✔									
	Road passenger															
Congestion (**)	Rail transport															
	Aviation															
	Water transport															
	Road freight															
	Road passenger															
Total number of measures (excluding fuel taxes)		4	3	3	3	2	4			1	1	5	1	1	5	4
Fuel taxation																
Lower fuel tax for unleaded petrol		(*)	(*)	(*)	(*)	(*)	(*)	✔	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)
Lower fuel tax for low-sulphur diesel or petrol			✔	✔	✔		✔					✔			✔	✔
Carbon tax on diesel and petrol					✔					✔						

✔ Countries that have or are introducing differentiated tax/charge schemes aimed at charging the user of transport services with the marginal external costs (i.e. environment, accidents and congestion costs) of the trip. Only instruments introduced at the national level are included, excluding e.g. parking fees and local road tolls.

(*) Leaded petrol no longer on the market.

Several countries apply tax differentiation schemes with the purpose of internalising the external costs of transport. The focus, however, is on air pollution from road transport and noise from aircraft.

Fuel tax differentiation has been successfully applied to promote the use of cleaner fuels.

Quality of information ☆☆

http://themes.eea.eu.int/Sectors_and_activities/transport/indicators
http://europa.eu.int/comm/transport/infr-charging/charging_en.html

4.6. Real changes in fuel prices

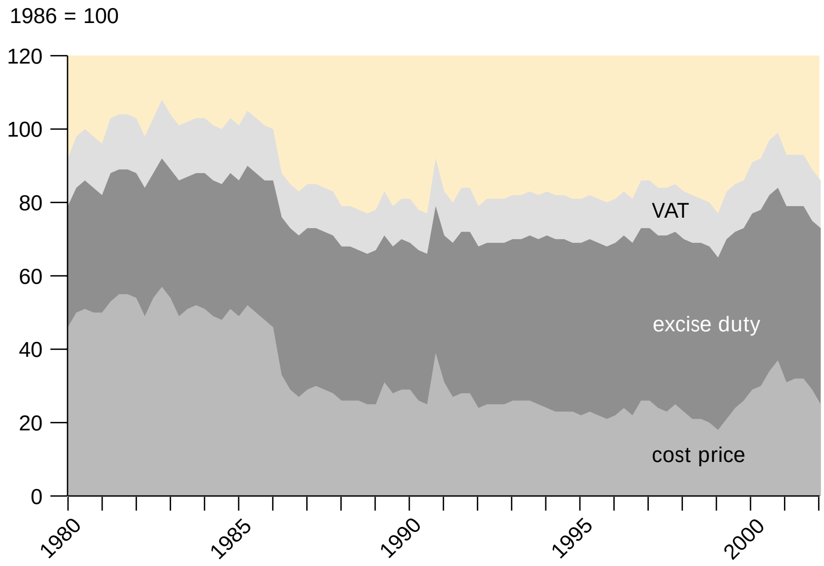
Fossil fuel consumption has a direct correlation with carbon dioxide emissions. Higher fuel prices can encourage the purchase of more fuel-efficient vehicles, and thus help to reduce fuel consumption. However, the impact of fuel prices on travel demand seems much less. Research has suggested that a 10 % increase in petrol price will, in the long run, reduce fuel consumption by 5 to 10 %, but would lead to only a 1 % to 3 % reduction in travel demand (IEA, 2001).

After the increase in the last months of 2000, fuel prices dropped again. Although trends vary among countries, the inflation-corrected EU average price of road fuel in early 2002 was lower than in the first half of the 1980s. The petrol price is significantly lower than 25 years ago, whereas the price of diesel is slightly higher. The share of taxes in prices at the pump has increased, in particular for diesel, preventing fuel prices falling as low as they would have under market forces only.

Tax regimes vary between countries, and in addition to fuels taxes, countries apply various other transport taxes and charges (Section 4.5). An increase or decrease in fuel taxes will therefore have a different effect in each country. The fuel tax competition provoked by 'tank tourism' between countries makes it furthermore difficult for individual countries to levy sufficiently high charges for internalisation (ECMT, 2000). The high excise duties in the UK are explained by its isolated position, which makes tank tourism difficult. The European Commission intends to propose a uniform taxation for commercial road transport fuel by 2003.

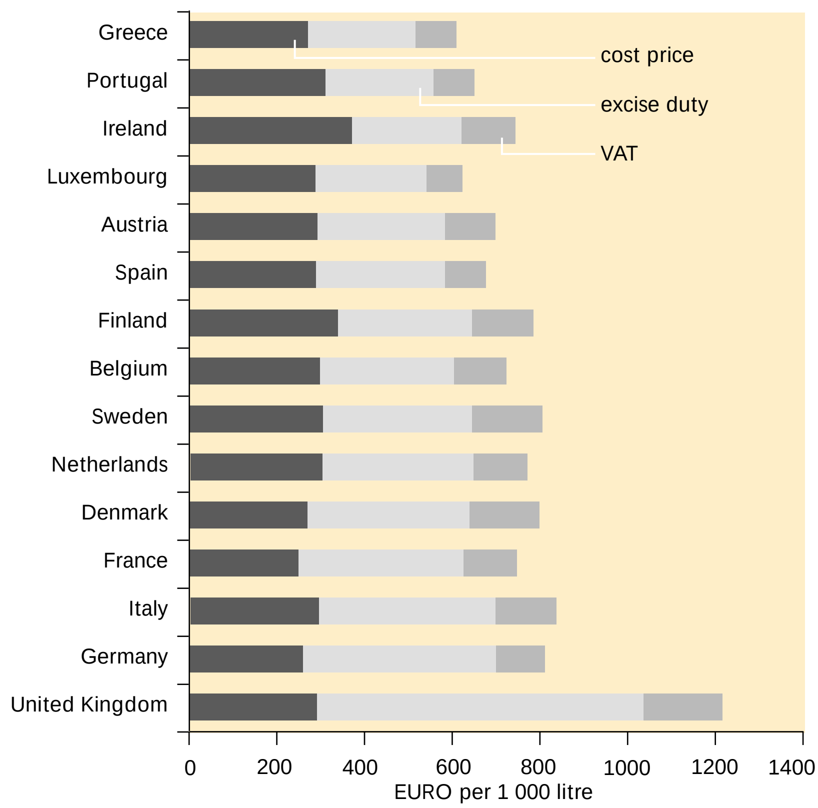
Fuel prices are, however, less appropriate instruments to internalise externalities other than the effects of climate change, as this requires a differentiation on the basis of vehicle type, time of the day, and location. Nevertheless, fuel tax differentiation has proved to be successful in promoting a shift towards cleaner fuels.

Real average prices of motor fuel, EU Figure 4.10.



Notes: petrol and diesel average combined
Source: Eurostat (processed by CE Delft)

Diesel prices in January 2002, EU Figure 4.11.



Source: Eurostat (processed by CE Delft)

The inflation-corrected EU average price of road fuel in early 2002 was lower than in the first half of the 1980s. This trend does not encourage fuel-efficient driving.

Quality of information ☆☆☆

http://themes.eea.eu.int/Sectors_and_activities/transport/indicators

5. Energy

policy issue	indicator	assessment
decoupling economic growth and energy consumption	energy intensity of the economy	☹
- " -	eco-efficiency of the energy industry	☺
decreasing energy-related emissions	emissions from electricity production	☺
encouraging the use of less carbon-intensive fuels	total energy consumption by fuel type	😐
encouraging the use of renewable energy	share of total energy and electricity obtained from renewables	☹
promotion of combined heat and power	share of combined heat and power in gross electricity production	😐
full internalisation of external costs	real energy prices	☹
- " -	energy tax levels	☹

The energy intensity of the EU economy decreased during 1990–1999, but with little influence from energy-saving policies. Energy prices generally remained low or even fell, despite increases in taxation, offering potentially little incentive to reduce energy consumption.

Energy use continues to be dominated by fossil fuels. Despite continued growth in renewables, substantial further growth is required to meet the EU indicative renewables targets of 12 % of total energy consumption and 22.1 % of electricity consumption by 2010.

Emissions of nitrogen oxides, sulphur dioxide and carbon dioxide from electricity production fell while electricity output increased, due largely to switching to fuels that produce fewer emissions, introducing emission-specific abatement measures, efficiency improvements and increased use of non-fossil fuel. Electricity production from combined heat and power increased, but increasingly liberalised energy markets may challenge the EU indicative 'combined heat and power in electricity' target of 18 % by 2010.

Many of the energy pressures on the environment are contributing to climate change and lasting damage to natural ecosystems, the built environment and human health (see Chapters 9 and 10). The EU sixth environmental action plan (6EAP) pays particular attention to measures to enhance energy efficiency, energy saving, more use of renewable energies and the reduction of greenhouse gases. In addition, the European Commission's strategy for sustainable development contains specific measures to limit climate change and increase the use of 'clean' energy. There are specific EU policies aimed at changing the fuel mix, including the promotion of renewable energies.

The need to 'minimise environmental impacts' is also explicitly recognised in the White Paper on Energy Policy alongside security of supply and competitiveness. The opening up and re-organisation of energy markets, driven by the electricity and gas Directives, could stimulate more efficient generating technologies, but to date, this incentive may have been outweighed by reduced energy prices, which in turn have reduced the incentive for energy conservation. Several EU policies aim to 'reduce energy consumption'. For example, the European Commission's Action Plan to Improve Energy Efficiency (COM(2000) 247 final) aims to integrate energy-efficiency policy more fully into other policy areas and to realise the economic potential for energy savings in line with the proposed targets.

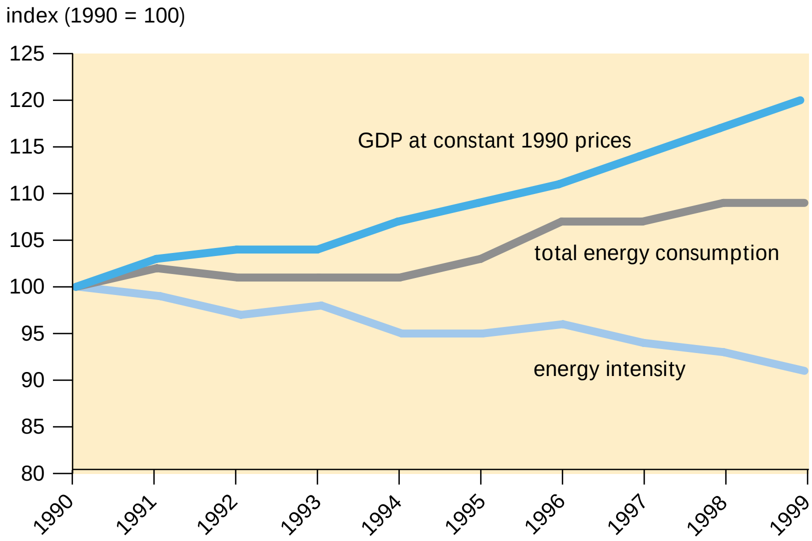
5.1. Energy intensity of the economy

Total energy consumption intensity (the energy consumption of all energy consumers per unit of GDP) decreased at an average annual rate of just over 1 % during the period 1990–1999, despite an average annual growth in the economy of 2.1 % over the same period. Much of this improvement was due to structural changes in the economy, including a shift from industry towards services that are typically less energy-intensive. Within the industrial sector, energy-intensive industries are being replaced by high value-added, less energy-intensive industries. The continued potential for energy savings in all sectors is widely acknowledged. Germany's decrease in energy intensity was partly the result of one-off structural changes. Given Germany's high levels of energy consumption, this impressive decrease contributed much to the reduction in energy intensity of the EU as a whole which, excluding Germany, would have decreased at an annual rate of just 0.3 % over the 1990–1999 period.

The European Council supported (98/C394/01) an EU indicative target for the period 1998–2010 to improve the energy intensity of final consumption by 1 % per year, on average, over 'that which would have otherwise been attained'; however, being not yet defined, it is not clear how such a target can be measured and monitored.

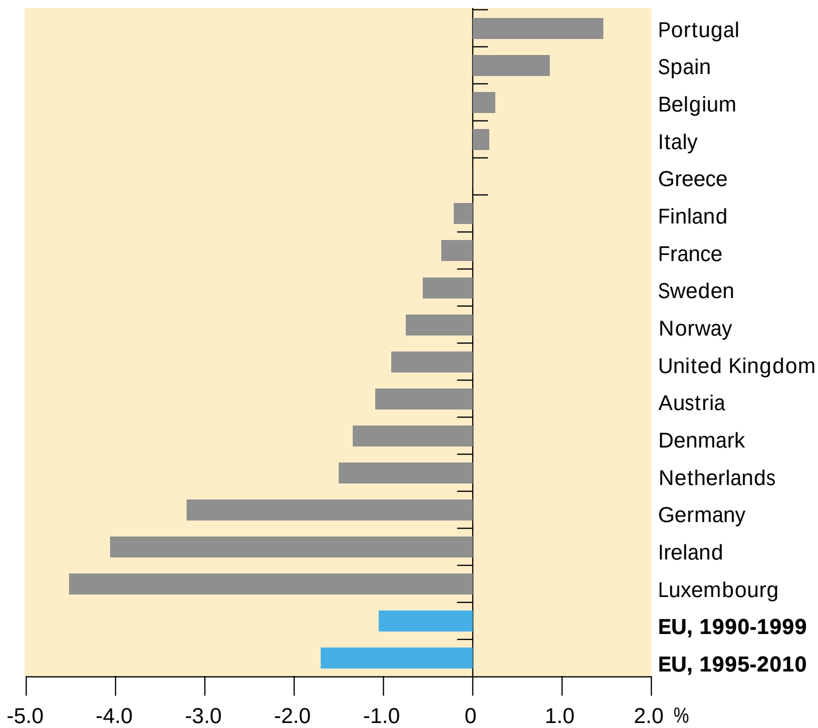
'Baseline projections' (NTUA, 2000) suggest an average decrease in energy intensity of 1.7 % per year between 1995 and 2010, due primarily to continued restructuring of the economy in favour of goods and services with lower energy intensity, but also to improvements in energy efficiency and energy conservation. The EU's GDP is expected to grow, on average, by about 2.4 % per year between 2000 and 2010. If the decrease in energy intensity is not keeping up with this percentage, then a further increase in energy use will result. Given the slow rate of change towards the use of less carbon-intensive fuels, this may lead to an increase in greenhouse gas emissions by 2010.

Index of energy intensity, EU Figure 5.1.



Source: Eurostat

Energy intensity, annual rates of change, 1990–1999, EU and Norway



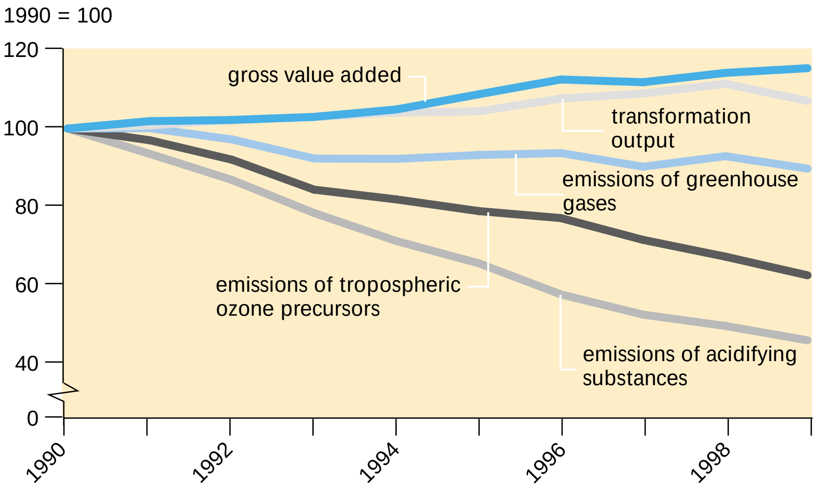
Note: insufficient data for Iceland and Liechtenstein
Sources: Eurostat; European Commission (Primes model)

The linkage between economic growth and energy consumption is not being reduced fast enough to stop growth in energy use, which may lead to increased energy-related pressures on the environment.

Quality of information ☆☆☆

http://themes.eea.eu.int/Sectors_and_activities/energy/indicators/energy_supply/index_html

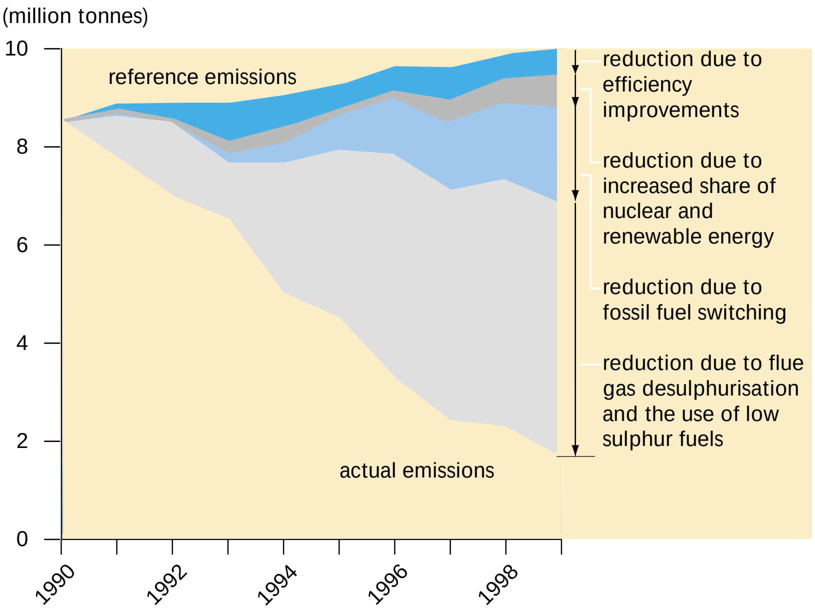
Figure 5.3. **Indicators of eco-efficiency in the energy supply sector, EU**



Notes: Gross value added of fuel and power products is at constant 1995 prices. Data values for transformation output are provisional for 1998 and 1999. Energy supply sector emissions include emissions from energy industries and fugitive emissions. Energy supply sector greenhouse gas emissions consist of CO_2, CH_4 and N_2O. Energy supply sector tropospheric ozone precursor emissions consist of NO_x, CO, NMVOCs and CH_4. Energy supply sector acidifying gas emissions consist of NO_x and SO_2. Weighting factors have been used so that emissions can be combined in terms of their polluting effects.
Sources: EEA; Eurostat; NTUA

Emissions to the air from the energy supply sector have fallen, while the sector's economic and physical output increased between 1990 and 1999.

Figure 5.4. **Reduction of emissions of sulphur dioxide in the electricity sector, EU**



Note: Data and analysis are the preliminary results of ongoing work to improve the associated statistics and methodology.
Source: EEA

There were reductions in air emissions from electricity production in the EU between 1990 and 1999, resulting mainly from fuel switching, flue gas treatment and burner modifications.

5.2. Eco-efficiency of the energy industry

The energy supply sector is by far the largest source of emissions of nitrogen oxides (NO_x) and sulphur dioxide (SO_2) and makes a significant contribution to carbon dioxide (CO_2) emissions. During the period 1990–1999, emissions to the air from the energy supply sector fell, while the sector's economic and physical output increased between 1990 and 1999. The increased use of emission abatement technologies and a reduction in the use of coal and oil, in favour of gas, which has a lower carbon (and sulphur) content, were the main factors that brought about this change. Policies that influenced energy efficiency in the energy supply sector and / or that altered the sector's fuel mix, played a much smaller part.

However, the current rate of improvement is not sufficient to accommodate predicted economic growth and the reductions needed to reach the required emissions targets (see Chapters 9 and 10).

5.3. Emissions to air from electricity production

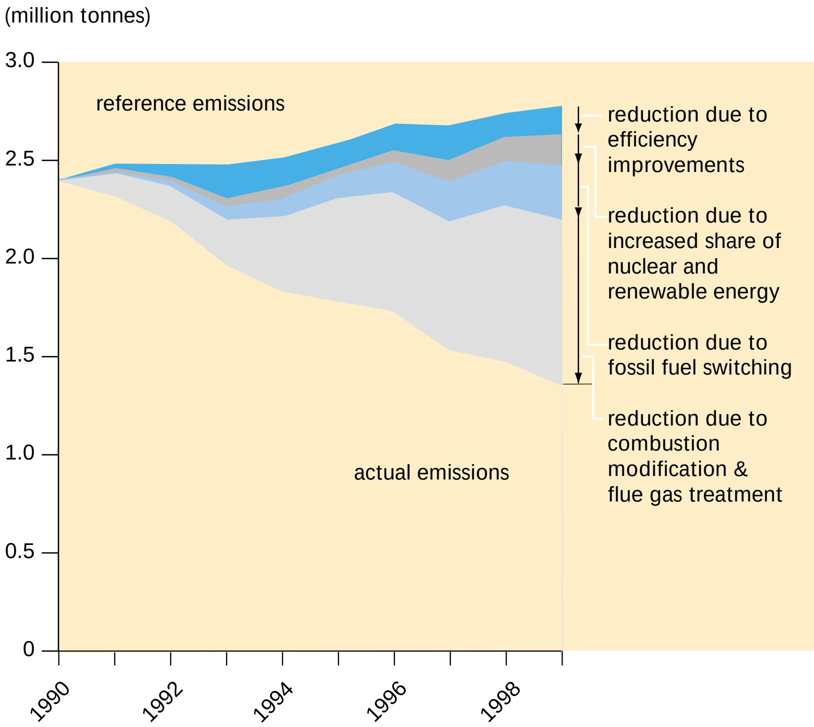
By 1999, emissions of air pollutants would have increased in line with electricity output (i.e. by 16 %), if methods of producing electricity had remained unchanged since 1990. In fact, over this period there have been a number of changes in the EU's electricity industry that have caused annual emissions of carbon dioxide, nitrogen oxides and sulphur dioxide to fall by 8 %, 44 % and 60 %, respectively.

Of the reduction in carbon dioxide emissions, 46 % can be attributed to changes in the fossil fuel mix from coal and lignite to natural gas. A further 20 % came from an increase in the efficiency of fossil-fuelled electricity production, much of which is linked to the switch to high-efficiency gas turbine combined cycle technology. The remaining 34 % is attributable to the increased share of nuclear power and renewable energy sources in the fuel mix.

For both nitrogen oxides and sulphur dioxide emissions, around 60 % of the total decrease is due to the introduction of emission-specific abatement measures, aided by the implementation of the Large Combustion Plant Directive (2001/80/EC). In the case of nitrogen oxides, the most significant of these measures was the introduction of flue-gas treatment and the use of low nitrogen oxide burners. For sulphur dioxide emissions, the introduction of flue gas desulphurisation (FGD) and the use of lower sulphur coal and fuel oil were most significant.

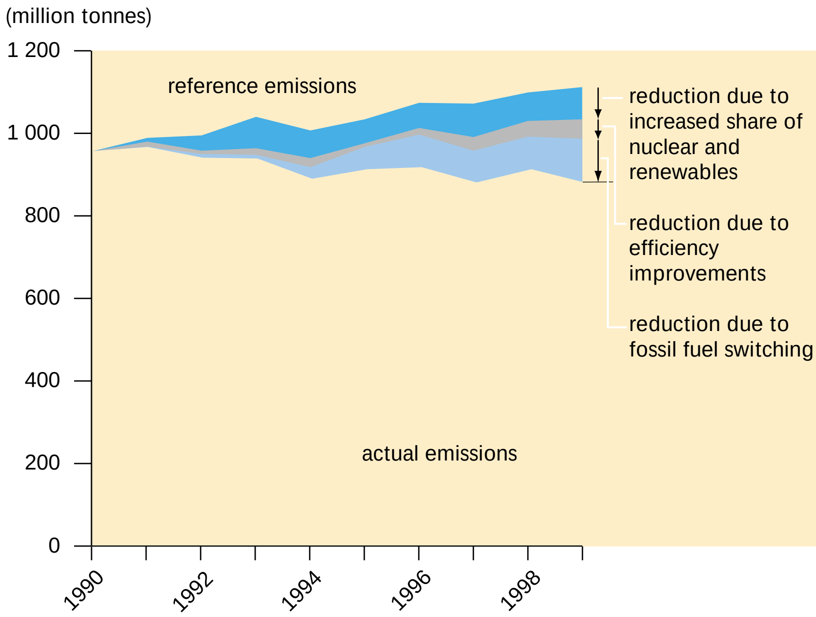
Most of the remaining decrease in emissions of both nitrogen oxides and sulphur dioxide were due to changes in the fossil fuel mix (20 to 25 %) and, to a lesser extent, improved efficiency of fossil fuelled electricity production (approximately 10 %). The increased share of non-fossil fuels, nuclear and renewables, also contributed an approximate 10 % reduction.

Reduction of emissions of nitrogen oxides in the electricity sector, EU Figure 5.5.



Note: Data and analysis are the preliminary results of ongoing work to improve the associated statistics and methodology.
Source: EEA

Reduction of emissions of carbon dioxide in the electricity sector, EU Figure 5.6.



Note: Data and analysis are the preliminary results of ongoing work to improve the associated statistics and methodology.
Source: EEA

Quality of information ☆☆

http://themes.eea.eu.int/Sectors_and_activities/energy/indicators/overall_energy/index_html

5.4. Total energy consumption by fuel

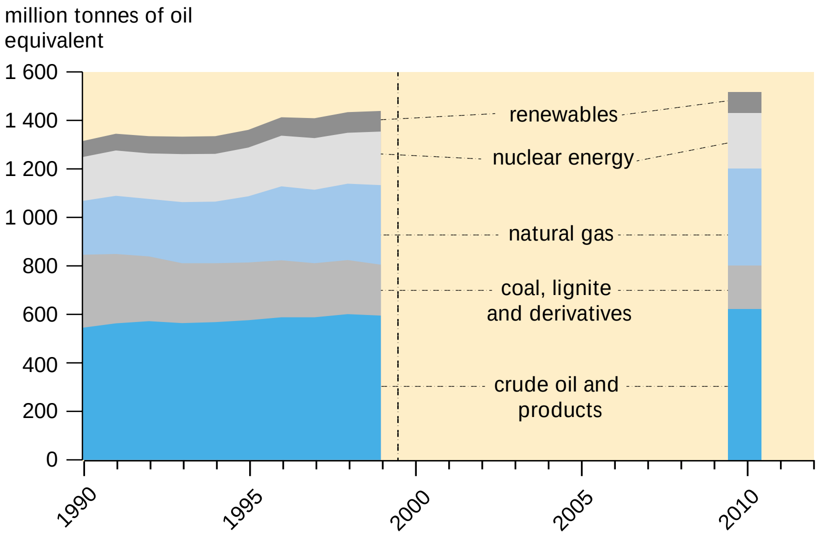
Member States' policies relating to total energy consumption and fuel mix reflect objectives relating to security of supply and the provision of energy at reasonable prices. Additionally, environmental considerations and the energy market liberalisation policies that resulted from the electricity and gas Directives are increasingly influencing the energy consumption fuel mix.

There are specific EU policies aimed at changing the fuel mix, including the White Paper on Renewable Energy Sources (COM(97) 599 final) (see section 5.5). The use of taxes for creating price differentials is considered by the EU to be a flexible and effective instrument (see Chapter 15) for encouraging the consumption of less-polluting fuels. Taxing energy products is the subject of a draft Directive (see Section 5. 9).

Total energy consumption in the EU continued to increase over the 1990–1999 period at an average rate of 1 % per year. Moreover, the share taken by fossil fuels declined only slightly, from 81 % of total energy consumption in 1990 to 79 % in 1999. This small reduction was taken up by increases in nuclear power and renewable energies. Within the share of total energy consumption supplied by fossil fuels, coal and lignite lost about one third of their market share, being replaced by natural gas. This was due mainly to fuel switching in the power production sector (see Section 5.3 for the relative effects on emissions). Oil retained its market share, reflecting its continued dominance in road and air transport. Although small in terms of market share, the growth of renewable energy was 29 % over this period (see Section 5.5).

'Baseline projections' to 2010 (NTUA, 2000) indicate that total energy consumption will continue to increase, but at a reduced rate. The fact that they suggest only limited changes to the fuel mix by 2010 underlines the need to strengthen support for non-fossil energy sources, if the targets mentioned in the following sections are to be met.

Figure 5.7. Total energy consumption by fuel, EU



Note: Fuels other than those listed in the legend have been included in the diagram, but their share is too small to be visible.
Source: Eurostat; NTUA

Biomass district heating in Austria

District heating is very common in Austria, and the use of biomass as a fuel is increasing. By 2000 there were more than 500 district heating plants (totalling more than 650 MW installed capacity) operating throughout Austria. Biomass district heating has enjoyed success for several reasons including: national and regional political support for expanding the use of biomass (several regions have biomass-related targets); taxes on gas and electricity, part of the revenue from which can be channelled into the promotion of renewable energy; public grants and subsidies for biomass installations; extensive forestry and other biomass resources; a long history of public support for and use of biomass as a fuel resource; indigenous manufacturing expertise; and active regional promotion of the economic and environmental benefits of using biomass as a fuel.

For more information see EEA Environmental issue report No 27 *Renewable energies: success stories*, (EEA, 2001).

Fossil fuels continue to dominate the type of energy we use. The switch from coal and lignite to relatively cleaner natural gas has reduced environmental pressures.

Quality of information

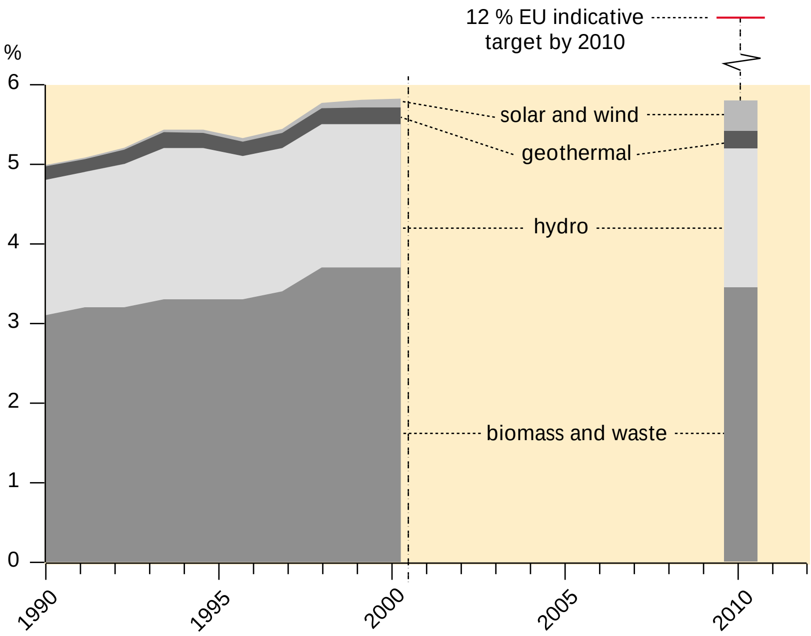
http://themes.eea.eu.int/Sectors_and_activities/energy/indicators/total_consumption/index_html

5.5. Share of total energy obtained from renewables

Renewable energy output grew at an average annual rate of 2.8 % over the 1990-1999 period, contributing 5.9 % to EU total energy consumption in 1999. Taking account of the projected expansion in total energy consumption, this growth rate needs to be increased to over 7 % per year if the EU renewable indicative target (12 % of renewable energy in total energy consumption by 2010 (COM(97)599 final)) is to be met. 'Baseline projections' (NTUA, 2000) suggest that renewable energy growth to 2010 will be much less than this, and will probably only be sufficient to maintain current market share. However, these 'baseline projections' missed the trend of increased production from renewable energy sources in the second half of the 1990s. An updated, new version of the 'baseline projections', to be released in the second half of 2002, will show a slight increase in the contribution that renewables are projected to make to total energy consumption by 2010.

Road transport accounts for about 80 % of energy consumption from the transport sector and is a major and growing area for energy consumption. Road transport is the almost exclusive preserve of oil-derived fuels, with little substitution of renewable energy sources. The European Commission proposed a Directive aimed at promoting the use of biofuels in transport (COM(2001)547 final), highlighting the pressing need to begin to replace fossil fuels in road transport. The Directive would require Member States to ensure that the minimum proportion of biofuels sold in their markets reaches 5.75 % of all gasoline and diesel sold for transport purposes, by 2010. However, there is concern over a number of environmental issues associated with the production and consumption of biofuels their production being energy-intensive. There may be competition with other energy crops for growing land, and the consumption of biofuels is associated with emissions of nitrous oxides and particulates.

Renewable energy sources contribution to total energy consumption, EU Figure 5.8.



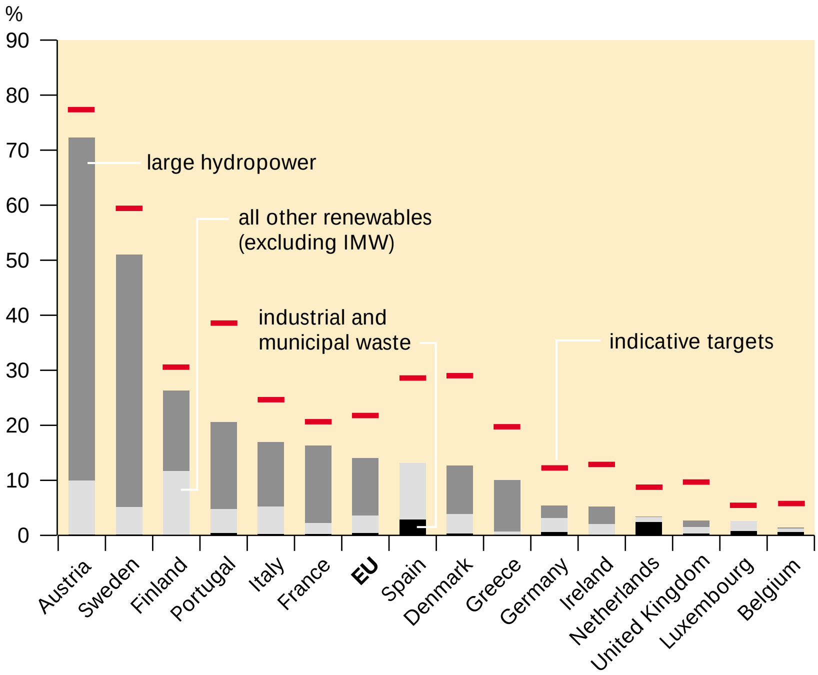
Notes: 'Biomass and waste' includes wood, wood wastes, other biodegradable solid wastes, industrial and municipal wastes (of which only part is biodegradable), biofuels and biogas.
Source: Eurostat; NTUA

Despite the continued growth of total energy obtained from renewables, on current trends, they will fall short of the respective EU renewable indicative targets.

Quality of information ☆☆☆

http://themes.eea.eu.int/Sectors_and_activities/energy/indicators/renewable/index_html

Figure 5.9. **Share of electricity consumption met by renewable energy sources, EU, 1999**



Notes: Industrial and Municipal Waste (IMW) includes electricity from both biodegradable and non-biodegradable energy sources, as there are no separate data available for the biodegradable part alone. The EU's 22.1 % indicative target for the contribution of renewable energy to gross electricity consumption by 2010 only classifies biodegradable waste as renewable. The share of renewable electricity in gross electricity consumption is therefore overestimated by an amount equivalent to the electricity produced from non-biodegradable IMW.
National indicative targets shown here represent reference values that Member States agreed to take into account when setting their indicative targets by October 2002, according to the EU renewable electricity Directive (2001/77/EC).
Source: Eurostat

Despite the continued growth of total electricity obtained from renewables, on current trends, they will fall short of the respective EU renewable indicative targets.

Quality of information ☆☆☆

http://themes.eea.eu.int/Sectors_and_activities/energy/indicators/renewable/index_html

5.6. Share of electricity obtained from renewables

In its Directive on the promotion of electricity from renewable sources (2001/77/EC) the EU proposed indicative targets for Member States and agreed to an EU overall indicative target of 22.1 % of gross electricity consumption from renewable sources by 2010.

Renewable energy sources contributed 14 % to the EU's gross electricity consumption in 1999, increasing at an average annual rate of 2.8 % over the period 1990–1999 (including electricity produced from large hydropower). Taking account of projected growth rates for electricity consumption to 2010, the indicative target will require the rate of growth of renewable electricity supply to roughly double if the target is to be met.

Renewable electricity was dominated by large hydro-power (74 % in 1999), followed by small hydro (11 %) and biomass/waste (10 %). Large hydro is an established technology, but its capacity is not expected to increase substantially because of concerns about its impact on the environment. Growth in renewable electricity will therefore have to come from other renewable sources such as wind energy, solar power, biomass and small hydro.

'Baseline projections' of future electricity production (NTUA, 2000), indicate a negligible increase in the share taken by renewable sources. If the indicative target is to be reached, the additional measures contained in the EU Directive, together with measures taken at Member State level, need to give a stronger stimulus to the deployment of renewable technologies. There are encouraging signs that this may be possible with the right mix of support measures (EEA, 2001). For example, the rapid expansion of wind power (38 % per year across the EU in the period 1990–1999) was driven by high growth rates in Germany, Denmark and Spain, which were the result of support measures including 'feed-in' arrangements that guarantee a fixed favourable price for renewable electricity producers.

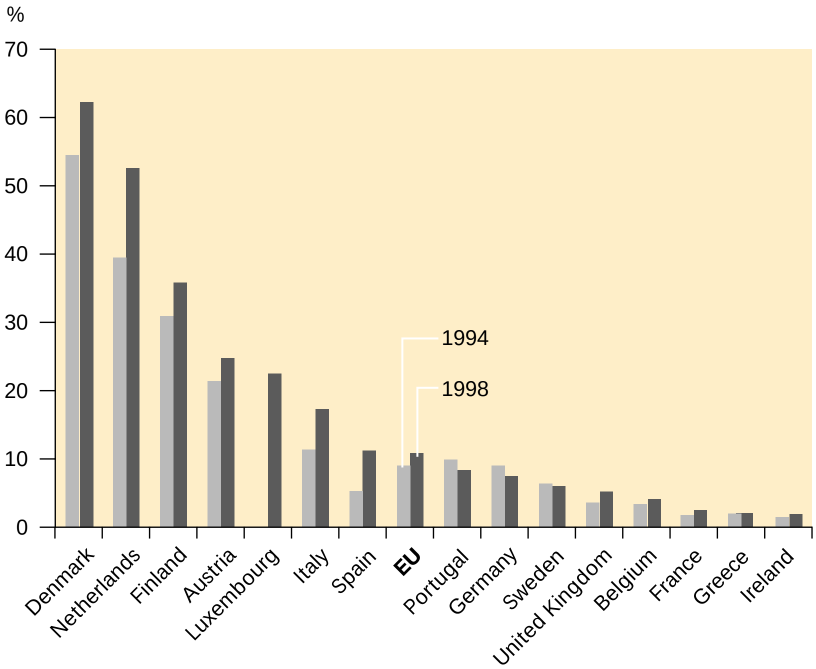
5.7. Share of combined heat and power in gross electricity production

Although combined heat and power (CHP) increased its share of electricity production from 9 % to almost 11 % between 1994 and 1998, this growth rate is not sufficient to achieve the EU indicative target to derive 18 % of all electricity production from CHP by 2010 (COM(97)599 final).

Preliminary information for 2001 suggests that the CHP share of electricity production has declined since 1998 (Cogen Europe, 2001). This has been caused by a combination of factors:

- an increase in natural gas prices (gas is the preferred fuel for new CHP), which has reduced the cost competitiveness of CHP;
- falling electricity prices, resulting from market liberalisation and increased competition, which has also hit the cost-competitiveness of CHP;
- uncertainty over the evolution of electricity markets, as liberalisation is progressively extended, which is making companies reluctant to invest in CHP;
- aggressive pricing by electricity utilities to protect their market.

Share of combined heat and power in gross electricity production, EU Figure 5.10.



Notes: No data for Luxembourg for 1994. The method for data collection by Eurostat on combined heat and power is under revision. This may result in some adjustments of the percentage contributions of CHP electricity in gross electricity generation reported here. The data include combined heat and power generation from public electricity and heat producers and from autoproducers (at specific industrial sites).
Source: Eurostat

During the period 1994–1998, the share of electricity production from combined heat and power (CHP) increased, but the current rate of change is not enough to reach the EU indicative CHP electricity target for 2010. Preliminary information suggests that the CHP share even declined between 1998 and 2001.

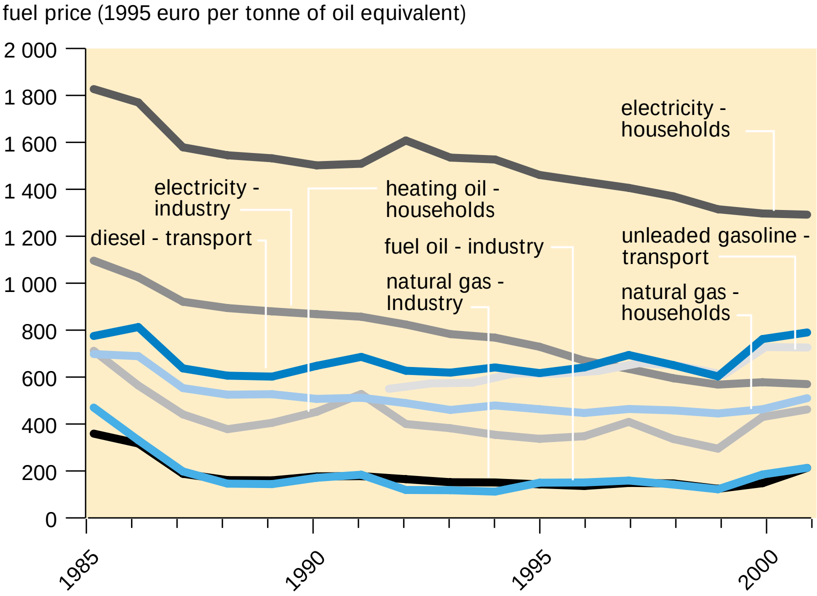
Quality of information

http://themes.eea.eu.int/Sectors_and_activities/energy/indicators/heat_energy/index_html

5.8. Real energy prices

Energy prices may influence energy consumption and/or provide an incentive for fuel switching. However, evidence suggests that energy consumers are not always responsive to price changes, particularly in the transport sector (see Section 4.5).

Figure 5.11. **Final energy prices, EU**



Notes: EU final energy prices are an average of prices in individual Member States, weighted by their consumption. The prices shown are real prices (i.e. the effect of inflation has been removed). Prices are those applicable in January of each year. Prices include all taxes with the exception of industry prices which exclude value added tax (VAT).
Source: Eurostat

Energy prices generally remained low, or even fell, between 1985 and 2001, offering little incentive to reduce energy consumption.

Quality of information

http://themes.eea.eu.int/Sectors_and_activities/energy/indicators

End-user energy prices, with the exception of those for diesel and unleaded gasoline, fell between 1985 and 2001. The decrease was greatest during 1986–1987 when the crash in crude oil prices had a knock-on effect on the price of natural gas, and on electricity. Since then, a slower decline has been sustained by continuing low oil prices, the opening up of additional natural gas supplies to the EU, and progressive liberalisation of EU gas and electricity markets. This last factor, which is continuing, was driven by the EU Electricity and Gas Directives and is leading to greater price competition.

World oil prices increased appreciably in 1999–2000 following an agreement within the Organisation of Petroleum Exporting Countries (OPEC) to restrict production. This contributed to an increase in the prices of oil products and natural gas in Europe. Electricity prices were not affected because only a small amount of electricity is generated from oil, because of the weakening link between oil and gas prices within a competitive gas market, and because of increased competition in electricity markets.

Road transport fuel prices are high in comparison to industrial fuel prices, reflecting the high percentage of tax in road transport prices. Policies in most Member States involved the progressive increase of taxation on road transport fuels in order to raise revenue and slow down the rate of growth in demand for road transport, but this has not prevented energy consumption from increasing (see Chapter 4).

Unleaded gasoline is the only fuel whose price rose substantially although it is worth noting that much of this tax increase was absorbed by reductions in the non-tax price of unleaded gasoline, and that most of the price increase was associated with the increase in crude oil prices in the year 2000.

5.9. Energy tax levels

Energy taxation offers one method of internalising the external costs of energy consumption. It also offers a mechanism for introducing price differentials between fuels to encourage the use of less polluting fuels.

In 1997 the European Commission proposed a Directive for restructuring the Community framework for taxing energy products, which includes suggested minimum taxation levels for each fuel. This has not yet been adopted, but it is worth noting that, in 2000 on average for the EU, actual taxes on transport fuels, oil-based heating fuels and electricity were higher than the proposed minimum tax levels for 2000. Actual taxation on natural gas was about equal to the proposed minimum for the year 2000 for industry and above the minimum for households.

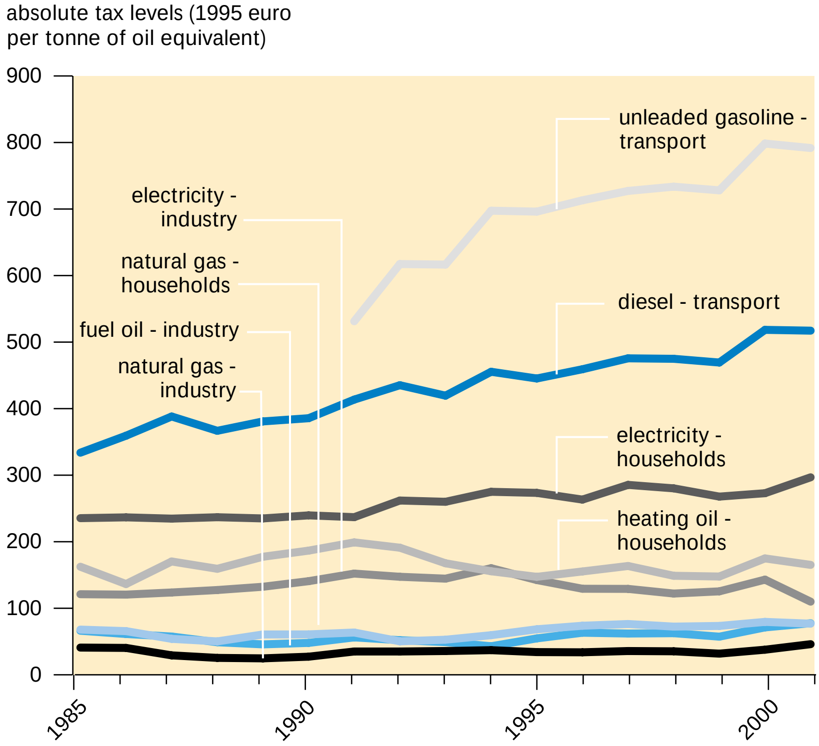
Evidence of the environmental effectiveness of energy taxation policies is limited at present, but positive environmental results have been identified from the Danish, Finnish and Swedish carbon dioxide taxes and the UK fuel duty escalator (EEA, 2000; see Chapter 15). In Finland, differentiated excise tax on motor fuels has accounted for a 10–15 % reduction in carbon monoxide and hydrocarbon emissions from car traffic (European Commission, 2000).

Taxation of transport fuels increased substantially between 1985 and 2001, but the impact on prices was partially offset by the effects of falling crude oil prices and market competition.

The generally modest increases in tax on industrial energy consumption reflect concerns over the impact of fuel prices on national competitiveness, with Member States looking to encourage energy efficiency through alternative schemes such as voluntary agreements, awareness campaigns and capital allowances. Some Member States have adopted a 'carrot and stick' approach with energy taxation combined with the option for significant rebates if energy-efficiency targets are met.

Taxes on the household consumption of electricity and natural gas increased significantly, particularly in the last few years of the 1990s. This has off-set price reductions resulting from energy market liberalisation.

Taxes in final energy prices, EU Figure 5.12.



Notes: Taxes are those applicable in January of each year. Value added tax (VAT) is included where applicable.
Source: Eurostat

Despite increases in taxation levels, energy prices for most fuels dropped and overall energy demand increased.

Quality of information ☆☆☆

http://themes.eea.eu.int/Sectors_and_activities/energy/indicators

6. Agriculture

policy issue	indicator	assessment
reduce resource use and outputs that damage the environment	agriculture eco-efficiency	😐
reduce impact of farming on biodiversity	bird population trends in relation to farming intensity	☹
prevent eutrophication	areas vulnerable to nitrates	😐
provide environmental incentives to farmers	structure of common agricultural policy support	😐
encourage less-intensive farming systems	developments in organic farming	🙂

Agricultural eco-efficiency is improving slowly and less quickly than in other sectors. This can in part be linked to the increasing specialisation of farming. The proportion of mixed farms fell from 27 % to 18 % in the decade to 1997. Although fertiliser use declined in the decade to 1999, nutrient surplus on agricultural land remains a serious problem causing nitrate pollution of ground waters and eutrophication of aquatic ecosystems. The current specialised farming practices in Europe have a negative impact on biodiversity. This is shown by the decline in farmland bird populations, which are negatively correlated with farming intensity.

The common agricultural policy (CAP) is one of the factors that has driven farm intensification. However, substantial progress has been made in the introduction of environmental elements into the CAP (e.g. via agri-environment schemes).

Agriculture is inextricably linked to the countryside and the social and economic well-being of rural populations. The need to reconcile the three dimensions of sustainable development within the agriculture sector is therefore imperative. Agricultural policy needs to support food production while maintaining the socio-economic fabric of rural areas and protecting the environment. Two important factors with the potential for helping to achieve these aims are the increasing interest in environmentally-sustainable farming systems and the ongoing reforms of the common agricultural policy (CAP).

In the post-war period the agriculture sector has undergone a process of concentration and specialisation: the number of holdings has decreased along with the numbers employed, and the emphasis is increasingly on large-scale units focusing on a limited range of products. This has often been accompanied by intensification in the use of land, fertilisers, pesticides, energy, irrigation and drainage. Overall, these lead to adverse impacts including eutrophication of water bodies and contamination of drinking water, acidifying air emissions and soil erosion, loss of biodiversity and changes to the landscape.

Although farming in the EU makes a small and declining contribution to GDP, the EU spends about half its annual budget, around EUR 40 billion, on agricultural support. Successive CAP reforms have increased financial support for agri-environment schemes that are now part of rural development programmes. These schemes explicitly target less intensive methods. Further CAP reform is very likely given EU expansion eastwards, continuing environmental issues and the international pressure to reduce agricultural subsidies.

6.1. Agriculture eco-efficiency

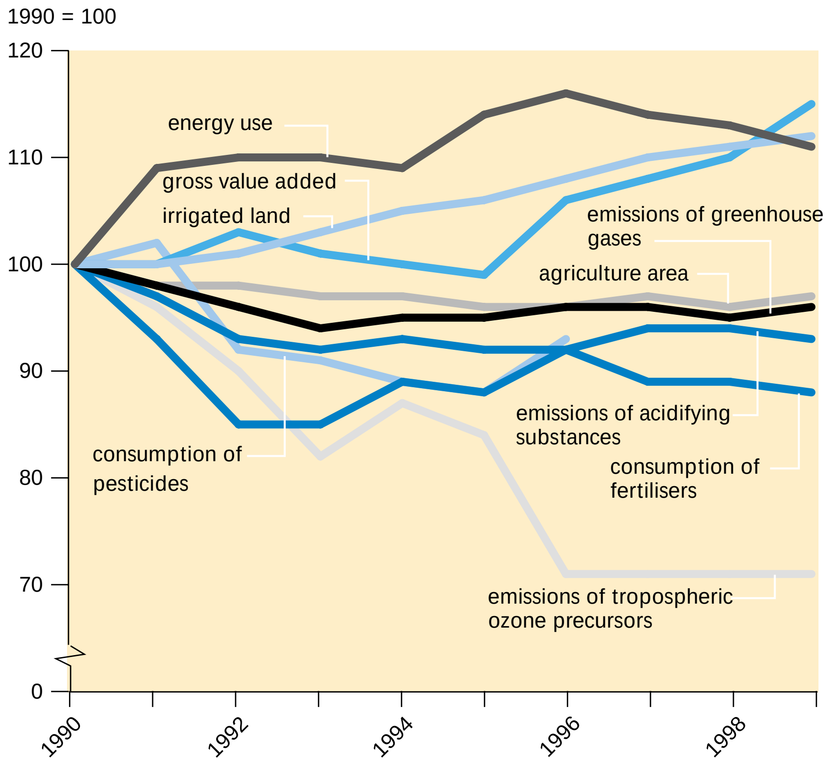
In general, there was less progress in improving eco-efficiency within the agricultural sector in the 1990s relative to other sectors. Energy use and irrigation have increased in line with productivity (gross value added) while there has been some reduction in the use of fertilisers and pesticides and emissions of greenhouse gases, acidifying substances and tropospheric ozone precursors.

Although fertiliser use declined somewhat in the decade to 1999, nutrient surpluses on agricultural land remains a serious issue giving rise to nitrate pollution and eutrophication of water bodies. Pesticide use has also declined slightly, but this is unlikely to have major beneficial effects. To further reduce environmental risks, the EU sixth environmental action programme encourages low-input or pesticide-free agriculture and the use of integrated pest management (IPM) techniques.

Agriculture is not a substantial source of greenhouse gases. Livestock ruminants however, are a significant source of methane, one of the greenhouse gases. The total contribution of agriculture is only 10 % to total EU greenhouse gases emissions (see Chapter 9).

Emissions of acidifying substances are significant; in 1999, agriculture was responsible for 31 % of total EU emissions. In particular, agriculture was responsible for 94 % of ammonia emissions. Ammonia can contribute to both acidification and eutrophication. The issue of ammonia emissions is particularly significant in parts of northwest Europe where intensive animal husbandry is practised. Improvements in the storage and spreading of slurry introduced in Denmark, Germany, Sweden and The Netherlands contributed to a 7 % decline in ammonia emissions between 1990 and 1999. The Belgian and Dutch programmes to reduce livestock populations by buying out livestock farmers are likely to be another important measure.

Components of agriculture eco-efficiency, EU Figure 6.1.



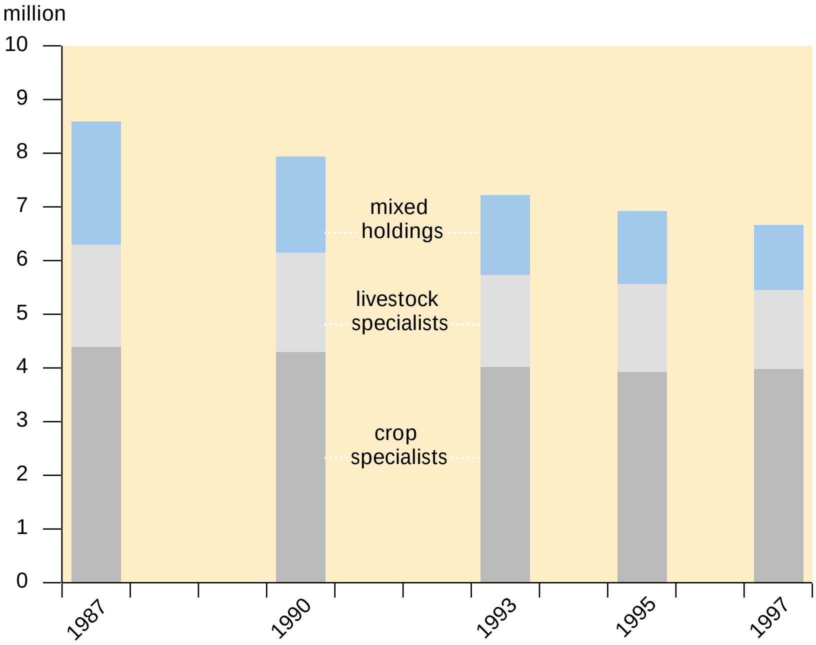
Notes: Gross value added at basic prices, constant 1995 prices; excluding Luxembourg. Irrigated land relates to areas equipped to provide water to the crops; these include areas equipped for full and partial control irrigation, spate irrigation areas, and equipped wetland or inland valley bottoms. Consumption of fertilisers refers to the quantity of synthetic fertilisers in metric tonnes as consumed in agriculture.
Sources: EEA; Eurostat; ECPA; FAO

Agricultural eco-efficiency is improving slowly, but less than in other economic sectors. Rates of fertiliser and pesticide use continue to be a concern, as do emissions of acidifying substances, particularly ammonia.

Quality of information ☆☆

http://themes.eea.eu.int/Sectors_and_activities/agriculture
http://europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat

Figure 6.2. **Number of farms by holding type, EU12**



Source: Eurostat

There is a strong tendency towards specialisation within the agricultural sector. Either specialised crop or livestock farms are replacing mixed holdings. This allows for spatial concentration and higher intensity of land use (see Chapter 13). A further indication of intensification is the increase in cropland at the expense of permanent grassland and pasture (see *Environmental signals 2001*, Chapter 15). Extensive livestock systems rely to a larger degree on the utilisation of pastures at low stocking densities than modern intensive livestock farms that use arable fodder crops. Thus, the decline of permanent grassland is on the one hand linked to the increasing specialisation in arable production (see Section 6.4), and on the other to increasing stocking densities in modern livestock systems. The objectives of the agri-environment Regulation 2078/92 (see Section 6.5) included, among others, options to maintain extensive production methods, to extensify livestock production, and to convert arable land into grassland.

Reuse of water for irrigation in Limagne, France

In Limagne, the water demand for irrigation is so great that small rivers in agricultural areas are at risk. A project was set up to reuse treated waste water coming from the waste water treatment plant of Clermont-Ferrant for the irrigation of 700 ha of maize, beet and lucerne. Reuse of water from the waste water treatment plant means that the eutrophication risk in the receiving river can be reduced. The waste water treatment plant produces 50 000 m^3/day, whilst the irrigation needs of the 51 farms involved are approximately 18 000–24 000 m^3/day. All the irrigation needs are therefore covered by the treated waste water and the quantity of water saved is around 2.5 million m^3 during a normal year. For a dry year, the quantity of water saved is even greater (around 4 million m^3). Clearly, the water quality has to be carefully monitored to ensure there is no risk to public health. The French government, a LIFE programme, the farmers and the water agencies jointly financed the project; the investment costs were around EUR 4.7 million.

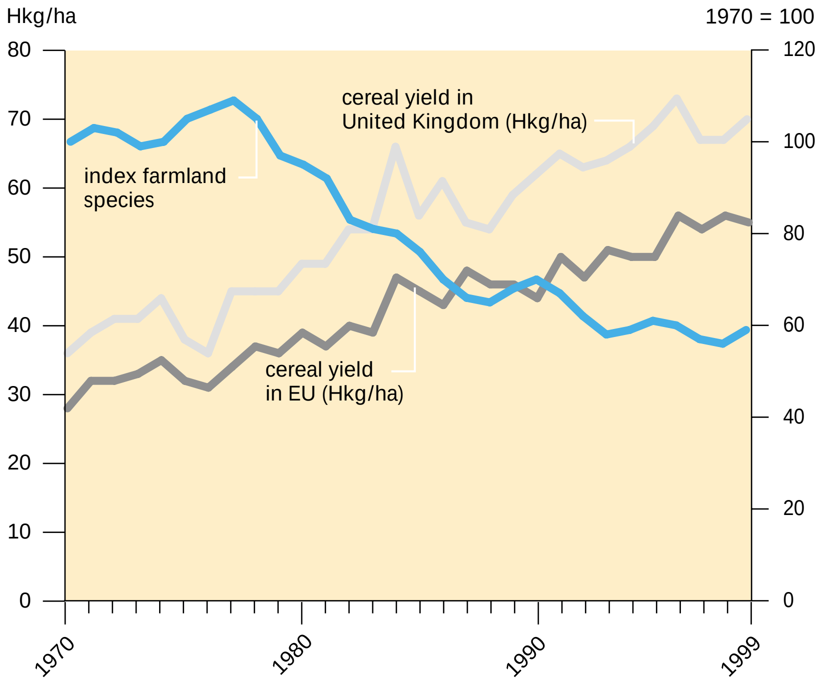
6.2. Bird population trends in relation to farming intensity

In 2001, the EU launched a biodiversity action plan for agriculture. This aims to safeguard three elements of agricultural biodiversity: the genetic variety of domesticated plants and animals; wild flora and fauna related to farmland; and life support systems. Farmland birds are a useful indicator for the general biodiversity of farmland. Diversity and abundance of plant and insect species directly affect the availability of food for birds. Landscape features such as hedgerows, uncultivated field margins, small woodlands and patches of scrub are important for many species, and particularly for birds. They provide food, cover against predators and sites for nesting.

In a recent multi-criterion analysis, Donald et al. (2001) demonstrated that cereal yield is a good proxy for overall intensification. It has been observed that the rapid intensification of agriculture in the UK (in terms of cereal yield) was associated with a strong decline in farmland bird populations (average trend for 20 species). The intensification process in the UK mirrors the general trend in the EU, although the average UK cereal yield is higher than corresponding EU figures.

The impacts of intensified management practices (e.g. increased fertiliser and pesticide use, mechanisation, removal of landscape features) on bird ecology are complex and vary according to species. Broadly, however, they can be grouped in three main categories of impact: loss of food; loss of cover against predators; and loss of nesting sites. Most young farmland birds feed on invertebrates. However, insecticides have reduced the amount of food available and thus increased chick mortality rates. Fertilisers and herbicides have reduced the floral diversity of farmland and decreased food supply for adult birds. Finally, small landscape elements have been removed, again reducing food supply and making birds (and their nests) much more vulnerable to predation. The combined impact is higher mortality and lower reproduction.

Cereal yield and farmland species in the United Kingdom — Figure 6.3.



Note: Index for 20 bird species
Source: FAO; Gregory et al, 2001

Taken as a whole, farming systems throughout Europe are not sustainable in terms of biodiversity. Farmland birds (as an indicator of overall biodiversity) have shown a decrease, which is correlated with increasing farming intensity. This intensity is expected to increase even further, given the present tendency towards specialist holdings at the expense of mixed farming.

Quality of information ☆☆

http://www.rspb.org.uk
http://themes.eea.eu.int/Sectors_and_activities/agriculture

Though the available data do not allow the same type of analysis for bird populations at the European level, similar trends have occurred in western European countries (e.g. The Netherlands and Denmark). The picture for other countries is less clear and data for central and eastern Europe are particularly scarce. However, Donald *et al.* (2001) indicate that the agricultural intensity in central and eastern Europe is generally lower while the conservation status of farmland birds is more favourable.

The intensification of agriculture in the EU in terms of inputs (fertilisers, pesticides, herbicides) levelled off in the 1990s. Still, further intensification of land use is to be expected, due to specialisation of farming practice and increasing farm size. This may also lead to further loss of landscape elements and vegetation diversity as land-use is further optimised. Conservation measures and agri-environment schemes in different countries, however, now aim to maintain and even increase the diversity of landscape elements.

Table 6.1. **Trends of cereal yield and farmland birds in selected European countries**

Country (period in brackets)	Annual cereal yield change (%) (yield in tonnes/ha in last year of range in brackets)	Species (yearly trend index)				
		Lapwing (Vanellus vanellus)	Linnet (Carduelis cannabina)	Skylark (Alauda arvensis)	White-throat (Sylvia communis)	Yellow-hammer (Emberiza citrinella)
UK (1978-1997)	+1.07 (6.8)	0.948	0.981	0.962	1.040	0.972
Netherlands (1984-1997)	+0.07 (7.0)	0.991	1.021	0.967	1.053	1.078
Denmark (1978-1997)	+1.01 (6.2)	0.989	0.997	0.995	0.997	0.982
W-Germany (1989-1997)	+1.26 (6.5)	0.986	0.976	1.022	1.029	1.008
E-Germany (1989-1997)		1.126	0.947	1.071	0.889	1.186
Finland (1978-1997)	-0.02 (3.4)	0.970	0.970	0.971	1.017	0.987
Latvia (1983-1994)	+0.69 (1.8)	0.930	1.002	1.103	1.003	1.052
Estonia (1983-1997)	+0.54 (2.0)	0.991	0.974	0.998	1.053	1.011

Statistical trend analysis:

- Substantial decrease (significant trend of >20 % in 20 years)
- Decrease (significant trend, but not significantly different from 20 % in 20 years)
- Insubstantial increase (significant trend of <20 % in 20 years)
- Stable (insignificant trend <20 % in 20 years)
- Increase (significant increase, but not significantly different from 20 % in 20 years)
- Substantial increase (significant trend of >20 % in 20 years)
- Poorly known (statistical power of data insufficient to detect a change of less than 20% in 20 years)

Notes: The species trends are expressed as an index for yearly population change. The value 0.90 means an annual reduction of 10 %. Cereal yield data combined for West and East Germany.
Source: van Strien *et al.*, 2001

6.3. Areas vulnerable to nitrates

The pollution of surface and groundwater by excess nutrients from agricultural sources is a major cause for concern in Europe (see Chapter 11). The 'Nitrates Directive' requires Member States to designate Nitrate Vulnerable Zones (NVZs) and prepare Action Plans for addressing agricultural pollution in these zones. These plans can include a range of measures including, for example, restricted fertiliser use during certain periods and on slopes or frozen soils, manure storage and crop rotation practices. Agriculture adds to a 'nutrient surplus' if not all the fertiliser and animal manure applied to encourage crop growth is absorbed by the plants or removed during harvest. Remaining nutrients can be washed into ground and surface water bodies and trigger eutrophication and nitrate pollution.

Apart from Brittany, the regions with the highest surplus of nitrogen are located in north-western Europe along the North Sea coast and in the Rhine catchment area where intensive animal husbandry is practised (see *Environmental signals 2001*, Chapter 7). In general, NVZs designated to date correspond relatively closely to areas with a high nitrogen surplus. Areas with a high nitrogen surplus, but few NVZs designated by July 2001, occur in southern Italy, Greece, Ireland and the UK.

In July 2001 the total area of NVZs, as designated by Member States, covered 38 % of the EU area (1.2 million km²). Based on a European Commission assessment of nitrate pollution risk this should be increased to at least 46 % (1.5 million km²). Designation and revision of NVZs is currently underway in Ireland, Greece, Belgium and the UK.

Progress in national Action Plans under the EU Nitrates Directive Figure 6.4.

Note: Mean progress scores are based on a semi-quantitative assessment of 12 aspects of the action plans (0 = unsatisfactory, 1 = partly satisfactory, 2 = fully satisfactory). Aspects covered: period of prohibition of fertiliser application; application restrictions on slopes; application restrictions on soaked, frozen or snow-covered soils; application restrictions near water courses; effluent storage works; capacity of manure storage; rational fertilisation; crop rotation; vegetation cover in rainy periods; fertilisation plans; other measures; date for application limits.
Source: European Commission, 2001a

The total area of Nitrate Vulnerable Zones currently covers 38 % (1.2 million km²) of the EU land area and this area should be increased to at least 46 % (1.5 million km²). However, none of the national action plans prepared by Member States fully comply with the obligations specified in the Nitrates Directive and only five plans were 'partly satisfactory'.

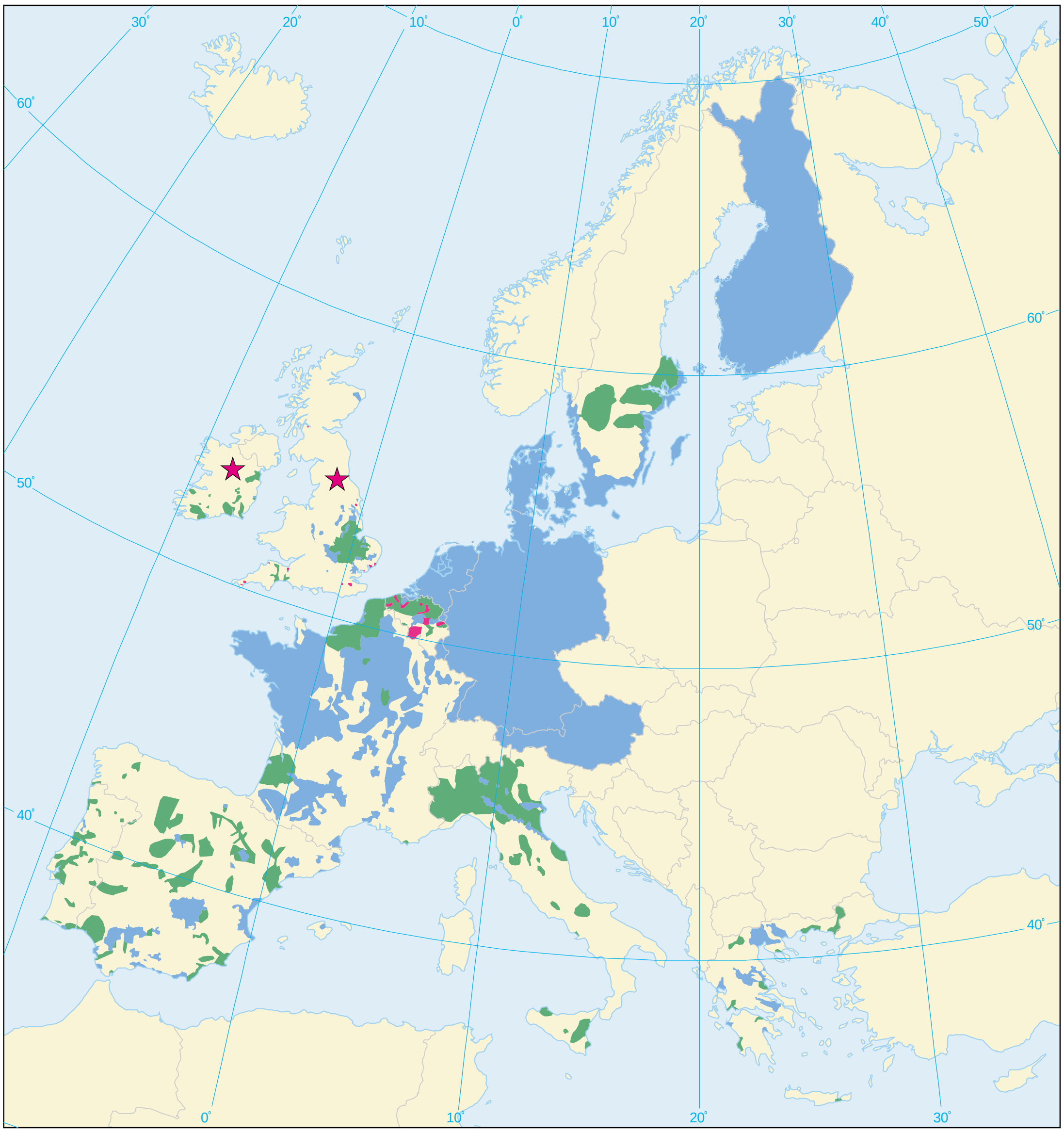
Quality of information ☆☆

http://europa.eu.int/comm/environment/water/water-nitrates/directiv.html

While considerable progress has been made in developing national Action Plans for NVZs, a recent assessment revealed that only five of those prepared for the period 1996-2000 reach a mean score higher than 1 (partly satisfactory). The action plan measures that were least satisfactory across Member States include restrictions for the spreading of manure on slopes, manure effluent storage works, crop rotation and crop maintenance guidance, and obligations on maintaining vegetation cover during winter or rainy periods.

It should be emphasised that nitrate pollution issues can also be tackled by measures that fall outside the immediate framework provided by the Nitrates Directive. Examples of such approaches are the buy-out programmes for reducing pig production capacity in The Netherlands and Belgium and the extensive agri-environment measures under Regulation 1257/1999 in Sweden. Alternative approaches to nutrient management, such as the Dutch MINAS programme, should also be mentioned in this context. While the Nitrates Directive does not explicitly list such measures, they can contribute significantly to achieving satisfactory protection of surface and ground waters from agricultural nitrate pollution.

Map 6.1.	**Nitrate vulnerable zones, EU**



designated zones

zones drafted by member states (2001)

potential vulnerable zones (EC assessment)

for Ireland and the UK, significant extension of the nitrate vulnerable zones is foreseen for 2001

Note: the Commission assessment is based on a (non-exhaustive) review of available information on waters with excessive nitrate concentrations threatened with eutrophication.
Source: European Commission, 2001a

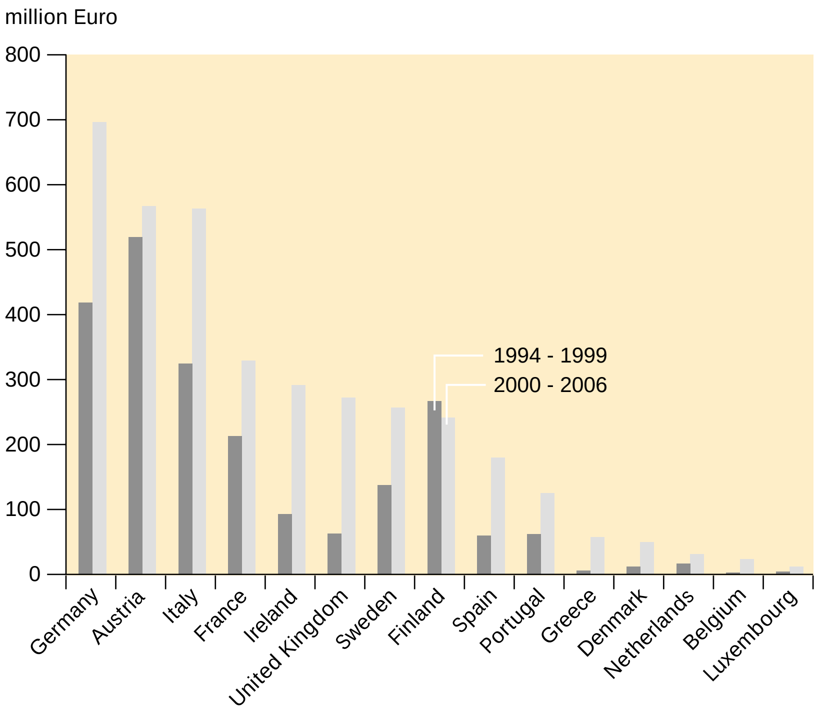
6.4. Structure of common agricultural policy support

The 1992 reform of the CAP took the first substantial step from market-based support (e.g. intervention to maintain producer prices) towards direct income support payments (e.g. payment per hectare or unit of livestock). The Agenda 2000 reform of the CAP continued this trend. Limited agri-environment schemes were introduced during the 1980s, became a compulsory policy measure with Regulation 2078/92 and were integrated into Member State rural development programmes with Agenda 2000.

CAP rural development measures are financed via the European Agricultural Guarantee and Guidance Fund (EAGGF) with additional co-financing by Member States. At the beginning of the 1990s the Guidance section financed nearly all rural development measures. However, the Guarantee section has gradually increased its share and now accounts for about 60 % of rural development spending. The latter has increased substantially since the early 1990s and now stands at about 15 % of total CAP spending, including Member State co-financing. Nevertheless, the Agenda 2000 CAP reform brought no real increase in rural development spending and further efforts are required to shift a larger share of the CAP budget into environmentally sustainable rural development measures.

Rural development funding under the CAP does not relate only to environmentally-beneficial measures. It also includes general infrastructure, farm investment aids, support for young farmers, agricultural marketing and processing and other measures with no direct environmental link. Agri-environment schemes compensate farmers for managing their land in a more environmentally-friendly manner. They include measures to reduce impacts on landscape, biodiversity, soil, air and water and extend to all aspects of agricultural practice. In 1998, one farmer in seven had an agri-environment management contract and more than 20 % of EU farmland was covered by agri-environment measures (see *Environmental signals 2001*, Chapter 5). Most evidence available to date shows that these measures lead to quantified reductions in use of inputs and the conservation of valuable farmland habitats. However, more careful monitoring and evaluation of such schemes is still required.

Agri-environment scheme expenditure Figure 6.5.



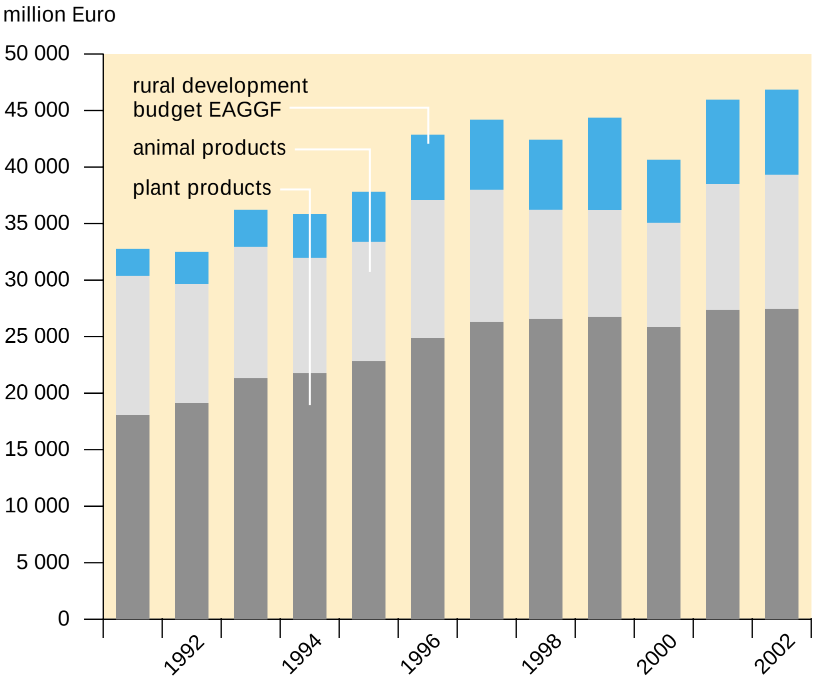
Notes: figures are for average annual expenditure and those for 2000-2006 are for planned expenditure.
Source: European Commission, 2002c

Substantial progress has been made in the introduction of environmental elements into the CAP (e.g. via agri-environment schemes). However, persisting environmental pressures require further CAP reform to strengthen the economic incentives for farmers to manage their land in an environmentally sustainable way.

Quality of information

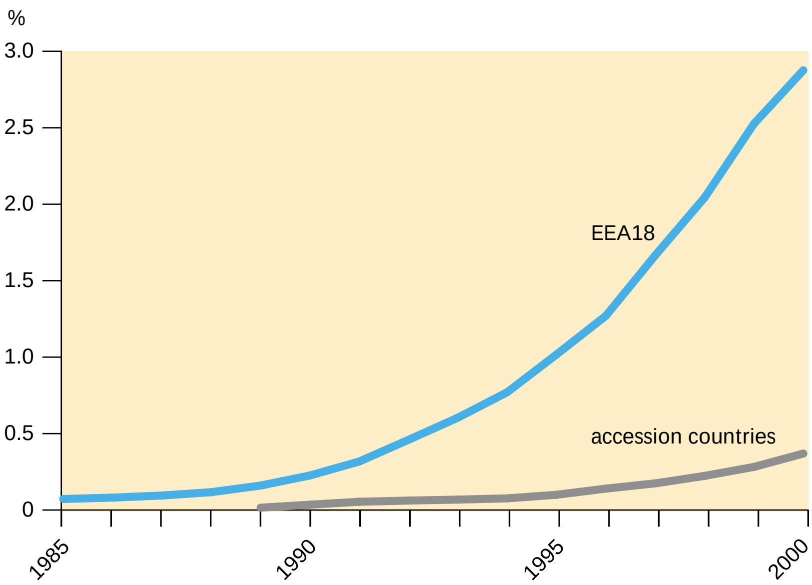
http://europa.eu.int/comm/agriculture/fin/index_en.htm
http://europa.eu.int/comm/agriculture/publi/agrep2000/index_en.htm

Figure 6.6. **CAP expenditure on commodity support and rural development**



Notes: Data for 2001 and 2002 are budgetary appropriations; rural development (RD) figures include co-financing by Member states.
Sources: European Commission, 2002a and b

Figure 6.7. **Share of organic farming in total agricultural area, EEA18 and accession countries**



Source: FAO; Eurostat; Lampkin

Substantial progress has been made in the introduction of environmental elements into the CAP (e.g. via agri-environment schemes). However, persisting environmental pressures require further CAP reform to strengthen the economic incentives for farmers to manage their land in an environmentally sustainable way. At present, agricultural support, even the direct payments, is still largely tied to the level of (past) agricultural production rather than the reward of specific environmental services by farmers. The enlargement of the EU to the east as well as international trade negotiations will also be important considerations in these reform debates.

6.5. Development in organic farming

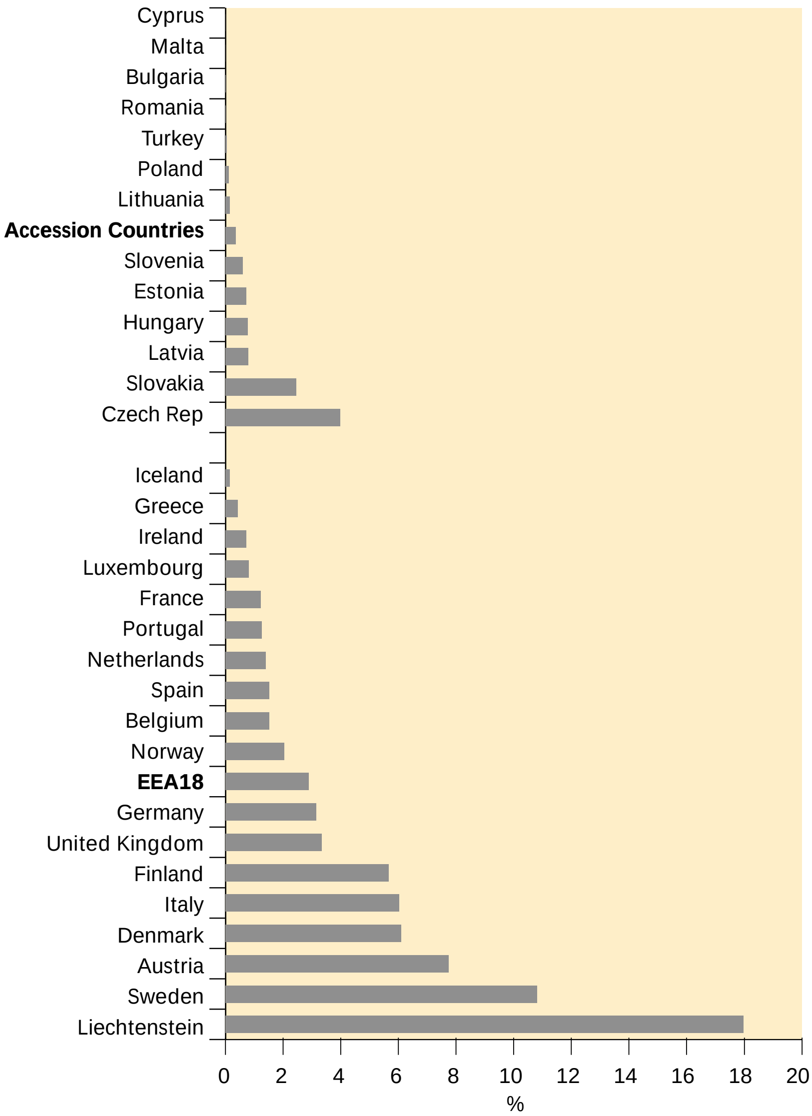
A particular trend in agriculture is the increasing interest in environmentally-sustainable farming systems. Organic farming is one such approach to reduce environmental pressure of agriculture. According to the international food standard-setting body Codex Alimentarius organic farming is based on holistic production management systems (for crops and livestock). These emphasise the use of management practices, such as cultural, biological and mechanical methods, in preference to the use of synthetic off-farm inputs (Codex Alimentarius Commission, 1999).

During the past five to ten years most western European countries experienced a five- to ten-fold increase in organic agriculture and almost 3 % of the EEA area is now farmed organically. In 2000, in terms of the area covered by organic farming, Italy led the way with nearly one million hectares followed by Germany (0.45 million ha), the United Kingdom (0.53 million ha) and Spain (0.38 million ha). The number of certified organic and in-conversion holdings in the EU rose from 29 000 in 1993 to 130 000 in 2000. It has been estimated that organic farming will account for 5-10 % of total farming in the EU by 2005.

Important drivers for this trend include EU funding for organic farming under the agri-environment regulations and consumer concerns over food safety. In 2000, the EU market for organic products represented EUR 8.6 billion with an estimated 10.3 billion for 2001. In 2000 Germany was the biggest market in absolute terms (EUR 2.5 billion) followed by UK (EUR 13.8 billion), Italy (EUR 1.2 billion) and France (EUR 1 billion). This is still small, however, in relation to EU's final agricultural production (EUR 240 billion). To increase the share of organic farming, the European Commission is currently formulating an EU organic farming strategy as requested by Agriculture ministers following the 'Copenhagen Declaration' on organic farming in May 2001.

Organic farming avoids the use of synthetic fertilisers and pesticides, thus minimising risks of pollution from these substances. It also tends to employ management practices with less impact on biodiversity and places significant emphasis on animal welfare. Organic farming, however, also needs to address some environmental issues, such as adequate biodiversity protection, minimisation of nutrient losses and soil conservation. Although further research is still required a number of research projects and conferences have addressed the environmental impact of organic farming (see Danish Ministry of Food, Agriculture and Fisheries, 2001).

Share of organic farming by country in 2000, EEA18 and accession countries Figure 6.8.



Notes: Figures for 2000 are provisional. For Germany and Sweden two categories exist: organic production approved under organic farming certification system and organic farm management supported under agri-environment schemes complying with Regulation 2092/91. The figures for land under certified organic management in Sweden and Germany are 5.7 % and 3.1 %, respectively.
Source: FAO; Eurostat; Lampkin

Almost 3 % of the EEA area is now farmed organically and the proportion of land under organic farming is predicted to rise substantially in the future.

Quality of information ☆☆

http://ew-news.eea.eu.int/Agriculture/organic/Europe/of_in_europe/#3
http://www.organic.aber.ac.uk/Eur%20land%20area%20July%2001.htm

7. Fisheries

policy issue	indicator	assessment
reducing overcapacity of the European fishing fleet	size of the fishing fleet	☹
reducing overfishing	status of fish stocks	☹
implementing the recovery plan for cod stock in the North Sea	North Sea cod stock	☹
sustainable aquaculture production	aquaculture production	😐

Continuous overfishing is putting European fisheries at high risk of collapse, as recognised by the European Commission in its 2001 Green paper on the Common Fisheries Policy. EU Multi Annual Guidance Programmes (MAGPs) were insufficient to address excess fleet capacity, although the EU fishing fleet decreased in tonnage (6 %) and power (12.5 %) during the 1990s. Many fish stocks of commercial importance in European waters appear to be outside safe biological limits: 62-91 % of commercial fish stocks in the North East Atlantic, 100 % in the West of Ireland Sea, 75 % in the Baltic Sea, and 65-70 % in the Mediterranean Sea. In addition, the highly migratory fish species of tuna and swordfish are also overexploited. During the same period, aquaculture production has increased considerably in the EEA18 countries, although this can have adverse environmental impact and interfere with other uses of coastal waters.

In March 2001, the European Commission adopted the first ever Green Paper on the future of the EU Common Fisheries Policy (CFP). It contains a critical review of elements of the CFP and aims to stimulate a wide-ranging debate about its future shape since many of the most important fish stocks are on the verge of collapse, and the renewal of fish stocks is being seriously hindered by too many fish being caught too young.

Securing an economically viable and self-sufficient fisheries sector is among the objectives of the Green Paper; public aid to the sector (at present some 1.1 billion EUR — while the total production of the sector is seven billion EUR for fisheries landings and two billion EUR for aquaculture) should encourage conservation, not work against it by encouraging over-investment in the fleet. Alternative sources of employment like aquaculture and processing need to be found to help coastal communities reduce their dependence on fisheries and compensate for job losses, while avoiding additional impacts on the environment.

The current harvest is in most cases not sustainable for roundfish and only in some cases sustainable for flatfish. Several deep-sea species show signs of overexploitation. New objectives are therefore aimed at:

- the adoption of multi-annual and multi-species fishing quotas, based on the precautionary principle, in order to tackle the problems resulting from annual decisions on single species;
- eco-labelling of fisheries products and more selective fishing;
- more effective fleet reduction programmes, which need to be made simpler to administrate and monitor. A reduction of fishing mortality of at least 40 % is necessary;
- strengthening and harmonising fisheries control in the Community, (through the setting up of a Joint Inspection Office);
- the integration of the Mediterranean into the CFP through the improvement of fisheries advice, the reviewing of technical measures and the strengthening of control and enforcement.

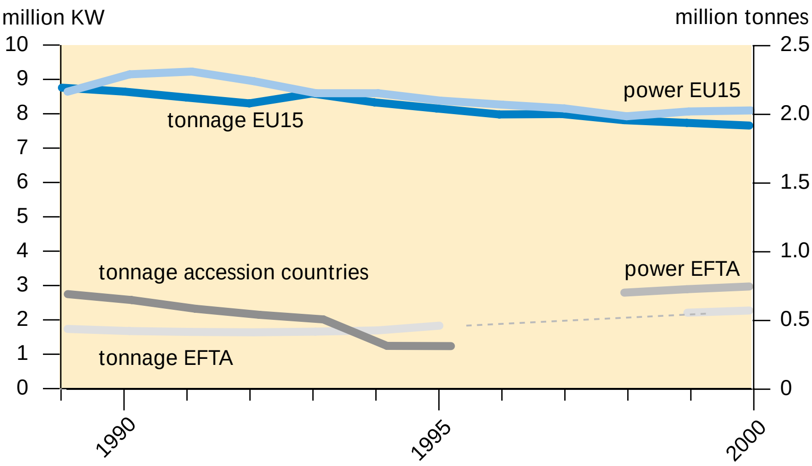
7.1. Size of the fishing fleet

Tonnage and power are the principal determinants of fleet capacity and therefore of the pressure exerted on fish stocks. Between 1989 and 2000, the tonnage of the EU fleet decreased by about 7 % to just over 2 million tonnes. In contrast, the tonnage of the EFTA fleet increased by 31 % to about 570 000 tonnes in 2000. In the case of the Accession Countries, a strong decline was observed in the first half of the 1990s, to about 530 000 tonnes in 1995. Between 1989 and 2000 the aggregate power of the EU fleet decreased by about 12.5 % to about 7.6 million kW; the difference being due to the relatively larger decrease in small vessels.

Subsidies for the construction, modernisation and running costs of the EU fleet provided through the Structural Funds and the Financial Instrument for Fisheries (Regulation 2792 / 1999) have aggravated the pressure on fish stocks. Of the monies allocated in the 1994-99 programme for the purposes of fleet-oriented aid, 60 % went into adjustment of the fleet and 40 % to its modernisation. The decline in fleet capacity overall, with the main reductions in Spain, has not led to an improved status for fish stocks. Advances in technology mean that new vessels exert a greater fishing pressure than older vessels of equivalent tonnage and power. In a number of countries modernisation and decommissioning of the fleet has led to a decrease in total power, but still a slight net increase in tonnage.

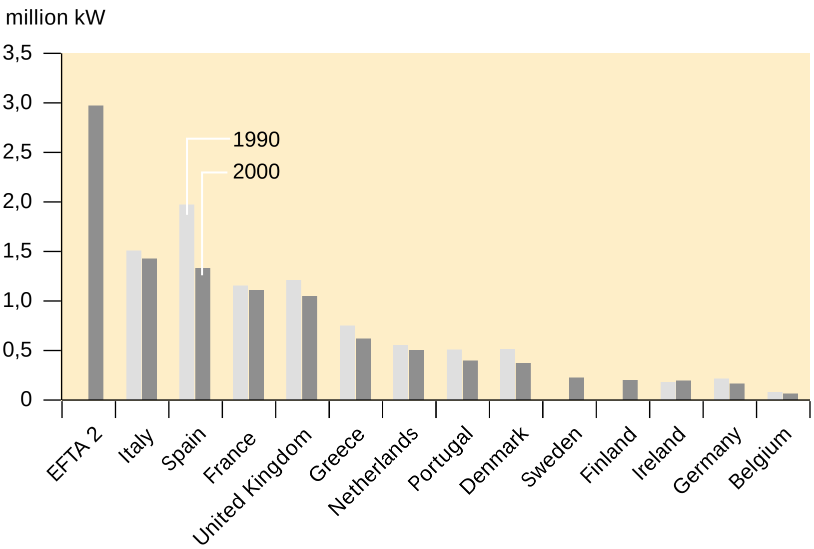
The EU Multi Annual Guidance Programmes (MAGPs) are currently focused on reducing fishing effort (defined as the product of the capacity of a fleet with the days spent at sea) through scrapping of vessels and keeping them in port. In the 4th MAGP cuts of 30 % in the fishing effort for stocks on the verge of collapse and 20 % for those that were overfished were agreed. However, MAGPs have not proved sufficiently ambitious to address excess fleet capacity particularly since they are complex to administer and have not always been adequately enforced.

Size of the European fishing fleet Figure 7.1.



Notes: EFTA countries: Norway and Iceland. Accession countries: Bulgaria, Cyprus, Malta, Poland, Romania and Slovenia. Estonia, Latvia and Lithuania were not included in the graphs due to limited time series.
Sources: Eurostat; FAO; European Commission; EEA

Fishing fleet per country: total engine power Figure 7.2.



Notes: EFTA countries: Norway and Iceland. No data for Norway, Iceland, Finland and Sweden in 1990
Source: Eurostat, 2001; FAO 1998; European Commission 1999

EU Multi Annual Guidance Programmes have so far failed in delivering permanent, structural reductions in fishing effort. Although the EU fishing fleet declined between 1989 and 2000 in terms of vessel numbers (-10 %), tonnage (-6 %) and power (-13 %), the decrease has not led to a corresponding improvement in the status of fish stocks. The much smaller fishing fleet of Norway and Iceland has dramatically increased in numbers (58 %), in tonnage (31 %) and in power (6 %) during the same period.

Quality of information

http://europa.eu.int/comm/fisheries/doc_et_publ/statistic/stat_en.htm

7.2. Status of fish stocks

Fisheries are only sustainable if the status of all fish stocks are within safe biological limits (SBL).

The ratio of the number of overfished stocks to the number of commercial stocks per fishing area indicates that fisheries in the North East Atlantic and the Mediterranean are not sustainable. For most of the NE Atlantic 62–91 % of commercial stocks are outside safe biological limits while the figures for the West of Ireland Sea, the Baltic and the Mediterranean are 100 %, 75 % and 65–70 %, respectively.

Definitions

Commercial fish stocks are defined as those stocks upon which the fishing effort is focused in each area and a profit aimed at. A fairly reliable picture of stock development can be generated by comparing trends in recruitment over time (the number of new fish produced each year by the mature part of the stock), spawning stock biomass (the mature part of a stock), landings (estimate of the most likely removal from the stock, sometimes including discards) and fishing mortality (the proportion of a stock that is removed by fishing activities in a year). A given stock can be considered outside Safe Biological Limits when the spawning stock biomass is below the biomass precautionary approach reference point (Bpa) or when fishing mortality exceeds a fishing mortality precautionary approach reference point (Fpa). Within the EU, reference points have been established for about 10 stocks in the NE Atlantic and Baltic Sea to date, but no such points have been defined for the Mediterranean stocks.

Concerns regarding the status of the stock in NE Atlantic include:

- almost all roundfish stocks, which have declined and are currently unsustainable;
- the dramatic decline in cod and hake stocks, which led to cuts of up to 50 % in total allowable catch (TAC) in 2001;
- whiting stocks with TAC cut to 35 % for the west of Scotland;
- deep-sea species, which show signs of overexploitation;
- flatfish stocks, which are heavily exploited, however close to sustainable levels;
- pelagic and industrial species, which are in better condition, but need to be subject to reduced fishing rates.

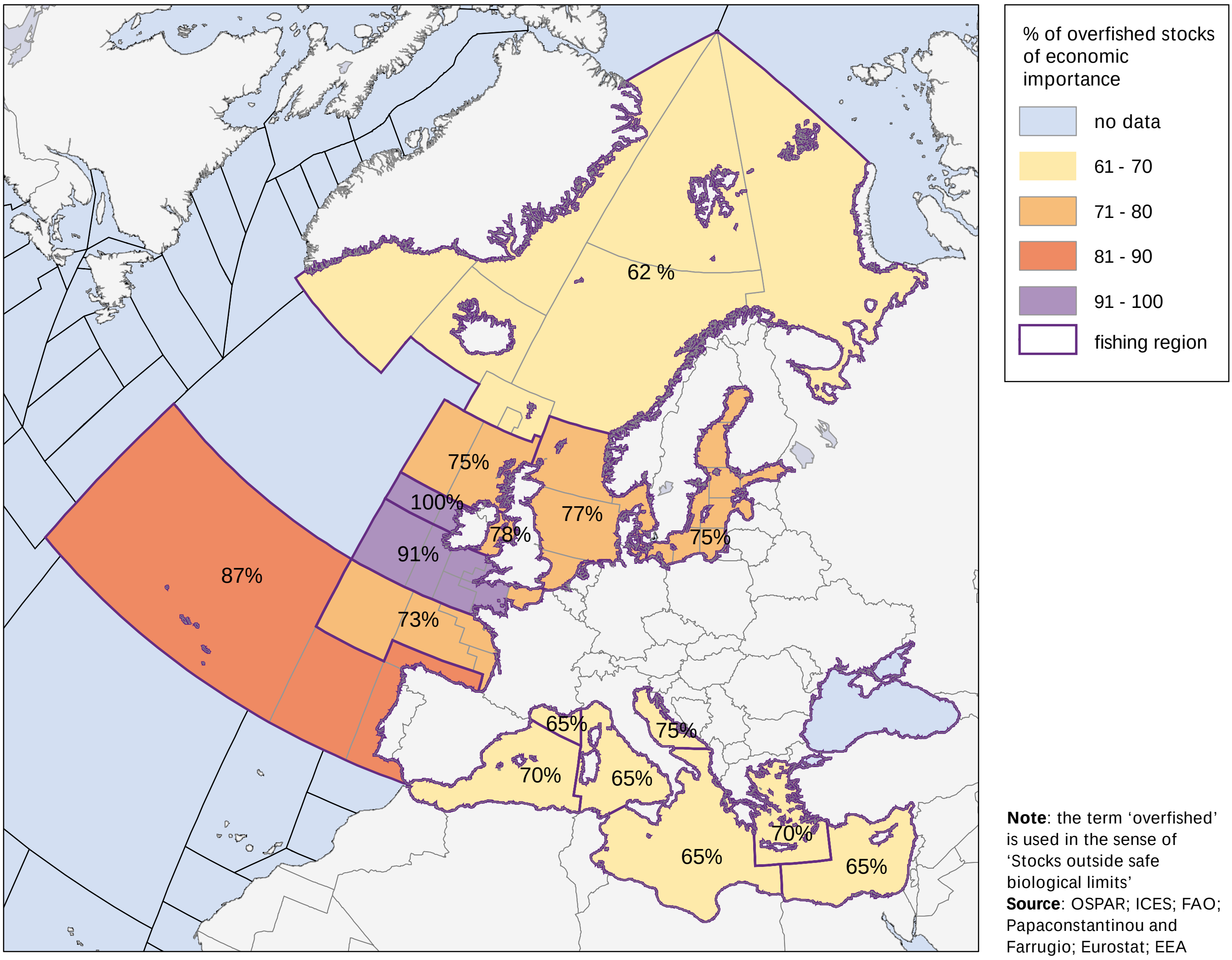
As a result of this unsustainable status of fish stocks in the NE Atlantic, a 10 % cut in the total allowable catches for 2001 for most of the species has been implemented. Knowledge of the biology of deep-sea species is insufficient, but it is suggested that stocks can only sustain low rates of exploitation.

In the Mediterranean, demersal stocks are outside safe biological limits. Small pelagic stocks in the same area exhibit large-scale fluctuations, but do not appear to be fully exploited anywhere, except for the case of anchovy in the Balearic, Adriatic and Aegean Seas.

Particular concerns have been raised over the exploitation of bluefin tuna and swordfish. The migratory nature of these species hinders data collection and consequently sustainable management. Bluefin tuna catches exceed the sustainable rate by 25 % and despite the recommendations from the International Commission for the Conservation of Atlantic Tuna (ICCAT) (for both the Atlantic and the Mediterranean), no measures (despite reductions in Total Allowable Catch) have been enforced or respected as yet.

Commercial fish stocks outside safe biological limits in North East Atlantic, Baltic Sea and Mediterranean Sea, 2001

Map 7.1.



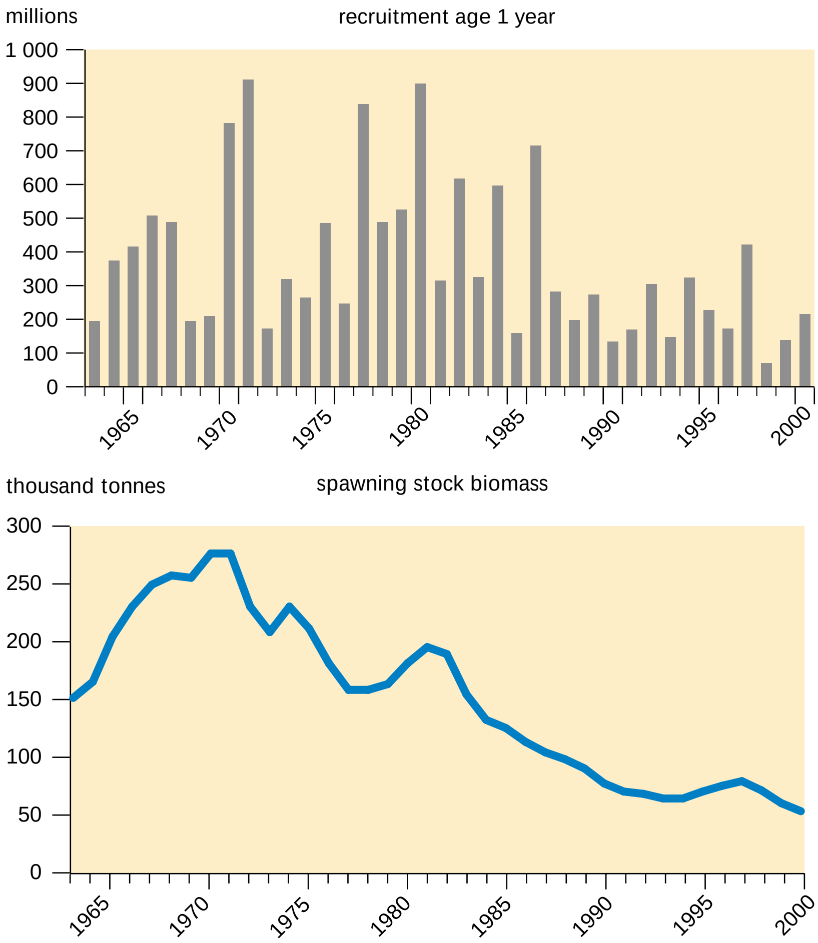
Note: the term 'overfished' is used in the sense of 'Stocks outside safe biological limits'
Source: OSPAR; ICES; FAO; Papaconstantinou and Farrugio; Eurostat; EEA

Most fish stocks of commercial importance in European waters appear to be outside safe biological limits. For most of the NE Atlantic 62-91 % of commercial stocks are outside safe biological limits while the figures for the West of Ireland Sea, the Baltic and the Mediterranean are 100 %, 75 % and 65-70 %, respectively.

Quality of information

http://fao.org/docrep/003/w4248e/w4248e00.htm
http://ices.dk/

Figure 7.3. **Recruitment age 1 year and spawning stock biomass of the North Sea Cod stock**



Note: Management precautionary approach reference point: Bpa = biomass precautionary approach is set at 150 000 tonnes.
Source: ICES; Eurostat

The North Sea Cod stock is overfished in all waters of and adjacent to the North Sea. The spawning stock biomass is calculated to have been below the critical limit for the last 17 years and reached a historic low in 2001.

Quality of information ☆☆☆

http://ices.dk/committe/acfm/comwork/report/2001/oct/cod-347d.pdf

7.3. North Sea Cod Stock

North Sea cod (*Gadus morhua*) is a key fish stock in the NE Atlantic and a valuable indicator of sustainability in fish resource exploitation and management. The spawning stock biomass reached a historic low in 2001 and the risk of stock collapse is high. In February to April 2001, a large part of the North Sea was closed for cod fishing for 10 weeks to protect juvenile cod, as part of an emergency recovery plan. Currently the Total Allowable Catch (TAC) has been set at approximately 50 % of the 2000 TAC. Fishing mortality for North Sea cod has been above the precautionary limit since 1980. With the exception of the 1996-year class (fish born in 1996), recruitment to the North Sea Cod stock has been below average since 1987. The 1997 and 2000 year classes are estimated to be the poorest ever recorded (ICES, 2001).

The cod stock spawns widely in the North Sea and high concentrations of cod eggs are found in the English Channel, on the Dogger Bank and along the Scottish coast. The main areas for growing are the German Bight and the south-eastern part of the North Sea. Towed gears in mixed roundfish fisheries, which include haddock and whiting, take cod. They are also taken in directed fisheries using fixed gears. By-catches of cod occur in flatfish and shrimp fisheries, especially in the Southern North Sea and in fisheries for Norway lobster.

The total catch of cod in the North Sea has decreased from 300 000 tonnes in 1981 to 59 000 tonnes in 2000 (ICES, 2001). ICES has recommended a recovery plan that will ensure recovery of the spawning stock to a level in excess of 150 000 tonnes. If it is not implemented, ICES recommends that fishing mortality is reduced to the lowest possible level in 2002. Reductions in TAC alone are not considered effective in regulating fishing mortality; restrictions in fleet efforts should also be implemented. In addition, a change in the fishing patterns, and attempts to reduce discard, by-catches and under-reporting of catches, should be considered.

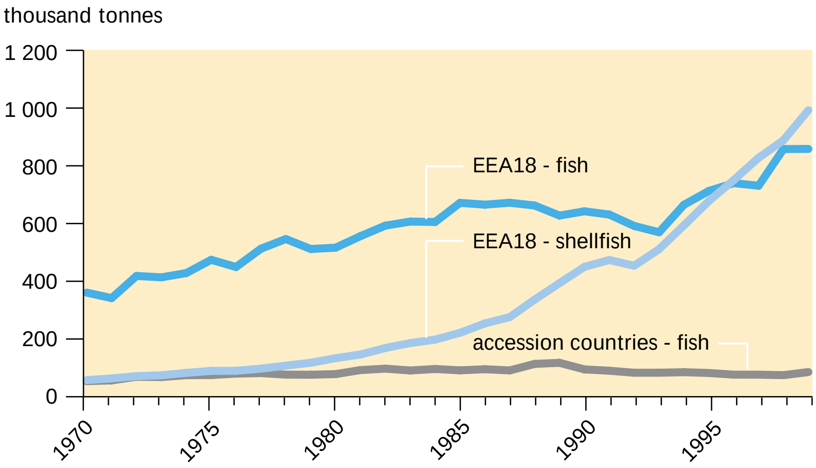
7.4. Aquaculture production

Aquaculture has benefited from European Community financial support since 1971. Limited at first to inland fish farming, Community support was extended to other areas in the late 1970s. Between 1994 and 1998 the aquaculture sector accounted for 5.1 % of Structural Fund expenditures under the Fisheries Instrument for Fisheries Guidance (FIFG) (213 million EUR). The FIFG requires stricter Environmental Impact Assessment (EIA) provisions than Directive 85/337/EEC and also provides an incentive for sustainable aquaculture, since a higher rate of public aid (up to 10 % more) can be paid to aquaculture projects where investments are directed towards techniques that significantly decrease their environmental impact.

Between 1970 and 1999 there was a fourfold increase in aquaculture production within the EEA18 countries, mainly to the tighter fishing quotas and an increase in fish consumption. Norway accounts for a quarter of total European production, largely due to success in the mariculture (marine aquaculture) of the Atlantic salmon. In 1999 the share of mariculture in the total fisheries production in Europe amounted to 14 %.

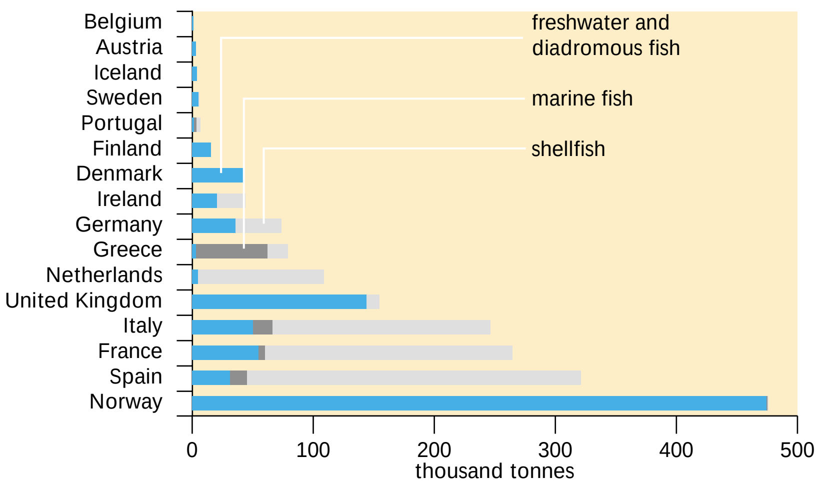
Aquaculture production per coastal unit is an indication of the potential impact on these coastal waters, but the impact will depend on the culture technique. The countries with the highest aquaculture production per km of coast in 1999 were The Netherlands (296.4 tonnes/km), followed by France (105.2 tonnes/km), Spain (85.1 tonnes/km), Germany (79.6 tonnes/km) and Italy (54.9 tonnes/km). However, for The Netherlands, France and Spain, the majority of this aquaculture is shellfish production, of which there is evidence of a lower environmental impact than fish farming. Molluscs accounted for a significant proportion (64 %) of EU aquaculture production in 1999. In contrast to the EU, molluscs accounted for less than 1 % of total production in 1999 in the Accession Countries.

Aquaculture production in coastal and inland waters, EEA18 and Accession countries — Figure 7.4.



Note: Shellfish not included for Accession countries (see Fig 7.5.) Aquaculture can give rise to significant environmental impacts including discharges: of organic matter, phosphorus, nitrogen, disinfectants, antifoulants, flesh colourants and medicines (including vaccines); quality of bathing water and the loss of recreational space; the depletion of oxygen in bottom waters; accidental introduction of alien species; genetic dilution due to escaped farmed fish breeding with wild populations; exchange of diseases and parasites between wild and farmed fish; potentially a large input of wild fish as fishmeal for a relatively low output of farmed fish.
Source: Eurostat, New Cronos database

Total aquaculture production in 1999, EEA18 — Figure 7.5.



Notes: No data available for Liechtenstein. Diadromous fish are those that migrate, either from the sea into the freshwater parts of rivers to breed or from freshwater to the sea. Salmon is thus a diadromous fish; it makes up almost all of the Norwegian production.
Source: Eurostat; DPMA/French Ministry of agriculture and fisheries

Aquaculture production has increased in the EEA 18 countries, particularly fish production. This represents a potential increase in pressure on water. However, it is difficult to quantify these impacts at a European or regional level due to insufficient data.

Quality of information ☆☆

http://europa.eu.int/comm/fisheries/doc_et_publ/cfp_en.htm

8. Progress in some key environmental issues

As in Environmental signals 2001, this short chapter brings together the main indicators from the chapters on environmental issues to serve those readers who need a quick and concise answer to the question: 'how is the environment doing?' This overview presents a number of indicators that show mainly changes in principal human pressures on the environment. Choosing pressures as the entry point gives an impression of the degree to which the implementation of plans and strategies has been successful.

It is important to note that in some cases the 'ideal' indicator for monitoring could not be constructed since the necessary data were not available; a proxy indicator has been used in these cases. Each of the core indicators presented here is explored in more detail in the chapters that follow, which include notes and sources relating to the data used.

Table 8.1. **Core environmental indicators and the four themes of the EU Sixth Environment Action Programme**

Issue	Indicator	Index 1990	Index 1999	Target 2010	Assessment
Tackling climate change					
Emissions of greenhouse gases	Trend in emissions and distance to 2008–2012 Kyoto target	100	96	92	[1]
Nature and biodiversity - protecting a unique resource					
Forest protection	Proportion of forest area under protection				
Emissions of acidifying substances	Trend in emissions and distance to 2010 NECD target	100	62	44	
Environment and health					
Emissions of ozone precursors	Trend in emissions and distance to 2010 NECD target	100	73	46	
Urban air quality	Exceedances for ozone, fine particles, sulphur dioxide and nitrogen dioxide				
Freshwater pollution	Trends in concentration of orthophosphate and nitrate in rivers	100 100	55 110		
The sustainable use of natural resources and management of wastes					
Material consumption	Total material requirement	100	95 (1997)		
Urban waste generation	Municipal waste collected	100 (1995)	109		
Water use	Water exploitation index	100	95 (1997)		
Land take by development	Trends in built up area, population and road network density	100	120		

(1)Assessment based on achievements in most countries and the outlook for 2010: in 2010 the index of greenhouse gas emissions is projected to be 100, the same as in 1990.

8.1. Overview of progress

Tackling climate change

Total greenhouse gas emissions in the EU have fallen (by 4 % between 1990 and 1999) and the EU is thus halfway towards reaching its Kyoto target for 2008–2012. Reductions have been achieved in carbon dioxide and methane emissions from the energy supply and industrial sectors, nitrous oxide emissions from the chemical industry and methane emissions from landfills, but these were offset by increases in carbon dioxide emissions from road transport. Progress in reducing emissions to date is, however, misleading, as much of the improvement in the energy supply sector and industry has been from 'one-off' gains. Germany and the UK are well below their linear Kyoto ('Burden sharing agreement') target path, but most EU Member States are significantly above this path (see Chapter 9).

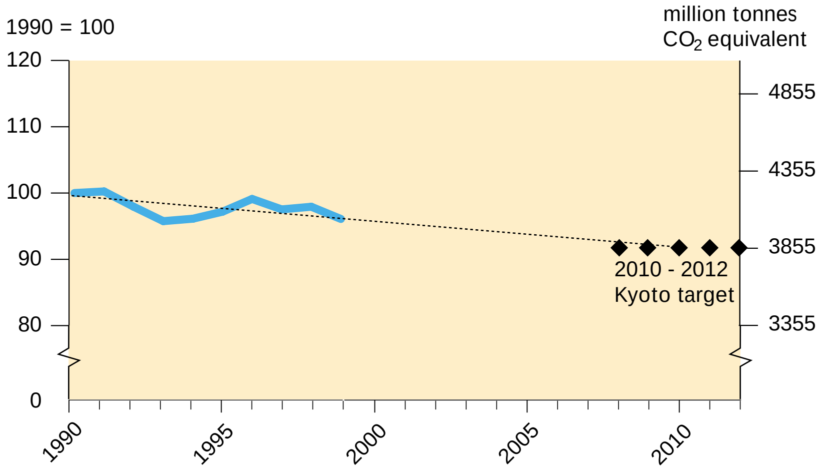
Substantial further emission reductions from all sectors are needed to reach the EU and national targets. Total EU greenhouse gas emissions are projected to be at the 1990 level by 2010, with existing policies and measures. Emissions from the transport sector are projected to rise by more than 30 % by 2010. All Member States, except the UK, project their baseline emissions (by 2010) to be above their Burden sharing target.

Nature and biodiversity

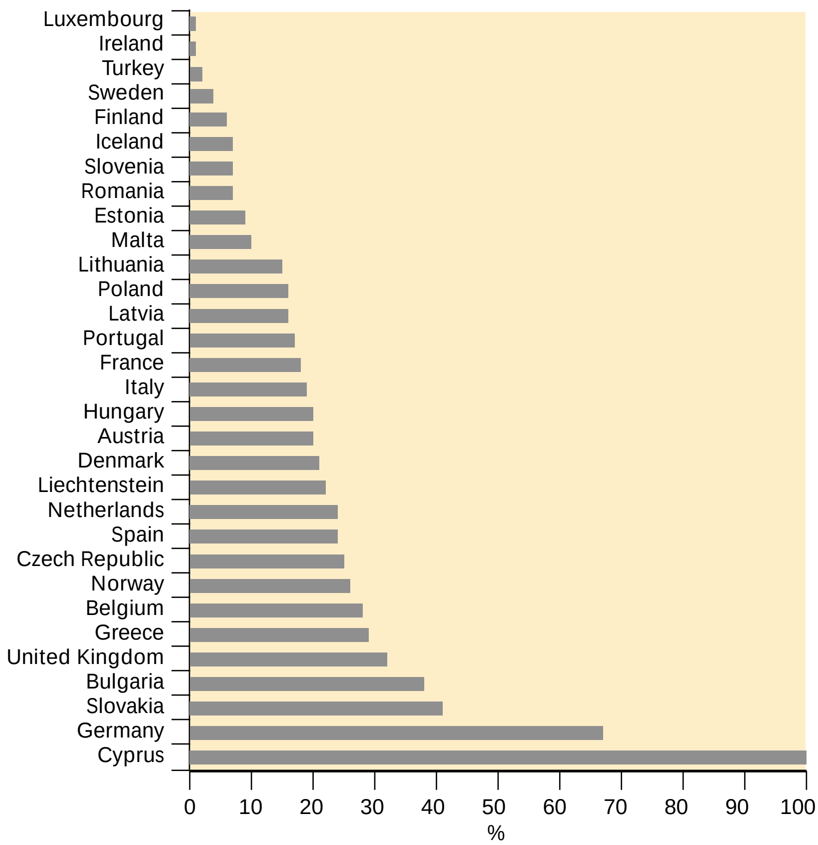
There is no overall indicator for biodiversity for Europe. Forests have been selected as the biodiversity topic for this year's Environmental signals (see Chapter 15). Forests are a key repository of biological diversity and play a central role in the functioning of the biosphere. Protection of forests, of which the total area in Europe has been increasing slightly, is part of a growing number of regulations, initiatives and programmes at the national, European and international level.

The deposition of acidifying substances, which emissions have been reduced, still exceeds the critical loads of the ecosystems in many areas.

Emissions of greenhouse gases, EU Figure 8.1.



Forest area protected Figure 8.2.



Emissions of acidifying substances, EU Figure 8.3.

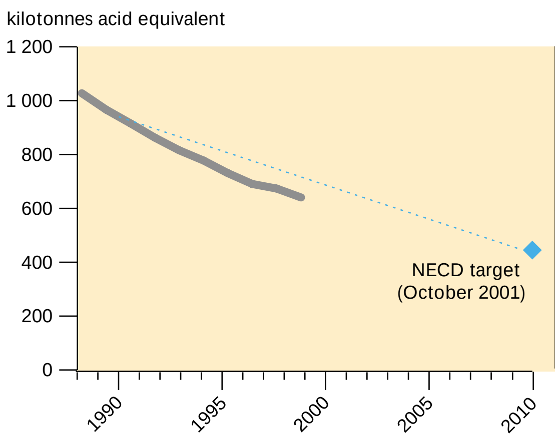


Figure 8.4. **Emissions of ozone precursors, EU**

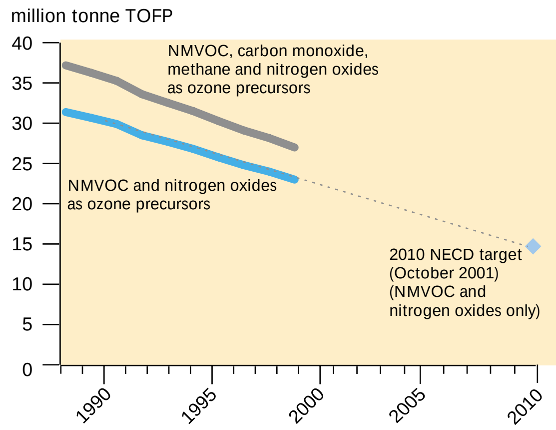


Figure 8.5. **Urban air quality, EU**

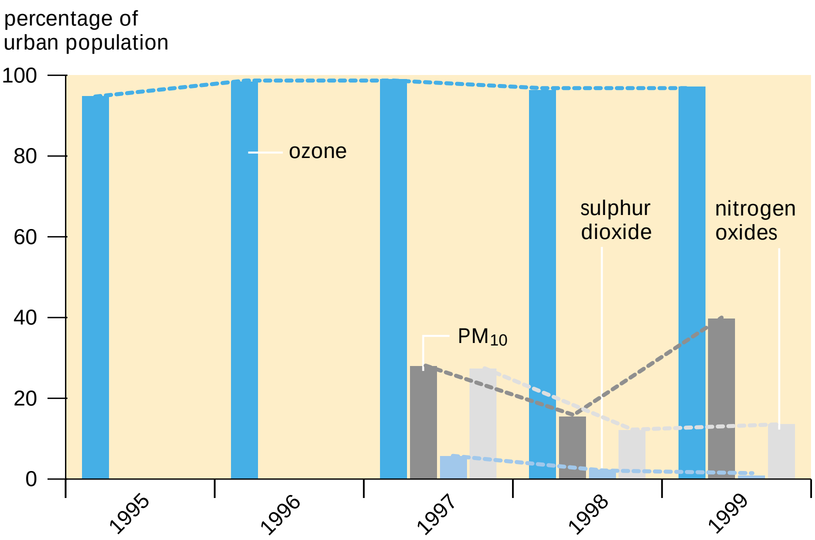
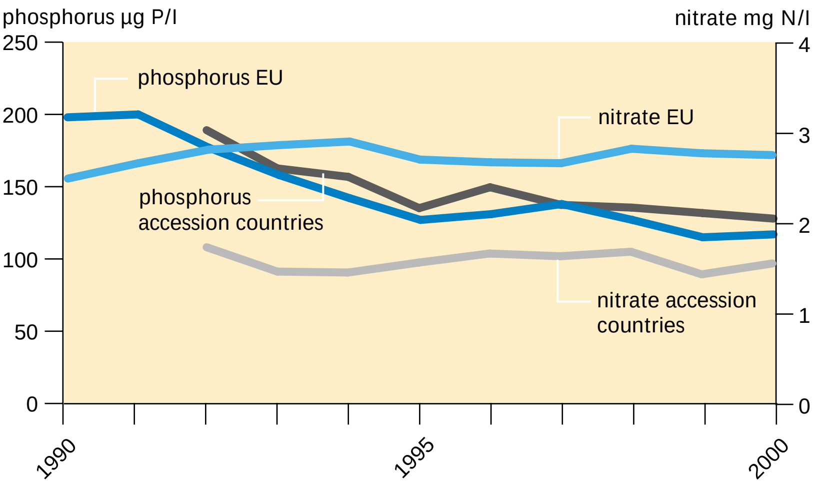


Figure 8.6. **Total phosphorus and nitrate concentrations in rivers**



Environment and health

The EU has reduced emissions of ozone-forming gases (ozone precursors) by 27 % between 1990 and 1999 and is on its target path towards reaching a 51 % reduction by 2010.

Despite the reductions, substantial urban populations in EEA Member Countries are exposed to high concentrations of ground-level ozone, nitrogen dioxide and fine particles.

Phosphorus concentrations in EU and accession country rivers generally declined by 30–40 % during the 1990s. The decrease was especially marked in countries with high concentrations at the beginning of the 1990s, which could be an indication that policies aimed at reduction of pollution by point sources were successful.

Nitrate concentration in rivers was highest in those countries with intensive agricultural production. In contrast to phosphorus, nitrate concentrations remained relatively unchanged although concentrations were lower in the accession countries due to the lower intensity of agriculture.

Overall, river concentrations of phosphorus and nitrates remain higher than natural or ‘background’ levels (see Chapter 11).

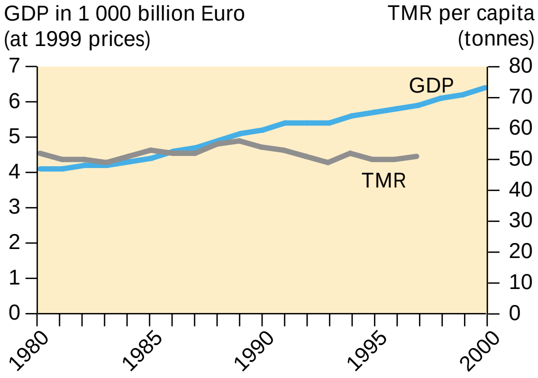
Sustainable use of natural resources and management of wastes

EU total material requirement, that is the total volume of materials flowing though the economy each year, has remained almost constant since 1980 at around 51 to 52 tonnes per capita, and is dominated by non-renewable resources with a practically constant share of around 88 %. Domestic extraction and import of fossil energy carriers, and the associated hidden flows, are a major component (some 15 tonnes per capita). Around half of this amount is 'unused' and ends up as mining waste somewhere in the world. While EU use of industrial and construction minerals requires primary resource extraction of around 12 tonnes per capita, the use of metals (around 10 tonnes per capita) is particularly linked with hidden material flows in foreign countries. The share of 'hidden' flows not directly entering the EU economy, (unused domestic extraction and the indirect flows associated with imports) has been decreasing slightly, indicating a slightly more efficient use of primary resources.

Development over time shows a relative but not absolute decoupling of economic growth and material use, but it is difficult to appreciate to what extent this is the result of specific improvements in resource-use efficiency or simply the effect of changes in economic structure.

The input of materials into an economy will lead to the generation of waste at some future point. Reliable trends in total waste generation are still not available. Whereas some reductions in other waste streams have occurred, the generation of municipal waste (approximately 14 % of total waste) is still rising and reached an EU average of 540 kg per capita in 1999. Recent years have seen a marked reduction in the overall quantity of waste being sent for final treatment/disposal (landfill or incineration), linked with an increase in recycling rates. However, landfill has remained the prevailing option in many EU countries (see Chapter 12).

Material consumption, EU Figure 8.7.



Municipal waste collected Figure 8.8.

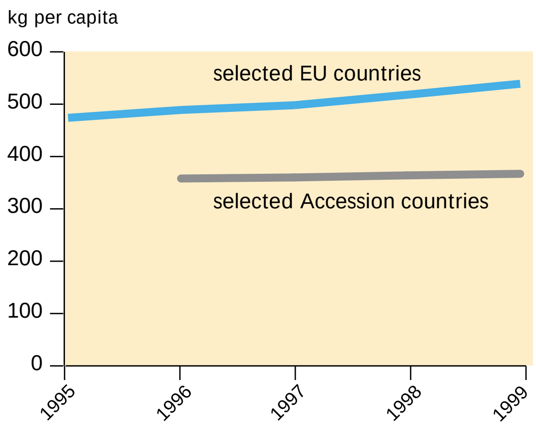


Figure 8.9. **Water exploitation index**

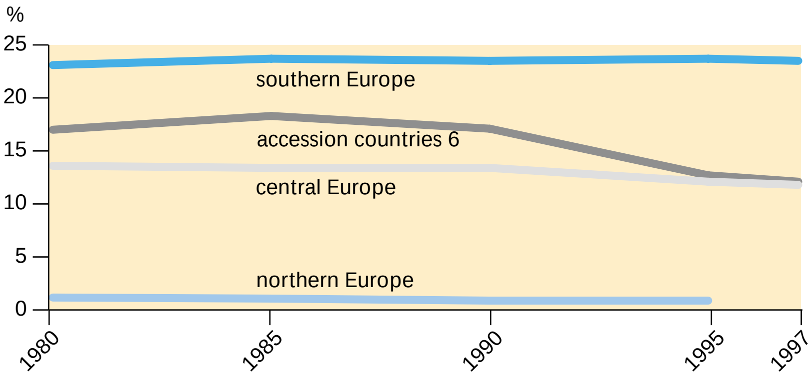
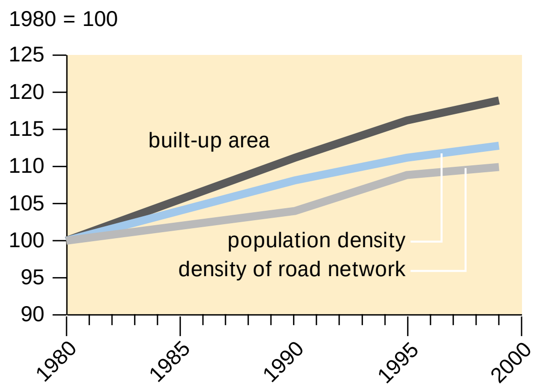


Figure 8.10. **Built up area and road network density, selected EU and accession countries**



The exploitation of the water resources has remained relatively constant over the last 20 years. Some reductions occurred in central EU and the accession countries in the 1990s. Southern Europe may be facing unsustainable trends with around one quarter of the available water resource exploited, predominantly for agriculture, while the exploitation rate is around 12 % in central Europe and 1 % in the northern countries (see Chapter 11).

During the last decade, improvements in the efficiency of water use have been made, especially in the industrial sector and urban uses across Europe. In some countries (e.g. The Netherlands and Denmark) the water exploitation index has been nearly halved during the last 20 years (i.e. in Denmark from around 20 % to 12 % and in The Netherlands from 10 % to 5 %).

Over the last 20 years the built-up area in major western and eastern European countries has increased by some 20 % (based on a selection of countries). This is a much greater rate of growth than has occurred in the population of the EU over the same period (6 %). There are a variety of reasons for this trend, including most significantly the increased demand for larger houses, out-of-town developments like supermarkets and leisure centres, with a consequent provision of transport infrastructure (see Chapter 13).

8.2. Conclusions

In general the answer to the question posed in the introduction 'how is the environment doing' is a positive one for the issues covered in this edition of Environmental signals: emissions of greenhouse gases in the EU are reducing on a linear path towards the Kyoto targets, emissions of air-polluting substances have been reduced, total waste generation appears, at least in the countries for which there is data, to be increasing less than the economic production, and emissions into water have been reduced due to extended wastewater treatment.

These overall reductions have been possible in many cases, however, because of relatively large decreases in environmental pressures in a few countries or by specific sectors. Many countries, and some sectors, have not contributed to this progress. This is very apparent for the issue of climate change, for example. Restructuring of industry and changes in fuel for power plants has caused a large reduction in carbon dioxide emissions - the most important substance responsible for the greenhouse effect — in Germany and the UK. However, nine out of the 15 EU Member States have increased their emissions and are moving away from their Kyoto target (or, where increases are allowed, are using their emission 'space' faster than a linear path to their target).

Comparable stories can be told for waste and water pollution: while a few countries have made major progress towards minimising landfilling of waste, in eight of the 15 EU Member States more than half of the municipal waste is still landfilled; and while significant progress has been made by industry and government administrations in providing wastewater treatment, the agriculture sector is lagging behind, as illustrated by more or less constant nitrogen concentrations in surface waters.

These observations point to the need for a dedicated approach for specific target groups of environmental policy, building on the achievements under the Cardiff process for the integration of environment in other policies. Elements of such a policy could include stimulating a proactive approach by the business sector, giving a more important role to environmental education, and developing transparent quantitative targets and timetables for sectoral achievements and an integrated approach to all aspects of sustainable development, which can be enhanced by facilitating networking between the actors involved (OECD, 2001). At the EU level, a similar dedicated approach towards countries could be envisaged. Benchmarking of progress made could lead to the sharing of best practice in the use of various mixes of instruments, planning tools, and the like.

9. Climate change

policy issue	indicator	assessment
achieving the Kyoto Protocol targets	total emissions of greenhouse gases	
controlling emission reduction - contributions across sectors	emissions of greenhouse gases by sector and gas	
maintaining average temperatures below provisional 'sustainable targets'	global and European mean temperature	

Total greenhouse gas emissions in the EU have decreased (by 3.5 % between 1990 and 2000) and thus the EU is about halfway towards reaching its Kyoto target for 2008–2012 assuming only domestic measures will be used. Decreases of carbon dioxide and methane emissions from the energy supply sector and industry, nitrous oxide emissions from the chemical industry and methane emissions from landfills were achieved, but these were offset by increases of carbon dioxide emissions from road transport. However, positive progress in reducing emissions to date is misleading as 'one-off' gains have delivered much of the improvements in the energy supply sector and industry. Germany and the UK are well below their linear target Kyoto ('Burden sharing agreement') target path, but most EU Member States are significantly above this path.

Substantial further emission reductions from all sectors are needed to reach the EU and national targets; total EU greenhouse gas emissions are projected to be at the 1990 level by 2010, with existing policies and measures. Emissions from the transport sector are projected to rise by more than 30 % by 2010. All Member States, except UK, Germany and Sweden, project their baseline emissions (by 2010) to be above their Burden sharing target.

Global mean temperature has increased about 0.6° C over the past 100 years. In Europe, the mean temperature in 2000 was an absolute record for the past 100 years. There is new and stronger evidence that most of the warming observed over the past 50 years is attributable to human activities.

Climate change, and avoiding its potential consequences, is addressed by the United Nations Framework Convention on Climate Change (UNFCCC). Achieving 'sustainable' atmospheric greenhouse gas concentrations would require substantial (50 to 70 %) global reductions in greenhouse gas emissions, far beyond the targets set at Kyoto, which are for a 5 % reduction of developed countries' emissions from 1990 levels by 2008–2012. For the EU, the Kyoto Protocol sets a target of a reduction of 8 % for this period for the basket of six greenhouse gases. In June 1998, EU Member States agreed a system of 'burden sharing' or 'target sharing'. The European Community reaffirmed these targets for Member States in the agreement on ratification of the Kyoto Protocol (European Commission, 2001a; European Community, 2002).

In November 2001 agreement was reached within the UNFCCC on many of the rules and guidelines for the use of both the Kyoto mechanisms (joint implementation, clean development mechanism, international emissions trading) and the sinks for meeting the Kyoto targets (UNFCCC, 2002). This enables countries, as well as the EU, to ratify in 2002. By early 2002, 47 parties had ratified the Kyoto Protocol but, as yet, no major developed country. The Protocol will enter into force when it has been ratified by at least 55 parties to the Convention, including developed countries accounting for at least 55 % of carbon dioxide emissions from this group in 1990. After the Kyoto Protocol has entered into force, the European Community and the Member States could also use the Kyoto mechanisms and sinks to meet their targets.

Greenhouse gas emissions (with their percentages of total emissions in 1999, weighted to take account of their different global warming potentials), originate from:

- carbon dioxide (81 %), the main greenhouse gas, mainly from fossil fuel combustion;
- methane (9 %) from agriculture (cattle and manure management), waste (waste disposal in landfills) and fugitive emissions from fuels (e.g. in gas distribution networks);
- nitrous oxide (8 %) from agriculture (soils and fertiliser use), industrial processes (mainly adipic and nitric acid production) and, as a by-product, passenger-car catalysts;
- industrial fluorinated gases (hydro-fluorocarbons, perfluorocarbons, sulphur hexafluoride) (2 %).

EU policy actions to reduce emissions are delivered through the European Climate Change Programme (ECCP), which was established in June 2000 to help identify the most cost-effective measures (i.e. at costs less than 20 EUR per tonne carbon dioxide equivalent). Important existing measures are:

- the agreement with the European, Japanese and Korean car industry to reduce carbon dioxide emissions from new passenger cars by 25 % between 1995 and 2008;
- the requirement of the Landfill Directive to reduce the amount of organic waste to landfills and to collect landfill gas for energy use;
- Directives on energy-efficiency requirements for appliances and agreements on minimum energy standards.

Various Member States have adopted comprehensive national programmes to reduce greenhouse gas emissions with a wide range of policies and measures for different sectors, for example energy saving in industry through negotiated agreements and programmes to promote renewable energy sources. Carbon dioxide taxes are in place in Denmark, Finland, Germany, Italy, The Netherlands, Norway, Sweden and the United Kingdom (see Chapter 15). The UK introduced a national emission-trading scheme in 2002.

ECCP reports (European Commission, 2001b) identified new policies and measures, resulting in proposals for Directives on:

- emission Trading (European Commission, 2001c) (industrial sector)
- bio-fuels (energy and transport sector)
- promotion of renewable energy sources (energy sector)
- energy performance of buildings (energy sector)
- energy efficient public procurement (energy sector)
- fluorinated gases (industrial sector).

Other recent Commission efforts, which are also expected to reduce greenhouse gases, include an Action Plan for Improved Energy Efficiency in the Community, a Green Paper on the Security of Energy Supply and a White Paper on a Common Transport Policy (see Chapters 4 and 5).

UK launches greenhouse gas emissions trading scheme

The UK Emissions Trading Scheme is the world's first economy-wide greenhouse gas trading system. Emissions trading is an approach designed to allow greenhouse gas emission reductions to be made in the most economically efficient way. Emissions trading is already being developed internationally - the European Commission has proposed that EU-wide trading at company level should begin in 2005 and the Kyoto Protocol envisages global trading in greenhouse gas emissions from 2008. The UK scheme is voluntary and started on 1 April 2002. The scheme will allow UK businesses and other organisations to gain valuable experience of emissions trading. The UK Government is making available up to EUR 343 million over 5 years for companies which voluntarily take on emission reduction targets for greenhouse gases. Companies can meet targets by reducing their emissions or by buying surplus allowances from another participating organisation. Firms have the choice of entering just carbon dioxide emissions or the basket of six greenhouse gas emissions covered by the Kyoto Protocol. Failure to meet voluntary targets can result in financial incentives being withheld or having to be repaid with interest. Additionally, the UK Government intends to publish a list of those firms failing to meet their annual targets. The scheme could significantly cut the cost to UK companies of complying with the Kyoto Protocol. A total of 34 companies are set to participate, including: British Airways; BP; Shell; and TotalFinaElf. However, it should be noted that critics have indicated that half of the planned emission reductions are either not real ('hot air') or would be achieved anyway.

Source: http://www.defra.gov.uk/environment/climatechange/trading/index.htm

9.1. Total emissions of greenhouse gases

Environmental signals 2000 and 2001 reported a downward trend in emissions of greenhouse gases by 1998 and this has been continued with a further 2 % decrease in 1999. Recent data (EEA, 2002) show that these emissions increased 0.3% from 1999 to 2000, and thus decreased 3.5% from 1990 to 2000. The favourable situation to date is misleading, as it is largely a result of considerable cuts in emissions in Germany and the UK, which together account for around 40 % of total EU greenhouse gas emissions. About half of the reduction in Germany and the UK (18.7 % and 14.0 % respectively) was due to one-off factors.

The emissions drop was due to a combination of favourable factors, some of which will not be repeated, including introduction of technical measures to reduce nitrous oxide emissions at adipic and nitric acid production plants in France and the UK and HFC emissions from the UK industry, a continuation of the shift from coal to gas seen during the 1990s, particularly in Germany and the UK, and relatively mild winters in Germany, UK, France and The Netherlands which reduced energy use for indoor heating.

Total EU carbon dioxide emissions decreased by 1.0 % from 1990 to 1999. Recent data (EEA, 2002) show that carbon dioxide emissions increased 0.5 % from 1999 to 2000, and thus decreased by 0.5 % from 1990 to 2000. Thus the EU target to stabilise carbon dioxide emissions at 1990 levels by 2000 was achieved. Carbon dioxide emissions increased from 1999 to 2000 by 1.2 % in the UK and stabilised in Germany.

In France, nitrous oxide emissions from transport increased significantly while large reductions were achieved in nitrous oxide emissions from the chemical industry. Transport and electricity production were the sources

Table 9.1. **Progress towards Kyoto Protocol and burden sharing targets**

Country	Greenhouse gas emission change 1990-1999 (%)	Kyoto (Burden sharing) target for 2008-2012 (% from 1990)
Luxembourg	–46	–28
Germany	–19	–21
United Kingdom	–14	–12.5
Finland	–1	0
France	0	0
Sweden	2	4
Austria	3	–13
Denmark	4	–21
Italy	4	–6.5
Belgium	6	–7.5
Netherlands	7	–6
Greece	17	25
Ireland	22	13
Portugal	23	27
Spain	24	15
EU Total	–4	–8

Notes: Including all six Kyoto Protocol greenhouse gases, but excluding land-use change and forestry. Base year is 1990 for all gases except fluorinated gases (base year is assumed to be 1995). The change in greenhouse gas emissions from Denmark is — 4.6 % if Danish greenhouse gas emissions are adjusted for electricity trade in 1990 (this methodology is used by Denmark to monitor progress towards its national target).

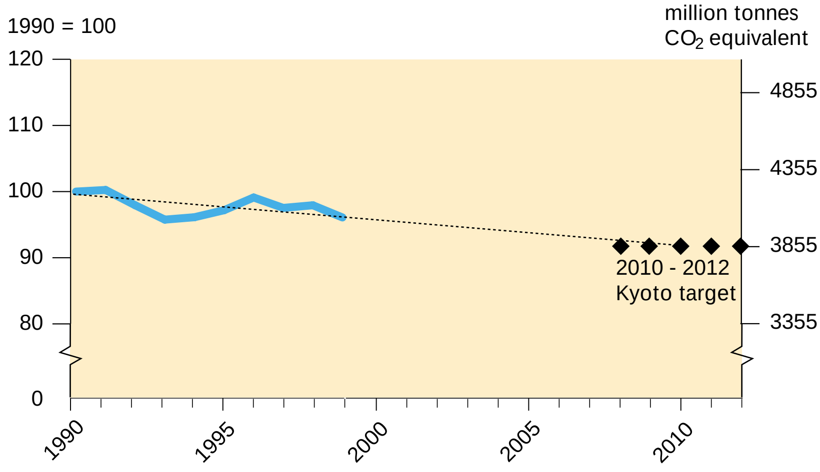
of increases in Italy while emissions in Ireland, Portugal and Spain have increased by more than 20 % since 1990 due to large increases in energy consumption in several sectors and increased passenger road transport due to high economic growth (in particular in Ireland).

Based on both Community-wide (European Commission, 2001d; EEA, 2001) and Member State projections, EU greenhouse gas emissions are currently projected to stabilise at around 1990 levels by 2010, with existing policies and measures, including for example the agreement with the car industry to reduce carbon dioxide emissions from new passenger cars. Only the UK, Germany and Sweden project their emissions to achieve their Kyoto Burden sharing target. Achieving the Kyoto Protocol targets for the EU and the Member States are therefore expected to require large additional efforts.

Emission trends in the transport sector are of particular concern. Projections of greenhouse gas emissions from the transport sector indicate a rise of more than 30 % by 2010 (excluding emissions from international transport which were estimated to be 6 % of total EU greenhouse gas emissions in 1999).

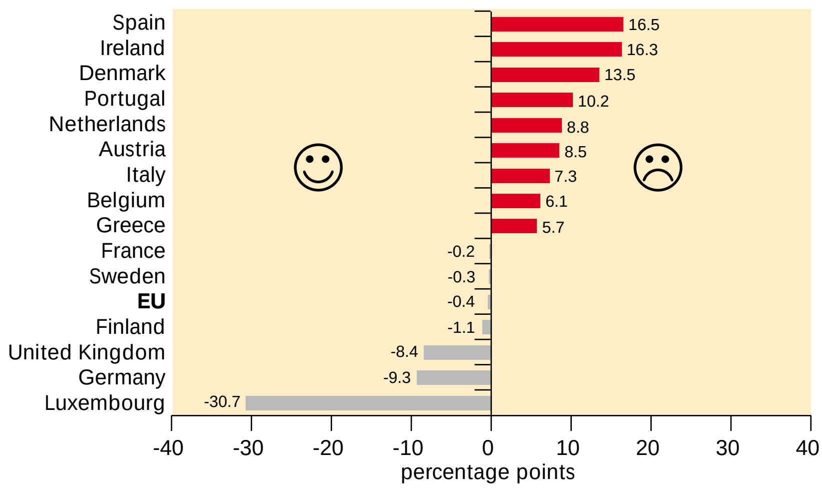
Member States have identified additional national policies and measures that could help achieve a 5 % reduction from 1990 emissions (about 210 million tonne CO_2 equivalent). This still leaves a gap of 3 % (about 110 million tonne CO_2 equivalent). Additional savings have been identified by several Member States, and the European Climate Change Programme (ECCP) (about 240 million tonne CO_2 equivalent, partly overlapping with reduction potentials identified by Member States). The technical potential to meet the target through domestic policies and measures therefore exists, but success is dependent on political acceptability and the timing of the delivery of these policy measures.

EU greenhouse gas emissions Figure 9.1.



Source: EEA, based on Member States data reported to UNFCCC and European Commission

Distance-to-target for EU Member States in 1999 (Kyoto Protocol and EU burden sharing targets) Figure 9.2.



Note:. The distance-to-target indicator is a measure of how close the current emissions (1999) are to a linear path of emissions reductions (or allowed increases) from 1990 to the Kyoto target for 2008-2012 (for total greenhouse gas emissions), assuming that only domestic measures will be used. The targets are the EU Kyoto Protocol target and for each Member State the EU burden sharing agreement targets. All six Kyoto gases are included, but land-use change and forestry are excluded. The unit is percentage points with 1990 emissions being 100 %. For example, if a country's target is 10 % reduction (by 2008-2012) from 1990 levels, the theoretical 'target' in 1999 would be a reduction of 4.5 %. If the actual emission in 1999 is an increase by 3 % the 'distance to target' index is 3+4.5 or 7.5 percent points. The Danish distance-to-target is 4.9 index points, if Danish greenhouse gas emissions are adjusted for electricity trade in 1990 (this methodology is used by Denmark to monitor progress towards its national target).
Source: EEA, based on Member States data reported to UNFCCC and European Commission

EU total greenhouse gas emissions have decreased by 3.5 % from 1990 to 2000 and are projected to stabilise at 1990 levels by 2010. However, without further policy measures nine Member States are likely to significantly exceed their agreed share of the EU total allowed emissions under the Kyoto Protocol which requires an 8 % reduction from 1990 levels.

Quality of information ☆☆☆

http://themes.eea.eu.int/Environmental_issues/climate/indicators/Kyoto_Protocol_targets/index_html

Figure 9.3. **Greenhouse gas emissions by sector, 1999, EU**

Source: EEA, based on Member States data reported to UNFCCC and the European Commission

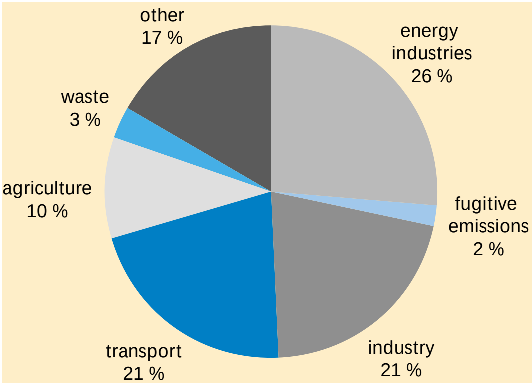
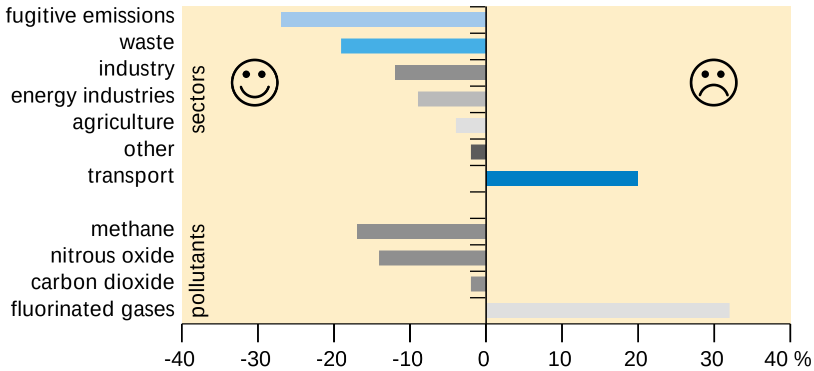


Figure 9.4. **Greenhouse gas emissions changes by sector and gas, 1990–1999, EU**



Source: EEA, based on Member States data reported to UNFCCC and the European Commission

The transport sector is of particular concern where projections indicate a rise in greenhouse gas emissions of more than 30 % by 2010. In some areas emissions have been reduced, but further substantial reductions from all sectors are needed.

Quality of information

http://themes.eea.eu.int/Environmental_issues/climate/indicators

9.2. Emissions of greenhouse gases by sector and gas

Attempts to control greenhouse gas emissions vary between sectors. Increases from transport are a particular problem, with carbon dioxide emissions from the sector (21 % of total emissions) increasing by 18 % between 1990 and 1999 due to road transport growth in almost all Member States (see Chapter 4). HFC emissions (1 % of total emissions) from industrial processes have increased by 66 % as a result of the expanding use of these chemicals as substitutes for ozone-depleting CFCs, which were gradually phased out in the 1990s.

The energy sector, electricity and heat production and petroleum refining, (see Chapter 5), the largest source of greenhouse gas emissions, with 26 % of the total, has seen carbon dioxide emissions fall by 9 % due to fuel shifts from coal to gas in the UK, efficiency improvements and increased use of combined heat and power generation in Germany and other Member States, increases in wind power generation in Germany, Denmark and Spain.

Other sectors providing reduced emissions include:

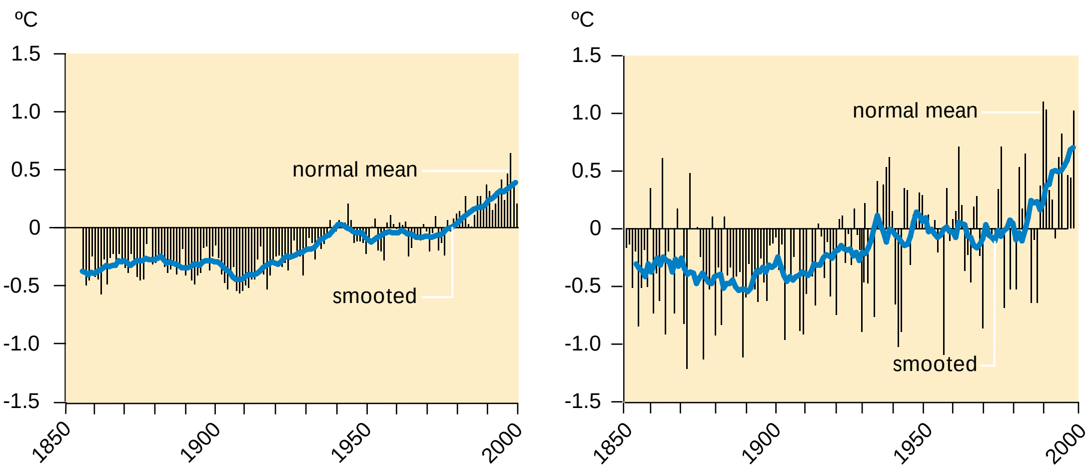
- chemical industry: reduced nitrous oxide emissions (1.2 % of total emissions), by 57 % due mainly to specific measures at adipic acid production plants in the UK, Germany and France;
- manufacturing: reduced carbon dioxide emissions (14 % of total emissions), by 9 % through efficiency improvements in several Member States and economic restructuring in Germany's manufacturing industry;
- solid waste: reduced methane emissions (2.6 % of total emissions), by 22 % in advance of the implementation of the EU landfill Directive (see Chapter 13);
- agriculture: reduced methane and nitrous oxide emissions due mainly to reduced animal numbers.

9.3. Global and European mean temperature

Global temperature increase is the most widely understood aspect of climate change. There is mounting evidence that emissions of greenhouse gases are causing an increase in global and European surface air temperatures. The potential consequences of further increased global temperatures include: rising sea levels, changing patterns of precipitation, floods and droughts, changes in biota and food productivity and increase of infectious diseases. These effects will have impacts on socio-economic sectors, such as agriculture, and on water resources.

Global mean temperature has increased by about 0.6° C over the past 100 years, with land areas warming more than the oceans. There is new and stronger evidence that most of the warming observed over the past 50 years is attributable to human activities (IPCC, 2001). The temperature increase in Europe during the 1990s is consistent with the global trend, although natural variations are larger. For Europe, the average temperature in 2000 showed an absolute record for the last 100 years. The annual average temperature was 1.15° C above the 1961–1990 average. The temperature extreme was caused mainly by a warm beginning and end of the year.

Observed annual average temperature deviations Figure 9.5.



Note: Temperature plotted as the difference (deviation) from the 1961 to 1990 average (° C). The bars depict the annual average; the line gives a 10-year smoothed trend.
Source: Climatic Research Unit and Met. Office Hadley Centre (UK); Jones et al, 1999, Jones, pers. comm.

Globally, the 1990s was the warmest decade of the millennium. It is likely that the increase of Northern Hemisphere surface temperatures in the 20th century was greater than during any other century in the last 1000 years.

Quality of information ☆☆☆

http://themes.eea.eu.int/Environmental_issues/climate/indicators/Average_temperatures/index_html

The objective of the United Nations Framework Convention on Climate Change (UNFCCC) is to achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interferences with the climate system but would allow sustainable economic development. The basis for determining what constitutes 'dangerous anthropogenic interferences' will vary among regions, depending, for example, on the local characteristics and consequences of climate change, and the ability to adapt to climate change. Achieving 'sustainable' greenhouse gas concentrations would require substantial (50 to 70 %) global reductions in greenhouse gas emissions, far beyond those set at Kyoto.

The EU Council of Ministers has proposed that global temperatures should not exceed 2° C above pre-industrial levels, which means 1.4° C above current global mean temperature. Provisional sustainable targets consistent with the EU proposal have also been proposed: limiting temperature rise to 0.1 °C per decade and sea level rise to 2 cm per decade.

Achieving the UNFCCC and EU goals represents a major challenge as anthropogenic climate change is expected to persist for many centuries (IPCC, 2001). Current prospects are that, without further climate change mitigation efforts, human influences will continue to change atmospheric composition throughout the 21st century. Between 1990 and 2100 the global average temperature and sea level are projected to rise by 1.4 to 5.8° C and 0.1 to 0.9 m, respectively, with much larger changes in the longer term.

10. Air Pollution

policy issue	indicator	assessment
human health: protecting the population against pollution exposures	urban air quality exceedances for ground-level ozone	☹
- " -	urban air quality exceedances for particulates	☹
- " -	urban air quality exceedances for sulphur dioxide	☺
- " -	urban air quality exceedances for nitrogen dioxide	😐
protecting the environment against exposure to ozone	exposure of agricultural crops and forests to ozone	☹
achieving the emissions policy targets	aggregated emissions of acidifying substances	☺
- " -	aggregated emissions of ground-level ozone precursors	😐
reducing emission levels	particle emissions	☺

Despite emission reductions, a substantial part of the urban population in EEA member countries is exposed to high concentrations of ground-level ozone, nitrogen dioxide and fine particles. Large areas of ecosystems and agricultural land are still exposed to acidification, eutrophication and ground-level ozone.

Emissions of most atmospheric pollutants have continued to decline, maintaining the downward trend of the past two decades. However, reaching European Union emission reduction targets for 2010 will require substantial further reductions through additional policies and measures in most Member States.

This chapter covers human health and air quality and effects on ecosystems, as well as examining the sources of emission of the various pollutants involved; it does not cover stratospheric ozone or toxic substances.

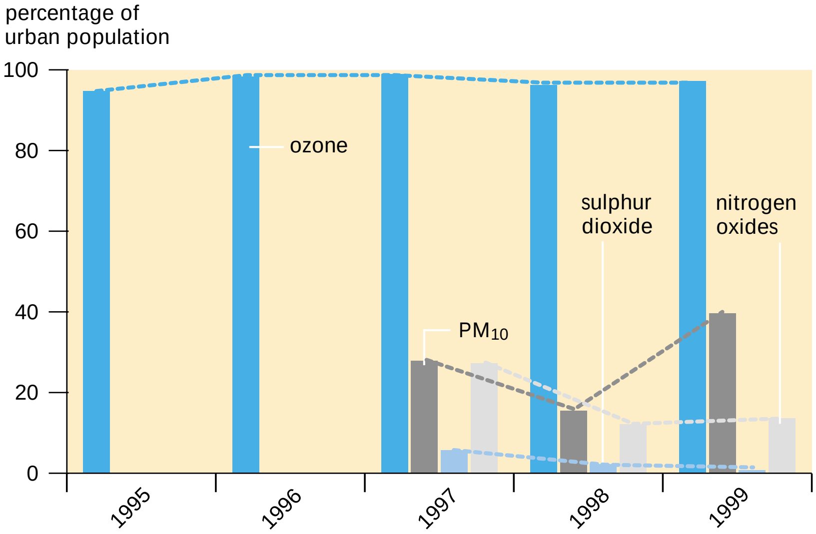
Recent EU policies and measures reflect a multi-pollutant approach. The Air Quality Framework Directive (96/62/EC) established a framework under which the EU has set limit values for specific pollutants and target values for ozone to protect human health and ecosystems.

Member States must monitor air quality and, where limit values or target values are being exceeded, devise abatement programmes and report on their implementation. The current priority pollutants are particulates and ozone, followed by nitrogen oxides and benzene.

The National Emissions Ceiling Directive (NECD) is intended to address, simultaneously, pollutant-specific ambient air quality problems as well as ground level ozone, acidification and eutrophication. The Directive sets national emissions ceilings to be achieved from 2010 for sulphur dioxide, nitrogen oxides, ammonia and volatile organic compounds. This is supported by legislation on emissions for specific sectors, such as those aimed at large combustion plants, the sulphur content of vehicle fuels and the reduction of non-methane volatile organic compounds (NMVOCs) from solvents.

Policy evaluation and new policy development take place through the Clean Air for Europe (CAFE) programme, which should lead to the adoption of a thematic strategy under the Sixth Environmental Action Plan (6EAP) in 2005.

Figure 10.1. **Population exposed to air pollution above limit values in 1999, EU**



Note: This data should only be regarded as approximate due to limitations in data quality resulting from the population sample size, see figure 10.2, 10.3 and 10.4.
Source: EEA

10.1. Human health and air quality

The effects of air pollution on human health are given a high priority in the EU; they are identified within the environment and health priority area of the sixth environmental action plan and under the theme to address threats to public health within the Sustainable Development Strategy (COM(2001)264 final).

The Air Quality Framework Directive (96/62/EC) has a central aim to avoid, prevent or reduce harmful effects on human health and the environment. Currently within the EU, the greatest air pollution threats to human health are ambient concentrations of ground-level ozone, fine particles (PM_{10}), sulphur dioxide and nitrogen dioxide. Limit values (or target values for ozone) have been set for these pollutants for 2005 and 2010. A large proportion of the European population is exposed to air pollution above these values, in particular from ozone and particulate pollution. Local concerns still remain regarding carbon monoxide in street canyons and lead, particularly around industrial installations. However, concentrations of these pollutants have decreased markedly during recent decades and generally meet their limit values.

Table 10.1. **Ambient air quality limit values and a target value for ozone for the protection of human health**

Pollutant	Value	Target: no. of exceedances should be:	To be met (year)	Reference
ozone	120 µg/m³ (8 hour average)	<26 days/year	2010	2002/3/EC
PM_{10}	50 µg/m³ (24 hour average)	<36 times/year	2005	1999/30/EC
PM_{10}	40 µg/m³ (yearly average)	none	2005	1999/30/EC
sulphur dioxide	350 µg/m³ (1 hour average)	< 25 times/year	2005	1999/30/EC
sulphur dioxide	125 µg/m³ (24 hour average)	< 4 times/year	2005	1999/30/EC
nitrogen dioxide	200 µg/m³ (1 hour average)	< 19 times/year	2010	1999/30/EC
nitrogen dioxide	40 µg/m³ (yearly average)	none	2010	1999/30/EC

In accession countries, concentrations of the classical air pollutants such as sulphur dioxide and fine particles have decreased dramatically as a result of economic restructuring. However, recent economic growth and increased traffic have resulted in ozone, PM_{10} and nitrogen dioxide becoming priority substances, as in the EU and with concentrations at the same level (EEA, 2001a).

The Clean Air for Europe (CAFE) programme has been set up to address air pollution problems, in particular human health and air quality, within Europe. CAFE is a programme of technical analysis and policy development, which aims to develop a long-term, strategic and integrated policy to protect human health and the environment from the effects of air pollution. The main priority for CAFE is to address air pollution problems associated with ambient ground-level ozone and PM_{10}.

The more specific objectives of CAFE are:

- to develop, collect and validate relevant scientific information relating to the effects of outdoor air pollution, emission inventories, air quality assessment, emission and air quality projections, cost-effectiveness studies and integrated assessment modelling, leading to the development and updating of air quality and deposition objectives and indicators, and the identification of the measures required to reduce emissions;
- to support the implementation and review the effectiveness of existing legislation, in particular the Air Quality Daughter Directives, the decision on exchange of information, and national emission ceilings as set out in recent legislation, to contribute to the review of international protocols, and to develop new proposals as and when necessary;
- to ensure that the sectoral measures that will be needed to achieve air quality and deposition objectives cost-effectively are taken at the relevant level through the development of effective structural links with sectoral policies;
- to determine an overall, integrated strategy at regular intervals which defines appropriate air quality objectives for the future and cost-effective measures for meeting these objectives;
- to disseminate widely the technical and policy information arising from implementation of the programme.

http://europa.eu.int/comm./environment/air/index.htm
http://reports.eea.eu.int/topic_report_2001_16/en

10.2. Urban air quality exceedances for ozone

Exposure to periods of a few days of high ozone concentration can have adverse health effects, in particular inflammatory responses and reduction in lung function. Exposure to moderate ozone concentrations for longer periods may lead to a reduction in lung function in young children. Ozone concentrations in Europe commonly exceed the EU threshold set for protection of human health. Analysis of monitoring data suggests that while peak ozone concentrations are decreasing, probably because of reductions of European emissions of nitrogen oxides and NMVOCs, median values are tending to increase. This is probably caused partly by increasing background concentrations of ground-level ozone in the northern hemisphere. In cities and densely populated areas, moderate emission reductions lead to increased ozone concentrations, which is inherent to the complex chemical process of ozone formation; only more drastic reductions bring ozone down again.

The reductions in ozone precursor emissions (see Section 10.9) that should result from enforcement of the National Emissions Ceiling Directive and the UNECE Convention on Long Range Transboundary Air Pollution (CLRTAP) Protocols are unlikely to reduce ozone concentrations to below the current thresholds and expected new target values in all EEA18 countries.

The indicator is based on information collected under the current Ozone Directive (92/72/EEC) and uses threshold values of 110 µg/m³ as defined in this Directive. The new agreed Ozone Daughter Directive (2002/3/EC) sets a target value to protect human health of 120 µg/m³ as a rolling 8 hour average, not to be exceeded on more than 25 days per calendar year, averaged over three years, from 2010. A long-term objective of 120 µg/m³ as a maximum daily 8 hour mean within a calendar year, not to be exceeded, has been set in the new Directive. Current data do not yet allow a systematic assessment of exceedances of the new threshold values. Available data suggest that the 120 µg/m³ threshold is frequently exceeded in a number of Member States.

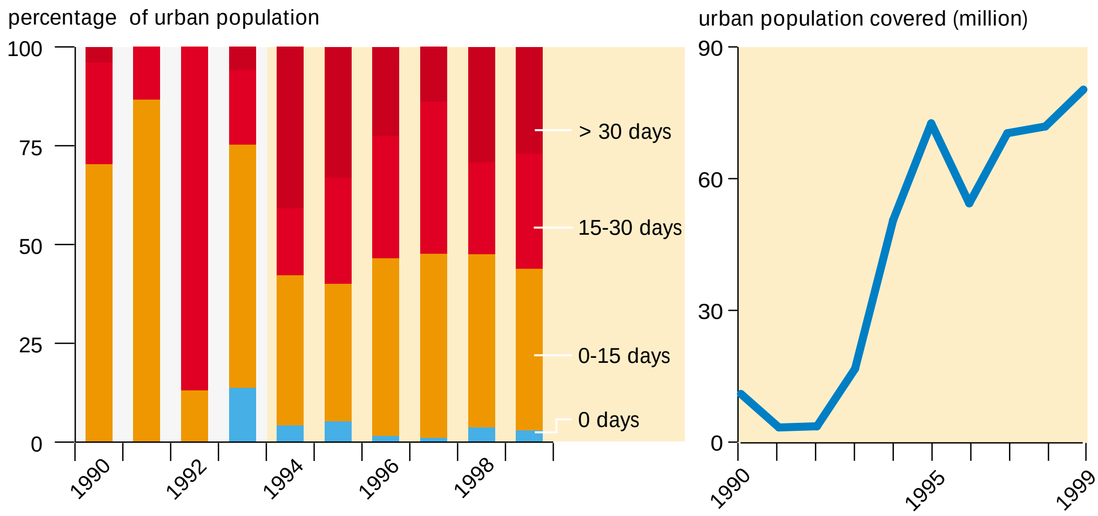
In 1995–1999, almost all the urban population were exposed to ozone concentrations above the threshold value for the protection of human health. For more than half that population, concentrations exceed the threshold for more than 15 days. While peak ozone concentrations are decreasing, median values are tending to increase.

Quality of information ☆☆☆

http://themes.eea.eu.int/Environmental_issues/air_quality/indicators/exceedance/index_html

Figure 10.2. **Exposure of urban population to ozone, EEA18**

Note: Exposure is defined as an 8 hour average ozone concentration above 110 (µg/m³. Over the years 1990 –1999 the total population for which exposure estimates are made increased markedly, from about 11 to more than 100 million, as a result of the increasing number of monitoring stations reporting air quality data. Year-to-year variations in exposure classes are caused partly by changes in spatial coverage. Note that the pre-1994 data is less reliable due to the sample population being less than 20 million, hence the light tone in the graph.
Source: EEA



10.3. Urban air quality exceedances for particulates

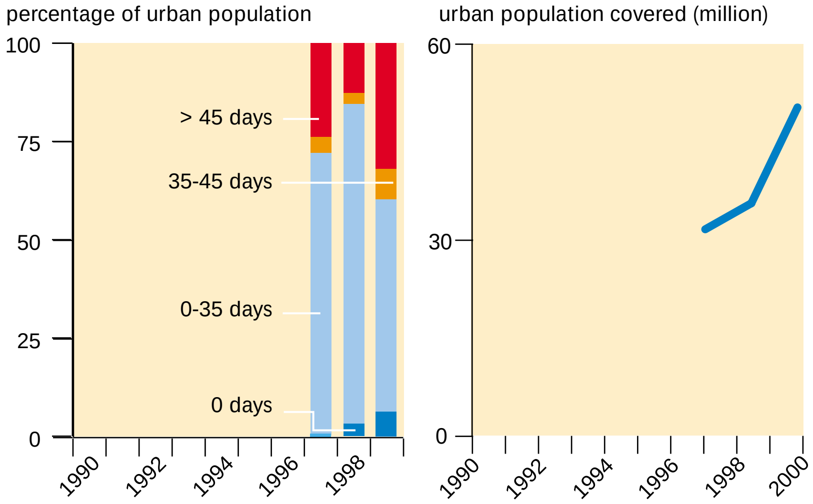
Breathing-in fine particles at concentrations that occur commonly in large parts of Europe can increase the frequency and severity of respiratory ailments with the risk of premature death. The impact is associated mainly with PM_{10} (particulate matter with a diameter of 10 µm or less) or even smaller particles.

PM_{10} in the atmosphere can result from direct emissions (primary PM_{10}) or emissions of particulate precursors (nitrogen oxides, sulphur dioxide, ammonia and organic compounds) which are partly transformed into particles by atmospheric chemical reactions (secondary PM_{10}). Particles thus result partly from the same emissions that cause acidification, eutrophication and ground-level ozone.

The first Air Quality Daughter Directive (1999/30/EC) sets a limit value for PM_{10} of 50 µg/m³ (24-h average), not to be exceeded more than 35 times a calendar year from 2005.

Although reliable data have only been available since 1997, it is clear that a significant proportion of the urban population is exposed to concentrations of fine particles in excess of the EU limit values set for the protection of human health. Emissions of the gaseous precursors of secondary PM_{10} are being reduced by enforcement of EU legislation and UNECE CLRTAP Protocols (see section 10.7). Abatement techniques to reduce precursor emissions often also reduce primary particulate emissions. Other measures (e.g. traffic measures from Auto-Oil-I and II and waste incineration Directives) should further reduce PM_{10} emissions. However, despite likely future reductions in emissions, concentrations of PM_{10} in most of the EEA urban areas are expected to remain well above the limit values for the near future.

Exposure of urban population to PM_{10} EEA18 — Figure 10.3.



Note: Exposure is defined as a 24 hour average PM_{10} concentration above 50 µg/m³. Over the years, the total population for which exposure estimates are made has increased markedly as a result of the increasing number of monitoring stations reporting air quality data. After 1996, routine monitoring of PM10 was introduced in EU Member States in preparation for implementation of the first Air Quality Daughter Directive 1999/30/EC.
Source: EEA

About 20–40 % of the urban population of Europe (EEA18 countries) are exposed to levels of fine particles in excess of limit values set for the protection of human health and substantial further reductions are needed to reach the limit values set in the EU First Daughter Directive to the Framework Directive on Ambient Air Quality (99/30/EC).

Quality of information ☆☆☆

http://themes.eea.eu.int/Environmental_issues/air_quality/indicators/particulates2/index_html

10.4. Urban air quality exceedances for sulphur dioxide

Sulphur dioxide (SO_2) is directly toxic to humans, its main action being on the respiratory system. Indirectly, it affects human health as it is converted to sulphate in the form of fine particles (see Section 10.3). Deposition of sulphur dioxide and sulphate onto the ground is an important cause of acidification (see section 10.8). Sulphur dioxide has some impact on vegetation, and causes damage to materials, buildings and monuments.

A limit value of 125 µg/m^3 24h average, not to be exceeded more than three times in a calendar year, has been set for the protection of human health in the adopted Daughter Directive for sulphur dioxide, oxides of nitrogen, particulate matter and lead in ambient air (1999/30/EC). This limit value has to be met by 1 January 2005.

In urban areas the number of days on which the EU limit value for sulphur dioxide has been exceeded has decreased between 1990 and 1999 as a result of the following factors. The first (1985) and the second (1994) sulphur protocol under the UNECE CLRTAP, together with EC limit values set in the previous Air Quality Directive (89/427 EEC amending 80/779/EEC) have resulted in major emission reductions and correspondingly decreasing ambient concentrations. Economic recession and subsequent restructuring of the central and eastern European countries has also contributed to decreasing winter smog episodes in central and western European countries. Measures such as the Large Combustion Plants Directive (2001/80/EC), the Integrated Pollution Prevention and Control (IPPC) Directive, the Auto-Oil Directives and the National Emission Ceilings Directive (2001/81/EC), and the reductions agreed under CLRTAP, are expected to further reduce sulphur dioxide levels.

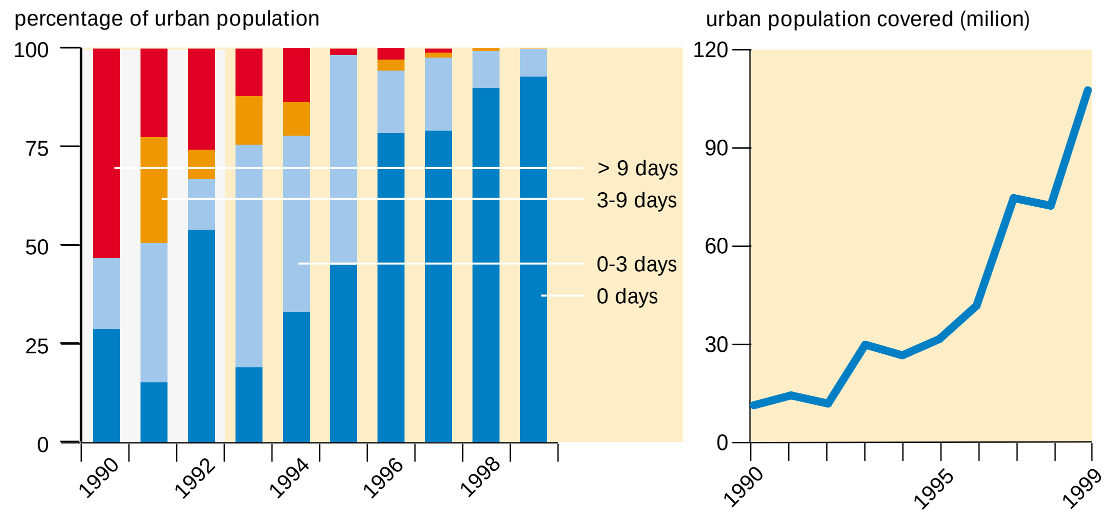
While important reductions of sulphur dioxide have been achieved in recent years and concentrations are expected to continue to decline, peak concentrations above the EC limit values still occur, especially close to sources and in cities. Restructuring of the central and eastern European countries in particular has contributed to decreasing winter smog episodes in central and western European countries.

Quality of information

http://themes.eea.eu.int/Environmental_issues/air_quality/indicators
http://reports.eea.eu.int/topic_report_2001_16/en

Figure 10.4. **Exposure of urban population to sulphur dioxide, EEA18**

Note: Exposure is defined as an 8 hour average sulphur dioxide concentration above 125 µg/m^3. Over the years 1990–1999 the total population for which exposure estimates are made increased markedly, from about 11 to more than 100 million people, as a result of the increasing number of monitoring stations reporting air quality data. Year-to-year variations in exposure classes are caused partly by changes in spatial coverage. Note that the pre-1993 data is less reliable due to the sample population being less than 20 million, hence the light tone in the graph.
Source: EEA



10.5. Urban air quality exceedances for nitrogen dioxide

Short-term exposure to nitrogen dioxide is associated with reduced lung function and airway responsiveness, and an increased reaction to natural allergens. Long-term exposure is associated with increased risk of respiratory infection in children. Nitrogen oxides play an important role in acidification, eutrophication, and photochemical smog.

For nitrogen dioxide a limit value of 200 µg/m³ 1h average, not to be exceeded more than 18 times a calendar year, has been set for the protection of human health in the first Air Quality Daughter Directive (1999/30/EC). This limit value has to be met by 1 January 2010. In addition to the limit value for hourly-average concentration, a limit value of 40 µg/m³ has been set for annual mean concentration.

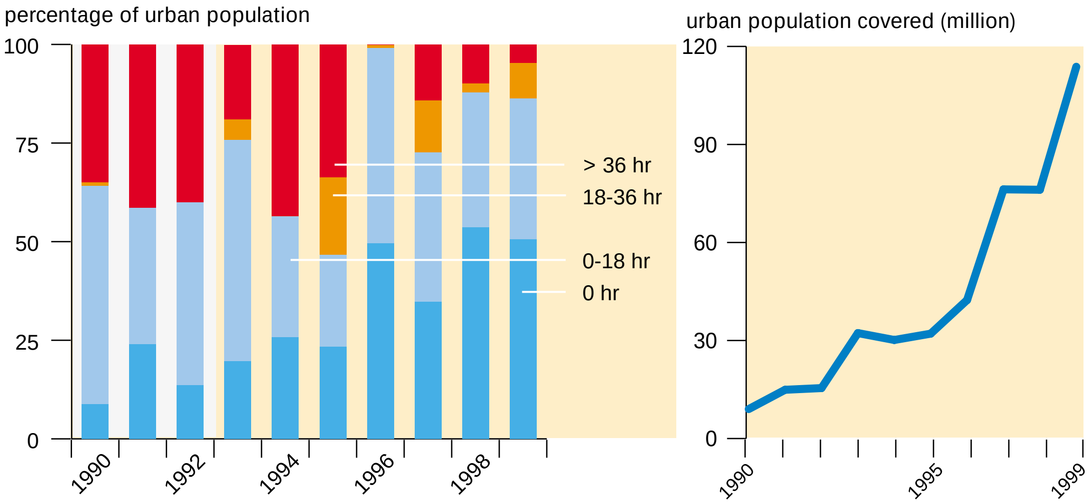
From 1997 to 1999, about 15–30 % of the urban population was exposed to nitrogen dioxide concentrations above the EU short-term limit value set for the protection of human health. There is no clear trend in the exposure of the urban population to the short-term limit value. Monitoring is complicated by large year-to-year variations in weather conditions and differences in the number and representativeness of the reporting monitoring stations for which reasonable time-series of recordings are available. Recent work indicates that the limit value for the annual mean is exceeded in a larger number of urban areas (286 monitoring stations in 30 cities) than the short-term limit value (38 monitoring stations in 18 cities). Peak concentrations, occurring in busy streets where road traffic is the main source, have tended to decrease during the period. The introduction of catalysts in the car fleet, along with other measures, has contributed to reducing urban emissions (see Chapter 4) and thereby peak concentrations. Overall, enforcement of current EU legislation, including the Large Combustion Plant IPPC Directive, the Auto-Oil programme and the CLRTAP protocols, have resulted in a reduction of nitrogen oxides emissions.

In 1999, 15 % of the urban population was exposed to nitrogen dioxide concentrations above the EU short-term limit value set for the protection of human health.

Quality of information ☆☆☆

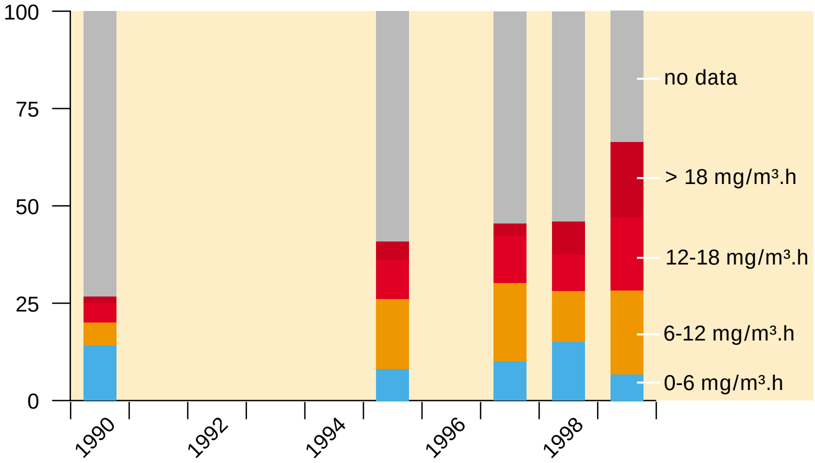
http://themes.eea.eu.int/Environmental_issues/air_quality/indicators
http://reports.eea.eu.int/topic_report_2001_16/en

Exposure of urban population to nitrogen dioxide, EEA18 Figure 10.5.



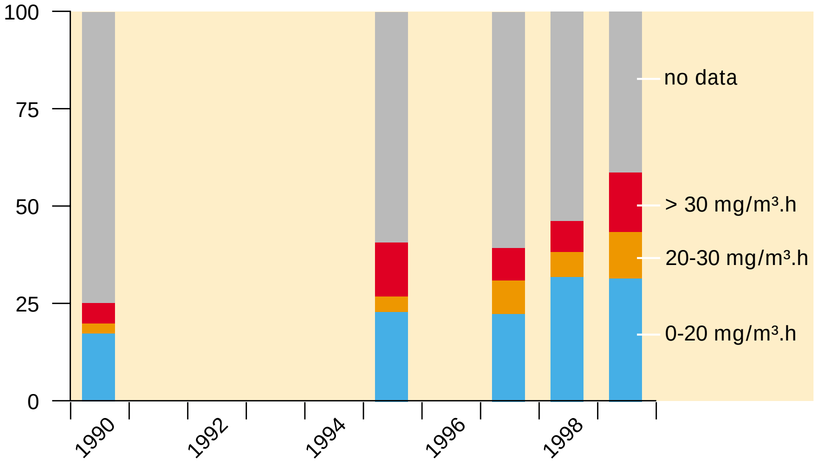
Note: Exposure is defined as a 1 hour average nitrogen dioxide concentration above 200 µg/m³. Over the years 1990–1999 the total population for which exposure estimates are made increased markedly, from less than 10 to more than 110 million, as a result of the increasing number of monitoring stations reporting air quality data. Year-to-year variations in exposure classes are caused partly by changes in spatial coverage. Note that the pre-1993 data is less reliable due to the sample population being less than 20 million, hence the light tone in the graph.
Source: EEA

Figure 10.6. **Ozone exposure of agricultural crops, EEA18**



Note: The target value for the protection of vegetation is AOT40 18 mg/m³.h averaged over five years (AOT40 stands for accumulated exposure to ozone above 40 ppb). The long-term objective is set at 6 mg/m³.h. Over the years the total area for which exposure estimates are made has increased as a result of the larger number of monitoring stations reporting air quality data.
Source: EEA

Figure 10.7. **Ozone exposure of forests, EEA18**



Note: The reference level for submission of information under the Ozone Directive 2002/3/EC is AOT40 20 mg/m³.h. Over the years the total area for which exposure estimates are made has increased as a result of the larger number of monitoring stations reporting air quality data.
Source: EEA

More than 60 % of the area of agricultural crops is exposed to ozone levels exceeding the EU long-term objective and more than 14 % to levels above the target value. Most the forest area for which data are available is exposed to ozone levels exceeding the critical level.

Quality of information

http://themes.eea.eu.int/Environmental_issues/air_quality/indicators

10.6. Exposure of agricultural crops and forests to ozone

Ground-level ozone is seen as one of the most prominent air pollution problems in Europe, mainly because of its effects on human health, natural ecosystems and crops. Ozone is a secondary pollutant formed in the atmosphere. The main precursors are nitrogen oxides and volatile organic compounds, and, to a lesser extent, carbon monoxide and methane.

The EU combined ozone abatement strategy, the new Ozone Daughter Directive, and the National Emission Ceilings Directive (2001/81/EC) set mutually-consistent target values for ozone concentrations and precursor emissions. These are also largely consistent with the UNECE CLRTAP protocol to abate ground-level ozone.

The target (2010) value for exposure of vegetation, including agricultural crops, to ozone is 18 mg/m³.h (averaged over a period of 5 years), while the long-term objective is 6 g/m³.h. The critical level for protection of forests under CLRTAP is 20 mg/m³.h. These thresholds have been exceeded widely. Most vegetation is exposed to ozone concentrations exceeding the EU long-term objective and a significant fraction to concentrations above the target value, and most of the forest area for which data are available is exposed to ozone exceeding the critical level. Complications from large year-to-year fluctuations and a lack of data prevent firm conclusions on trends over time. However, reductions of emissions of ozone precursors as implemented or agreed (see section 10.9) are currently insufficient to prevent the exceedances that are occurring.

Precursor emissions are expected to continue to decrease through enforcement of EU legislation and the UNECE CLRTAP Protocols. However, it is expected that for the next decade the exposure of vegetation to ozone concentrations will remain well above the long-term objective; current predictions suggest that half of the gap with current levels will remain.

10.7. Air pollutant emissions

Emissions of sulphur dioxide, nitrogen oxides, ammonia, NMVOCs and particulates are the main cause of air quality threats to human health and ecosystems. To mitigate air pollution the EU has used a multi-pollutant, multi-effect air pollution abatement strategy manifest in the 2010 national emission ceilings targets of the National Emissions Ceilings Directive - NECD. The NECD targets for EU Member States are slightly more stringent than the corresponding ones set in the multi-pollutant, multi-effect Protocol under the UNECE CLRTAP - the Gothenburg Protocol from 1999.

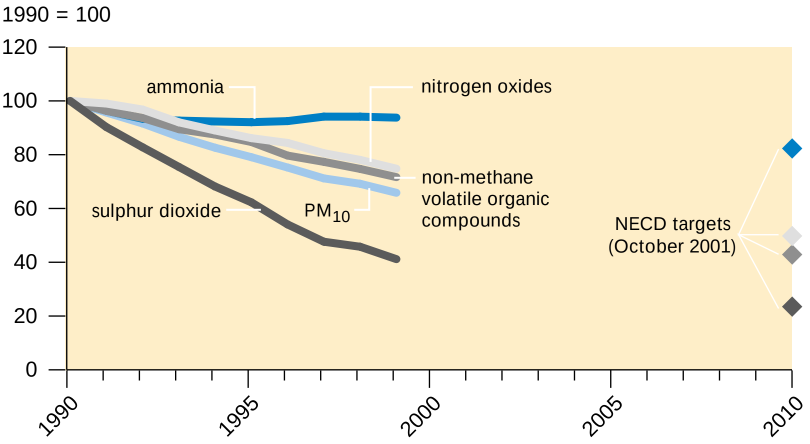
Whereas significant progress has been made towards the 2010 targets for sulphur dioxide and nitrogen oxides emissions, the emission reduction of ammonia is a particular concern at the EU level. The successful reduction of sulphur dioxide emissions is due to the fact that it was identified early as one of the main contributors to the acidification of fresh-water ecosystems and forests. Further, efficient abatement strategies, using available end-of-pipe techniques, focused on easily-identifiable point sources, resulting in cost-effective reductions. The first CLRTAP protocol to curb sulphur dioxide emissions was signed in 1985.

Progress towards emissions reduction targets by country Table 10.2.

Country	Sulphur dioxide NECD target for 2010 (%)	Sulphur dioxide change 1990–1999 (%)	Nitrogen oxides NECD target for 2010 (%)	Nitrogen oxides change 1990 –1999 (%)	NMVOCs NECD target for 2010 (%)	NMVOCs change 1990–1999 (%)	Ammonia NECD target for 2010 (%)	Ammonia change 1990–1999 (%)
Greece	+3	+7	+6	+17	-22	+20	-8	-6
Portugal	-55	+4	-21	+16	-53	+27	-14	-2
Ireland	-77	-15	-45	0	-50	-13	+3	+13
Spain	-64	-27	-27	+3	-65	-9	-25	+10
Italy	-71	-44	-49	-23	-47	-24	-10	-4
France	-71	-47	-57	-18	-57	-27	-1	+2
Belgium	-73	-50	-48	-14	-59	-21	-31	-4
Netherlands	-75	-51	-55	-27	-63	-44	-43	-25
Sweden	-49	-52	-63	-34	-55	-21	-23	-26
Austria	-57	-54	-47	-11	-54	-33	-17	-12
Finland	-57	-66	-43	-17	-38	-20	-24	-13
UK	-84	-68	-58	-42	-52	-37	-12	-5
Denmark	-70	-69	-53	-23	-50	-24	-46	-25
Luxembourg	-73	-74	-53	-31	-52	-30	-7	-3
Germany	-90	-84	-61	-39	-69	-49	-28	-18
EU15	-76	-59	-51	-25	-57	-28	-18	-6

Note: Base year for targets is 1990.
Source: EEA, based on Member States data reported to UNECE/CLRTAP/EMEP

Figure 10.8. **Summary of emissions, EU15**



Notes: No target has been set for particulate emissions.
Source: EEA based on Member States data reported to UNECE/CLRTAP/EMEP

Nitrogen oxides emissions have been more difficult to address since there are more diffuse sources, (e.g. in the transport sector). Further, technical measures in the transport sector have been partly offset by increased transportation.

Ammonia emissions originate mainly from the agriculture sector. At present, there are no EU-wide policies aimed at reducing ammonia emissions from this sector although the CLRTAP refers to good practices and the IPPC Directive should lead to reductions from intensive livestock farming. Also some Member States have national policies in place. The observed reduction in ammonia emissions is a side-effect of reducing livestock numbers following the reform of the CAP (Common Agriculture Policy).

Ireland, Spain and Portugal face extraordinary challenges as they are as yet less than halfway towards their target emissions levels for all four pollutants.

10.8. Aggregated emissions of acidifying substances

Deposition of acidifying substances causes damage to ecosystems, buildings and materials. The acidifying effect of each individual pollutant (sulphur dioxide, nitrogen dioxide and ammonia) depends on its potential to acidify and the characteristics of the exposed ecosystems or materials.

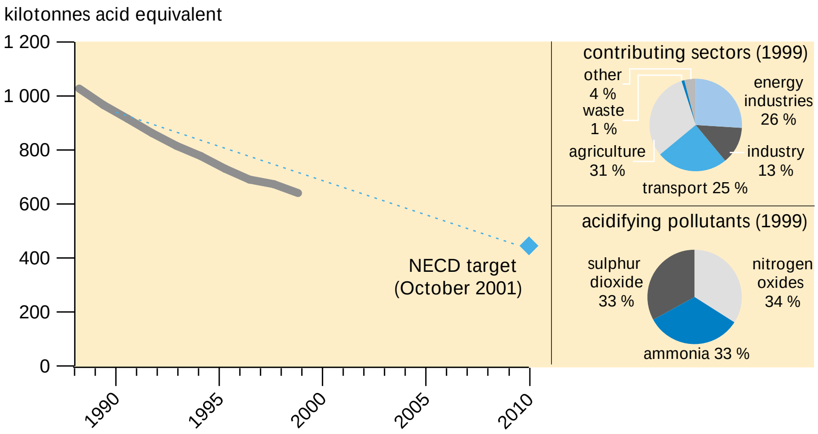
Emissions of acidifying substances have been reduced by 38 % between 1990 to 1999, and the EU is more than halfway towards the 2010 NECD target – a reduction of 57 % between 1990 and 2010.

The reduction in emissions of acidifying substances is due mainly to a 60 % reduction of sulphur dioxide emissions since 1990. This has resulted from a switch from high-sulphur solid and liquid fuels to natural gas in the energy, industrial and household sectors, as well as economic restructuring of the new Länder in Germany and the introduction of flue-gas desulphurisation in power plants.

Reductions in emissions of nitrogen oxides due to abatement in road transport and large combustion plant were to some extent offset by increased road traffic (see Chapter 4). For ammonia, emissions are stabilising, although agriculture emissions, the major source, are difficult to monitor and to control.

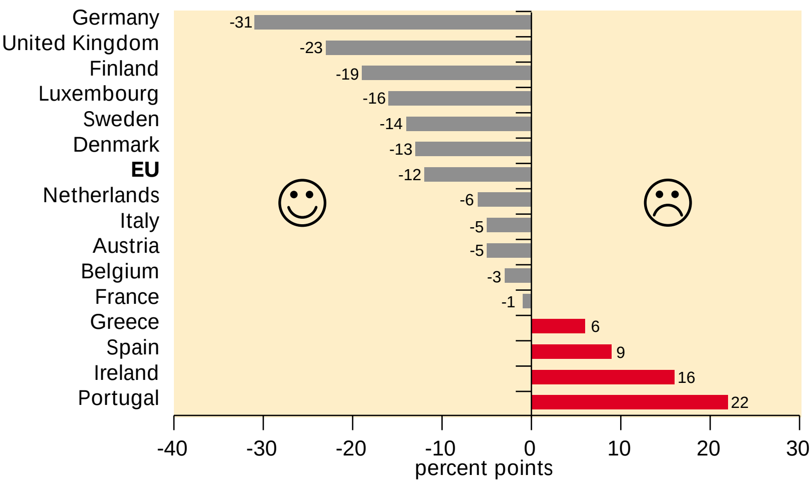
Even though the EU as a whole has made good progress in reducing emissions of acidifying pollutants, four Member States are not on course for their NECD targets for 2010. The deposition of acidifying substances also still exceeds the critical loads of the ecosystems in many areas (see *Environmental signals 2001*, Chapter 10). Substantial further reductions of emissions of acidifying pollutants are therefore needed to continue to make progress towards and beyond the 2010 NECD targets.

Emissions of acidifying pollutants, EU Figure 10.9.



Note: The following weighting factors are used to combine emissions in terms of their potential acidifying effect (acid equivalent/g): SO_2=1/32, NO_x=1/46 and NH_3=1/17.
Source: EEA, based on Member States data reported to UNECE/CLRTAP/EMEP

Acidifying pollutants: distance-to-target in 1999, EU Figure 10.10.



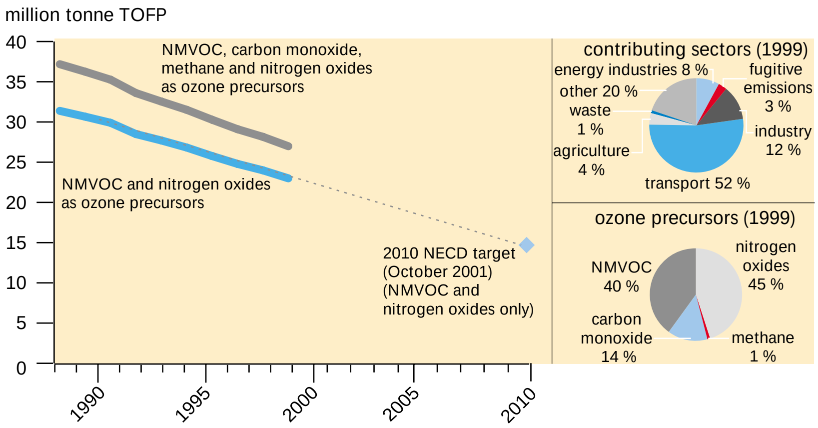
Note: The distance-to-target indicator is a measure (in percentage points) of how close current emissions (in 1999) are to a theoretical linear path of emissions reductions from 1990 to the National Emission Ceiling directive target for 2010 for aggregated emissions of acidifying substances. The 1990 emissions are set at 100 %. For example: if a country's target is a 10 % reduction (by 2010) from 1990 levels, the theoretical 'target' in 1999 would be a reduction of 4.5 %. If the actual emission in 1999 is an increase of 3 % the 'distance to target' index is 3+4.5 or 7.5 percentage points.
Source: EEA

The EU has reduced emissions of acidifying substances by 38 % between 1990 and 1999. Greece, Portugal, Ireland and Spain are less than halfway to their 2010 NECD targets.

Quality of information ☆☆

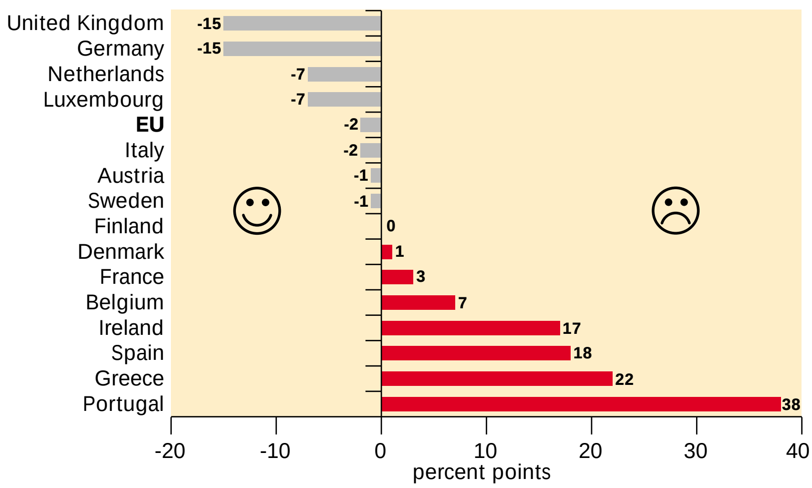
http://themes.eea.eu.int/Environmental_issues/air_quality/indicators/acidification/index_html

Figure 10.11. **Emissions of ozone precursors, EU**



Note: Weighting factors are used to derive tropospheric ozone-forming potentials (TOFP) so that emissions can be combined in terms of their contribution to tropospheric ozone: nitrogen oxides 1.22, NMVOCs 1.0, carbon monoxide 0.11 and methane 0.014. The sector pie chart includes carbon monoxide emissions.
Source: EEA, based on Member States data reported to UNECE/CLRTAP/EMEP

Figure 10.12. **Ozone precursors: distance to target in 1999, EU**



Note: Distance to target (nitrogen oxides and NMVOC only). The distance-to-target indicator is a measure (in percentage points) of how close the current emissions (in 1999) are to a theoretical linear path of emissions reductions from 1990 to the National Emission Ceiling Directive target for 2010 for aggregated emissions of ozone precursors. The 1990 emissions are set at 100 %. For example: if a country's target is a 10 % reduction (by 2010) from 1990 levels, the theoretical 'target' in 1999 would be a reduction of 4.5 %. If the actual emission in 1999 is an increase of 3 % the 'distance to target' index is 3+4.5 or 7.5 percentage points.
Source: EEA

The EU has reduced emissions of ozone-forming gases (ozone precursors) by 27 % between 1990 and 1999 and is on its target path towards reaching a 51 % reduction of emissions by 2010. However, further efforts are needed, particularly in Portugal, Greece, Spain, and Ireland.

Quality of information

http://themes.eea.eu.int/Environmental_issues/air_quality/indicators/ozone_precursors/index_html

10.9. Aggregated emissions of ground-level ozone precursors

Emissions of ozone precursors: NMVOCs, nitrogen oxides, carbon monoxide and methane, contribute to the formation of ground level (tropospheric) ozone, which may have adverse effects on human health and ecosystems.

The EU National Emission Ceilings Directive (NECD) and the Gothenburg Protocol under UNECE-CLRTAP address emissions of nitrogen oxides and NMVOCs.

Emissions of ozone precursors have been reduced by 27 % between 1990 and 1999. The emission reductions are due mainly to the introduction of catalytic converters for cars and the increased penetration of diesel vehicles, resulting from legal requirements and fuel price differentials respectively (see chapter 4), so that road transport emissions have been reduced by 35 % since 1990. Also, implementation of the Solvents Directive and IPPC regime has helped to reduce emissions from industrial processes.

Although these reductions appear to have reduced peak concentrations of ground-level ozone, they have not yet been enough to limit human health and ecosystem risks significantly (see section 10.6). Substantial further reductions of emissions of ozone precursors are required to reach the 2010 NECD targets, particularly in Portugal, Greece, Spain, and Ireland.

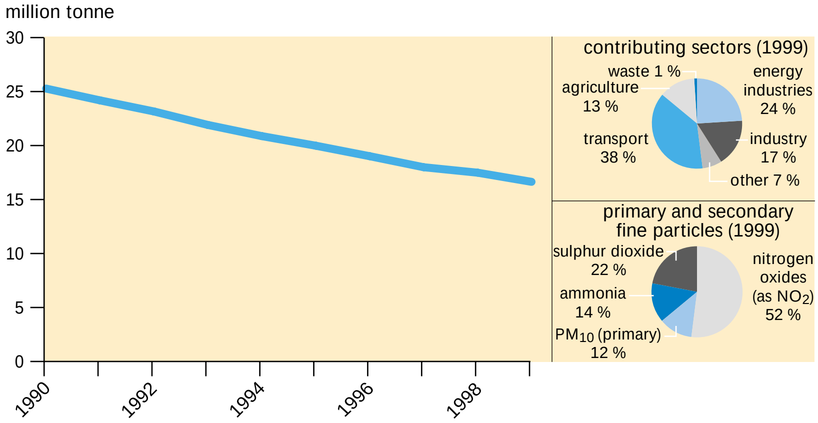
10.10. Particle emissions

Currently there are no emission ceilings or reduction targets for primary PM_{10}. The NECD and the UNECE CLRTAP address emissions of PM_{10} precursors. However, there are emission standards for specific mobile and stationary sources for primary PM_{10} and secondary PM_{10} precursor emissions (such as Auto-Oil measures for particulate emissions from vehicles).

Total emissions of fine particles in the EU have been reduced by 34 % in the period 1990 to 1999 and nine Member States have reduced their emissions by more than 25 % since 1990. Only Portugal and Greece have increased their emissions during the period, in each case by around 10 %. These reductions are due mainly to control of emissions of PM_{10} precursors but also to reductions of primary PM_{10} in the energy sector. Measures have included fuel switching and abatement measures in energy and industrial installations as well as increased penetration of catalytic converters for new road vehicles (see Chapter 4). These measures have resulted in emission reductions of 28 % in the transport sector, 52 % in the energy sector and 37 % in the industry sector.

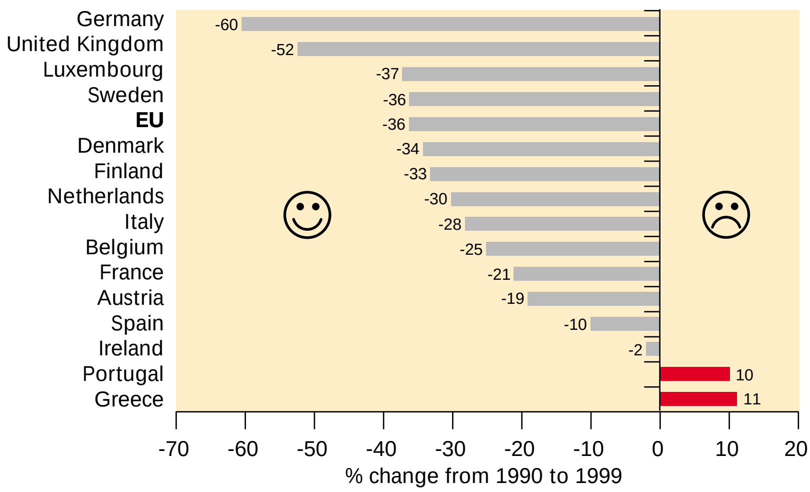
Emissions of primary PM_{10}, and PM_{10} precursors are expected to decrease in future as improved vehicle engine technologies are adopted and stationary fuel combustion emissions are controlled through abatement measures or the use of low-sulphur fuels such as natural gas. Despite this, airborne PM_{10} concentrations will be well above the limit values for the near future (see section 10.3) in the majority of the urban areas in EU. Substantial further reductions are needed to reach the limit values set in the EU First Daughter Directive to the Framework Directive on Ambient Air Quality.

Emissions of primary and secondary fine particulate, EU15 Figure 10.13.



Note: Emission trend of primary and secondary fine particulates. No target exists for emissions of primary particles. Fine particles may have adverse effects on human health and be responsible for and/or contribute to respiratory problems. Fine particles, in this context, refer to the sum of primary PM_{10} (of diameter less than 10µm) directly emitted into the atmosphere and the weighted emissions of PM_{10} precursors: nitrogen oxides, sulphur oxides and ammonia. PM_{10} precursors are (partly) transformed to particles (the so-called secondary fraction) by photo-chemical reactions in the atmosphere.
Source: EEA

Change in emissions of primary and secondary fine particles since 1990 Figure 10.14.



Source: EEA

The EU has reduced emission of fine particles (PM10) by 34 % between 1990 and 1999 and nine Member States have reduced emissions by more than 25 %.

Quality of information

http://themes.eea.eu.int/Environmental_issues/air_quality/indicators/particulates/index_html

11. Inland and coastal waters

policy issue	indicator	assessment
encourage sustainable water use	water use versus resources	
reduce water pollution from organic matter	organic pollution in rivers	
reduce water pollution	wastewater treatment	
reduce eutrophication	nutrients in rivers nutrients in coastal waters chlorophyll-a in coastal waters	
preserve amenities	bathing water quality	
reduce oil pollution at sea	oil pollution from offshore installations and illegal discharges	

The overall extraction of water resources in the EU is currently sustainable in the long-term. However, extraction rates in some areas may be approaching unsustainable levels especially in southern Europe where improved efficiency of water use, mostly in agriculture, is needed to prevent seasonal water shortages. Apart from causing problems providing water to users, over-exploitation of water has lead to the drying-out of natural areas in western and southern Europe, and to salt-water intrusion in aquifers.

Progress continues in reducing discharges of organic matter and phosphorus to European rivers, mainly as a result of improved wastewater treatment, but concentrations of nutrients still remain well above background levels. Nitrate pollution, mainly from agriculture, remained high during the 1990s. The effects of eutrophication, for example phytoplankton blooms, measured as chlorophyll-a in coastal waters, have not changed during this period.

Despite the improvement in the quality of bathing waters, 30 % of inland bathing waters and 12 % of coastal bathing waters do not meet optimum (guideline) values even though legislation has been in place for almost 25 years.

Although oil production increased, oil discharges from offshore installations and coastal refineries generally decreased during the 1990s, except for Norwegian offshore installations. This improvement resulted from the application of cleaning technologies and wastewater treatment. Illegal oil discharges from ships, as observed by aerial surveillance, decreased during the 1990s in the North Sea, but remained unchanged in the Baltic Sea.

There has been considerable progress over the last two decades in reducing discharges from point sources, such as wastewater treatment plants and industrial sites. However, there has been far less success in controlling discharges from diffuse sources, in particular agriculture. Implementation of the Nitrates Directive has been unsatisfactory in most Member States and further changes are required in agricultural practices to reduce nutrient pollution (see Chapter 6). Proper and full implementation of the Urban Waste Water and of the Nitrates Directives will be an important positive factor in reducing eutrophication.

Most EU water legislation dates from the 1970s and early 1980s, including Directives on the quality of water for specific purposes, the control of discharges, and the protection of waters from specific sources of pollution. In the early 1990s, Directives were adopted on urban wastewater treatment and the protection of waters against nitrate from agriculture. The recently adopted Water Framework Directive rationalises EU water legislation, and its implementation over the coming years is a major policy challenge. Its key features include:

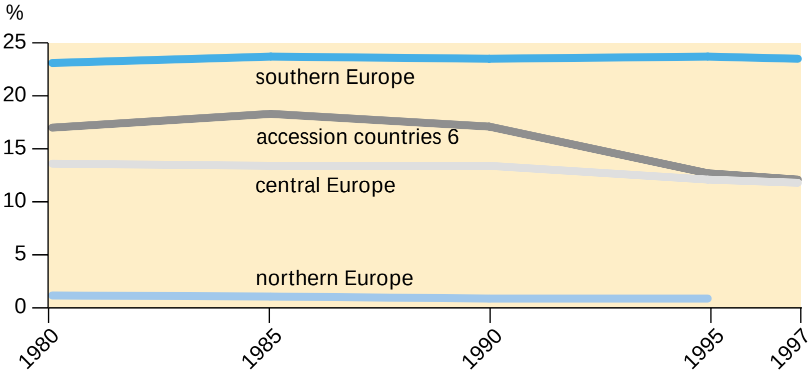
- the aim of achieving 'good' surface water and groundwater status by 2015;
- prevention of further deterioration and protection and enhancement of the status of aquatic ecosystems;
- promotion of sustainable water use based on long-term protection of available resources;
- support of the protection of transboundary, territorial and marine waters;
- stimulation of the progressive reduction of pollution by hazardous substances;
- the principle of recovery of the costs of water services, including environmental and resource costs.

The Directive introduces a requirement to manage surface and ground waters at River Basin or River Basin District level. It also introduces for all surface waters a general requirement for ecological protection and aims at 'good ecological status' for all surface water. Good ecological status is defined in terms of the quality of the biological community based on quality elements such as invertebrate and fish fauna and composition and abundance of aquatic flora, the hydrological characteristics and the chemical characteristics; and are specified as allowing only a slight departure from the biological community, which would be expected in conditions of minimal anthropogenic impact.

The sixth environmental action programme (6EAP) includes an objective 'to achieve levels of water quality that do not give rise to unacceptable impacts on, and risks to, human health and the environment and to ensure the rates of extraction from our water resources are sustainable over the long term'.

In relation to the marine ecosystem, the 6EAP includes an objective to develop 'a thematic strategy for the protection and conservation of the marine environment taking into account the need to reduce emissions and impacts of sea transport and other sea and land-based activities and to promote integrated management of coastal zones'.

Figure 11.1. **Water exploitation index**



Notes: The water exploitation index in a country is defined as the mean annual total abstraction of freshwater divided by the long-term average freshwater resources. Country groupings: accession countries 6: Czech Republic, Lithuania, Poland, Romania, Slovak Republic, Slovenia; central Europe: includes Switzerland but not Liechtenstein; northern Europe: includes Nordic countries apart from Denmark.
Sources: Eurostat; OECD; EEA

The exploitation of water resources has remained reasonably constant during the past 20 years. Some reductions have occurred in central Europe and the accession countries in the 1990s. In southern Europe around one quarter of the available water resource is exploited, around 12 % in central Europe and 1 % in the northern countries.

Quality of information ☆☆

http://themes.eea.eu.int/Specific_media/water/indicators
http://www.europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat&collection=02-Statistics %20in %20Focus&product=KS-NQ-01-006-__-I-EN

11.1. Water use versus resources

The highest water exploitation index is found in Spain were more than one third of the water resource is exploited every year. In some countries (e.g. The Netherlands and Denmark) the water exploitation index has been nearly halved during the last 20 years (i.e. in Denmark from around 20 % to 12 % and in The Netherlands from 10 % to 5 %).

Although water exploitation was relatively constant in southern and northern Europe between 1980 and 1995, it decreased in central Europe, mainly due to a reduction in use by industry, public water supply and energy production. It also decreased in the Accession Countries due to a reduction in use by industry and in public water supply. On average, 35 % of total freshwater abstraction in Europe is used for agriculture (irrigation), 19 % for urban use, 11 % for industry (excluding cooling), and 29 % for energy production.

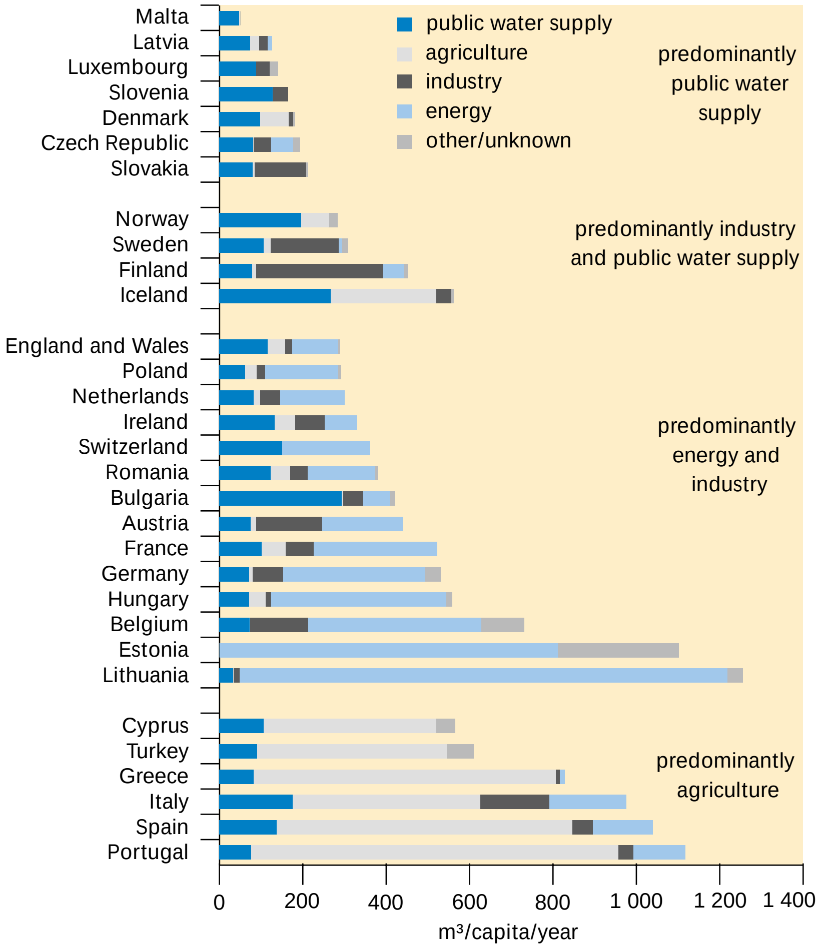
Water use varies from less than 200 m^3/inhabitant/year in countries with public water supply being the dominant use to more than 500 m^3/inhabitant/year in countries with high industrial, cooling water or agricultural water use. The northern countries have high water use for water-intensive industries such as pulp and paper and for energy production. For many countries in central Europe, the dominant water use is cooling water for power plants. In the southern countries the high water use (more than 70 %) is for agriculture.

Exploited water is typically returned to a point different from the abstraction point, so there may be significant impacts, for example dried up rivers, at abstraction points. Water consumption levels (i.e. water abstracted which is no longer available for use) are much higher when the water is used for irrigation than when used for urban or industrial uses and least when used for energy production. Measures to improve the efficiency of water use in the agricultural sector are needed to prevent water shortages in dry years.

Building reservoirs and transferring water from areas of high to low availability can increase water availability. Such infrastructure measures can, however, have negative effects on aquatic ecology and water quality. In contrast, demand-side management by water saving and more efficient use of water do not have such negative environmental consequences. One of the focuses of the 6EAP is to provide products and services using fewer resources, including water, and encouraging resource efficiency through more sustainable consumption patterns. The Water Framework Directive obliges Member States to use pricing for water-related services as an effective tool for promoting water conservation. This would also allow the environmental costs of water to be reflected in the price of water.

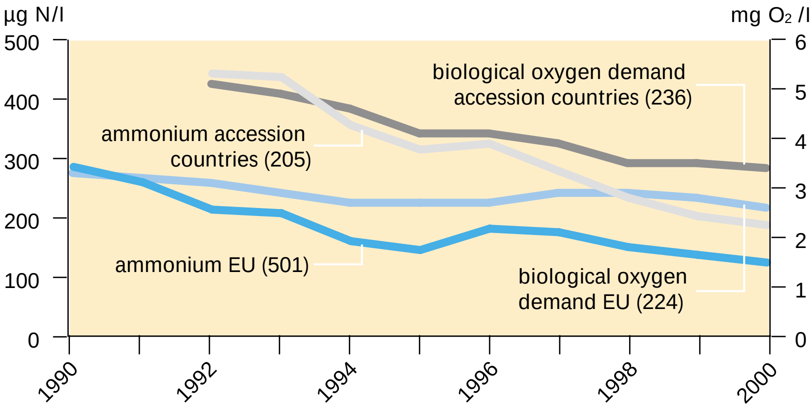
Other significant impacts from water abstraction include overexploitation of aquifers, a particular problem in Mediterranean countries where it commonly arises from excessive abstraction for irrigation. Wetlands or wet ecosystems are also damaged when the aquifer water level drops. It is estimated (EEA, 1999) that about 50 % of major wetlands in Europe have 'endangered status' due to groundwater overexploitation. Salt water intrusion into aquifers can result from groundwater exploitation along the coast, where urban, tourist and industrial centres are commonly located. The intrusion of salt water is a problem in many coastal European regions, but especially along the Mediterranean and Baltic coasts (EEA, 1999).

Water use by sector Figure 11.2.



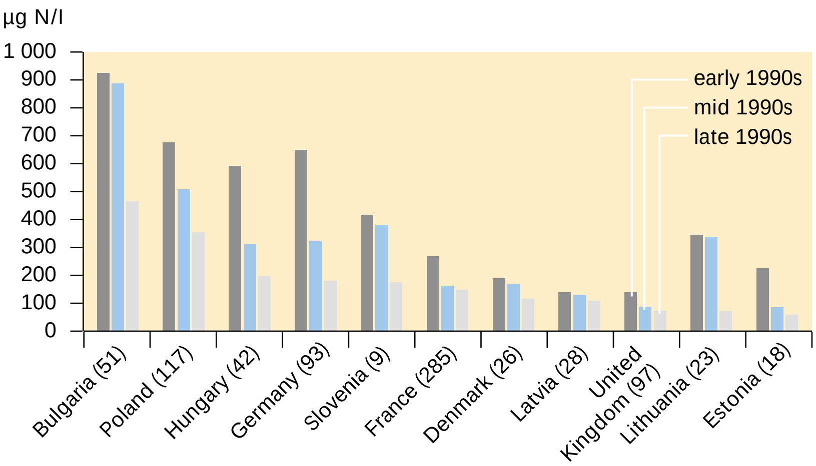
Notes: data refers to 1999 or the latest year available.
Sources: Eurostat; OECD; EEA

Figure 11.3. **BOD and ammonium in European rivers, EU and accession countries**



Note: Average of annual median concentrations. Number of monitoring stations in brackets.
Source: EEA

Figure 11.4. **Ammonium concentrations in European rivers, by country**



Note: Number of monitoring stations in brackets.
Source: EEA

BOD and ammonium levels generally decreased in the 1990s, by 20-30 % and 40-60 % respectively; they are lower in the EU countries than in the accession countries. The largest decreases in ammonium were observed in those countries with highest concentrations at the beginning of the 1990s.

Quality of information ☆☆☆

http://themes.eea.eu.int/Specific_media/water/indicators/bod/index_html

11.2. Organic pollution in rivers

Biochemical oxygen demand (BOD) and ammonium are key indicators of the oxygen content of water bodies. High values are usually a result of organic pollution, caused by discharges from wastewater treatment plants, industrial effluents and agricultural runoff. The effects on the aquatic environment include reduced chemical and biological quality, as well as impaired biodiversity of aquatic communities.

Increased industrial and agricultural production, coupled with more of the population being connected to sewers, has resulted in increases in discharges of organic waste into surface water in most European countries since the 1940s. Over the past 15 to 30 years, however, biological treatment of wastewater has increased (see Section 11.3), and organic discharges have consequently decreased across most of Europe. The result is that many rivers are now well oxygenated.

During the 1990s BOD levels fell by around 20–30 % in both EU and Accession Country rivers. The improvement in EU countries was largely due to the Urban Wastewater Treatment Directive, which increased the level of treatment of wastewater.

The reduction in ammonium concentrations in the 1990s was even greater than that in BOD, with a 40 % decrease in EU rivers and a nearly 60 % decrease in the Accession countries. The lowest levels of ammonium are found in Finland, with the new Baltic States, UK and Denmark also having ammonium concentrations generally below 100 µN/l, close to natural levels. The highest ammonium concentrations are found in Poland, Germany, Hungary and Bulgaria, in which countries significant improvements were made during the 1990s with ammonium levels being more than halved.

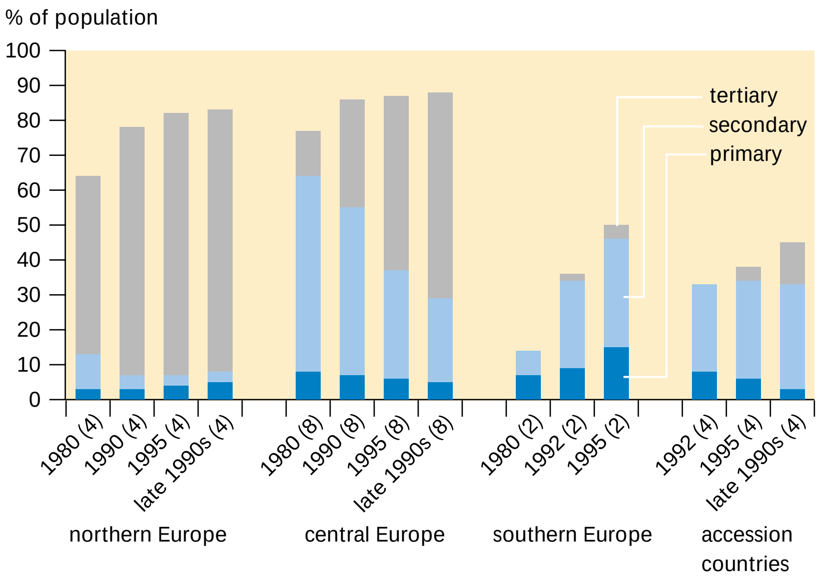
11.3. Wastewater treatment

There are some key differences in wastewater treatment between the different regions of Europe. Most of the population in northern countries are now connected to tertiary wastewater treatment plants, which efficiently remove nutrients and organic matter from the wastewater.

In the central EEA countries, more than half of the wastewater is treated by tertiary treatment and a quarter by secondary biological treatment only which removes most of the organic matter and the ammonia. In Denmark, The Netherlands, Austria, Switzerland and Germany more than two thirds of the population is connected to tertiary treatment, while in the UK and Luxembourg most have secondary (biological treatment). In Belgium and Ireland, wastewater treatment is comparable to that in southern Europe and the accession countries in that they currently have around half of the population connected to wastewater treatment plants, with 30–40 % of the population connected to secondary or tertiary treatment plants.

The percentage of the population connected to tertiary treatment plants has increased since 1980 in all European regions. In northern countries such as Finland and Sweden, this level of treatment was introduced earliest, in the early 1980s, while many of the western countries constructed treatment plants with nutrient removal in the late 1980s and 1990s; this explains the marked increase in tertiary treatment in the central region.

Wastewater treatment in regions of Europe Figure 11.5.



Notes: Only countries with data from all periods included, the number of countries in parentheses. Northern: Iceland, Norway, Sweden and Finland. Central: Austria; Ireland; the UK; Luxembourg; The Netherlands; Germany; Denmark; and Switzerland. Southern: Greece; and Spain. Accession Countries: Bulgaria; Estonia; Hungary; and Poland. Primary treatment (mechanical treatment technology) removes part of the suspended solids, while secondary treatment (biological treatment) uses aerobic or anaerobic micro-organisms to decompose most of the organic matter and retain some of the nutrients (around 20-30 %). Tertiary treatment (or advanced treatment technology) generally includes phosphorus retention and in some cases nitrogen removal. Primary treatment alone will remove no ammonium whereas secondary (biological) treatment will remove around 75 %.
Source: EEA; OECD; Eurostat

The Urban Wastewater Treatment Directive requires Member States to provide different minimum levels of treatment depending on the size of the urban population and the sensitivity of the receiving waters. The implementation of this Directive will lead to a reduction of nutrient discharge from point sources; it has been estimated that phosphorus discharges will be reduced by about 30 %. However, implementation of the Directive has been delayed, although considerable investment programmes are in place in all Member States to comply with the Directive's objectives.

The northern and western European countries have a high proportion of treated wastewater, with continual improvements in treatment level. Southern countries and the accession countries have only around half of the population connected to wastewater treatment plants; the level of treatment has also improved during the past 15 years.

Quality of information ☆☆

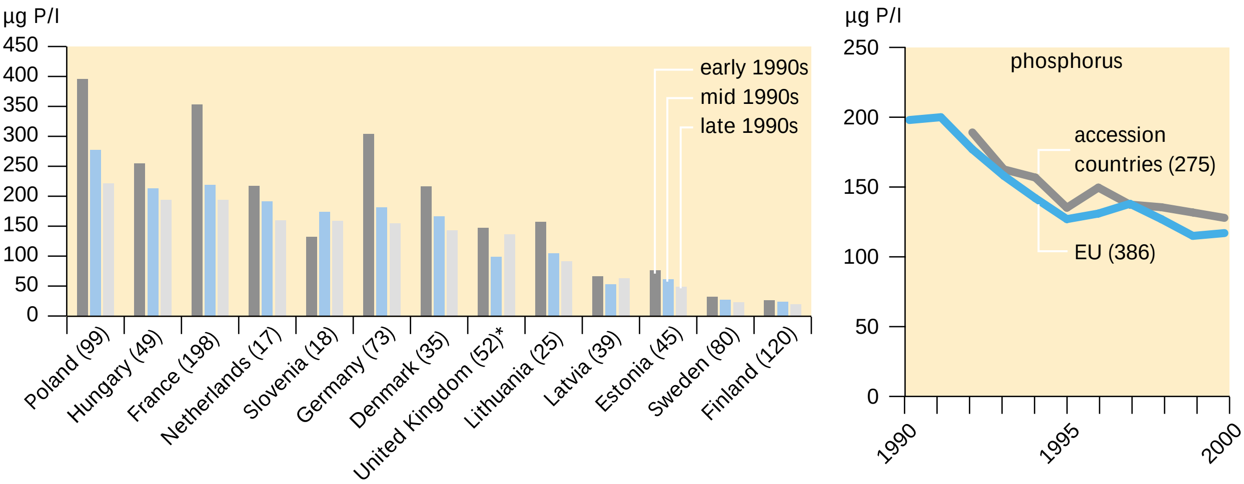
http://themes.eea.eu.int/Specific_media/water/indicators/wastewater/index_html
http://europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat&collection=02-Statistics%20in%20Focus&product=KS-NQ-01-014-__-I-EN

11.4. Nutrients in rivers

Excessive inputs of nitrogen and phosphorus is an issue for rivers as well as coastal waters (see Section 11.5). Eutrophication can lead to the loss of flora and fauna and reduce the quality of water for human consumption. In many catchments, runoff from agricultural land is the principal source of nitrogen pollution. For phosphorus, households and industry tend to be the most significant sources although with reduced point source discharges agriculture runoff can also be significant.

The average phosphorus concentration in rivers per country varied from less than 25 µg P/l in the sparsely populated Sweden and Finland to around 50 µg P/l in the Baltic states and to more than 100 µg P/l in the more densely populated countries. Phosphorus concentrations in EU and Accession Country rivers generally declined by 30-40 % during the 1990s, especially in the countries with average concentrations higher than 200 (µ P/l at the beginning of the 1990s. The large reductions in areas with formerly high phosphorus concentrations indicate that upgrading of wastewater treatment plants has been successful. Phosphorus load from industries has also been reduced due to the use of cleaner technology.

Figure 11.6. **Total phosphorus concentrations in rivers, selected EU and accession countries**



Notes: Average of annual median concentrations. Number of stations in brackets;
* UK figures for orthophosphate-P.
Source: EEA

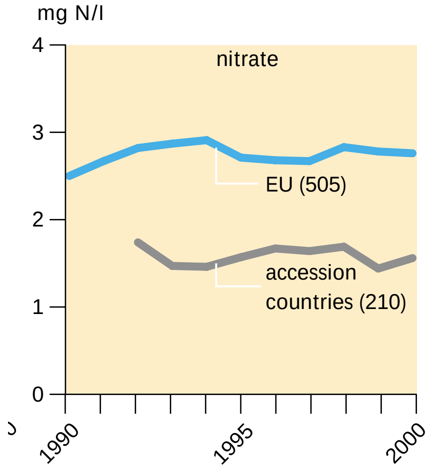
Although concentrations of phosphorus decreased in both the EU and the accession countries during the 1990s, nitrate concentrations remained relatively unchanged. The decline in phosphorus concentrations can be attributed to improvements in wastewater treatment. Overall, concentrations of phosphorus and nitrates are much greater than natural or 'background levels'.

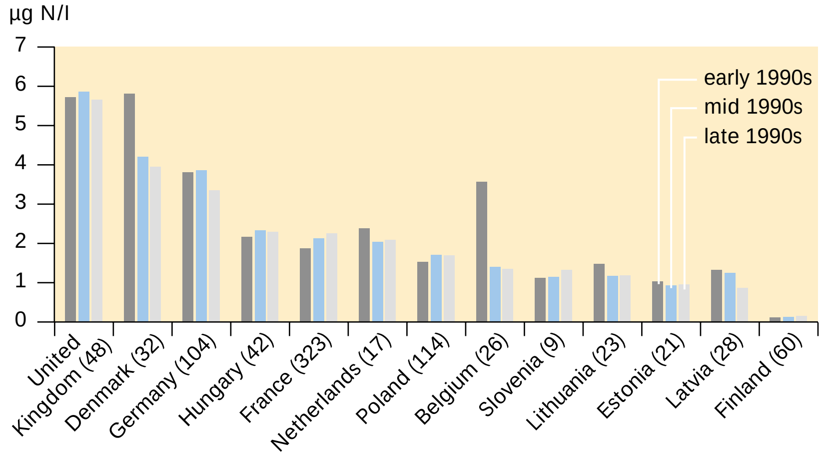
Quality of information

http://themes.eea.eu.int/Specific_media/water/indicators

Nitrate concentration is highest in the countries with highly intensive agricultural production, average in the accession countries and lowest in Nordic countries like Finland. In contrast to phosphorus, no clear trends for nitrates are evident although concentrations are lower in the accession countries due to the lower intensity of agriculture. A few countries, Latvia, Germany and Denmark, had indications of reduced river nitrate concentrations in the late 1990s. Overall, current concentrations of phosphorus and nitrate are still well above what might be considered natural or 'background' levels.

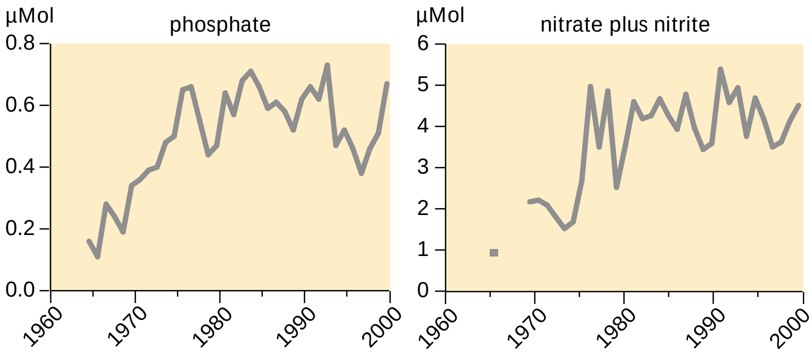
Nitrate concentrations in rivers, selected EU and accession countries Figure 11.7.





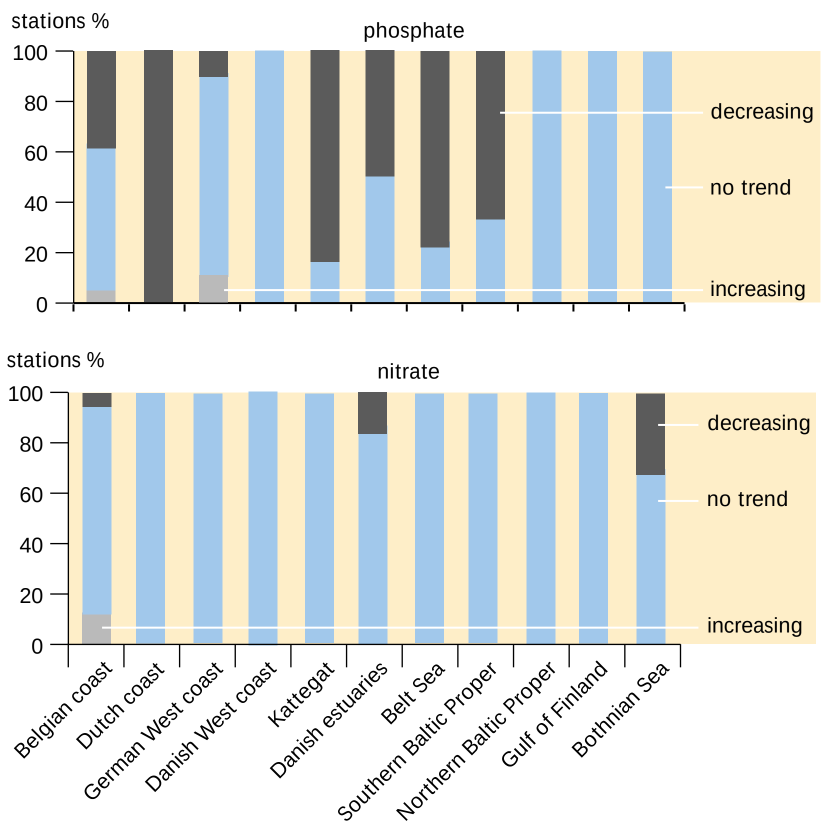
Notes: Average of annual median concentrations. Number of stations in brackets.
Source: EEA

Figure 11.8. **Winter concentrations of nutrients in the open Baltic Proper (East-Gotland Basin)**



Notes: Winter covers mid-January to mid-April. The surface layer is 0-10 m.
Source: HELCOM; ICES

Figure 11.9. **Trends in nutrients in the Baltic Sea and coastal North Sea waters, 1985–1997/2000**



Notes: For each station or sampling point in the sub-regions of the Baltic and North Sea, a trend analysis of winter nutrient concentrations in water from 1985 to 1997/2000 was carried out. The bars in the graph show, at how many sampling points (as %) a decrease or an increase in nutrient concentrations at the 5 % significance level is observed.
Source: HELCOM, OSPAR, NRCs via ICES, data manipulation by EEA

Nitrogen and phosphorus concentrations in coastal waters of the Baltic Sea and southern North Sea more than doubled between the 1960s and 1980s. Since the mid-1980s, phosphate concentrations have generally declined as a result of less discharge from point sources, while nitrate concentrations have remained fairly constant as a result of increased nutrient runoff from agricultural land, compensating for any reductions in input from point sources.

Quality of information

http://themes.eea.eu.int/Specific_areas/coast_sea/indicators
http://reports.eea.eu.int/topic_report_2001_7/en

11.5. Nutrients in coastal waters

The long-term development of nutrient concentrations in the Baltic is probably representative of the development of nutrients elsewhere in European seas. Nitrogen and phosphorus concentrations in the Baltic Sea area and the southern and eastern North Sea more than doubled between the 1960s and the 1980s. Since the mid-1980s, phosphate concentrations have declined in many estuaries and coastal areas while nitrate concentrations have remained relatively constant. In some areas, phosphorus concentrations have fallen by up to 50 % as a result of improved wastewater treatment and use of phosphate-free detergents. Nitrogen inputs from point sources have also been reduced, but diffuse inputs from agriculture remain high.

The more recent years of the long-term development for a selection of other seas show that winter surface phosphate concentrations were constant in the Northern Baltic Sea area and the coastal waters of the eastern and southern North Sea. Decreasing concentrations were, however, observed in Dutch coastal waters and a tendency towards decline was seen in Belgian coastal waters, Danish estuaries, Kattegat, the Belt Sea and the southern Baltic Proper. With the exception of a few sampling points, no general trend in winter surface nitrate concentrations can be detected. This reflects continuing high nutrient inputs from diffuse agricultural sources. A recent Finnish report shows decreasing nitrate concentrations in the Gulf of Bothnia and Finland.

11.6. Chlorophyll-a in marine and coastal waters

The eutrophication of coastal waters remains a significant problem in many coastal areas of Europe. It results from the excessive input of nitrogen and phosphorus generated through human activity: runoff from agricultural land brought to the sea via rivers (see Sections 11.4 and 11.5), atmospheric deposition and nitrogen fixation from the atmosphere, especially in the Baltic Sea, and fish farming.

The concentration of chlorophyll-a in coastal waters provides an indication of eutrophication levels. No trend at or above the significance level of 5 % was apparent between 1985 and 1997 / 2000 in the summer surface concentrations of chlorophyll-a, either in the coastal waters of the eastern and southern North Sea or in the Baltic Sea. Exceptions included several sampling points in Danish estuaries and the Danish North Sea, which recorded a decrease and a few monitoring stations in the Bothnian Sea and in Belgian coastal waters which witnessed an increase.

Coastal areas with potentially enhanced chlorophyll levels Table 11.1.

Baltic Sea	North-eastern part and eastern coast of Bothnian Bay; the Quark area; Coastal areas of Bothnian Sea; Gulf of Finland; Gulf of Riga; Coastal areas off Kaliningrad and Lithuania; Gulf of Gdansk; Pomeranian Bight; Swedish Baltic Proper coast
Belt Sea and Kattegat	Especially coastal and shallow areas of the Belt Sea and Kattegat
Skagerrak	North-eastern and south-western parts and coastal areas of Skagerrak
North Sea	Eastern North Sea; German Bight; Wadden Sea; Southern Bight; UK coast and estuaries
The Channel	Coastal areas, especially Baie de Somme, Baie de Seine and Baie du Mont St. Michel
Celtic Seas	Bristol Channel; Liverpool Bay with associated estuaries; Solway Firth; Firth of Clyde; Ireland's coast to the Irish Sea
Bay of Biscay and Iberian Coast	French coastal areas and estuaries in Bay of Biscay, especially in the vicinity of the Loire and Gironde estuaries; Spanish and Portuguese Atlantic coasts
Mediterranean Sea	Costa del Sol; Vicinity of the Ebro delta; Gulf of Lyon; Italian west coast, especially Gulf of Gaeta, Napoli Bay and in the vicinity of the rivers Tiber and Arno; Northern Adriatic Sea, especially Gulf of Venice and the areas influenced by the river Po; Northern Aegean Sea, especially Bights of Thessaloniki and Thermaikos and in the Limnos area with inflow from the Black Sea through the Marmara Sea. Outside EU-countries, enhanced chlorophyll concentrations are found along the south-east coast of Tunisia and the Egyptian coast from Alexandria to Gaza

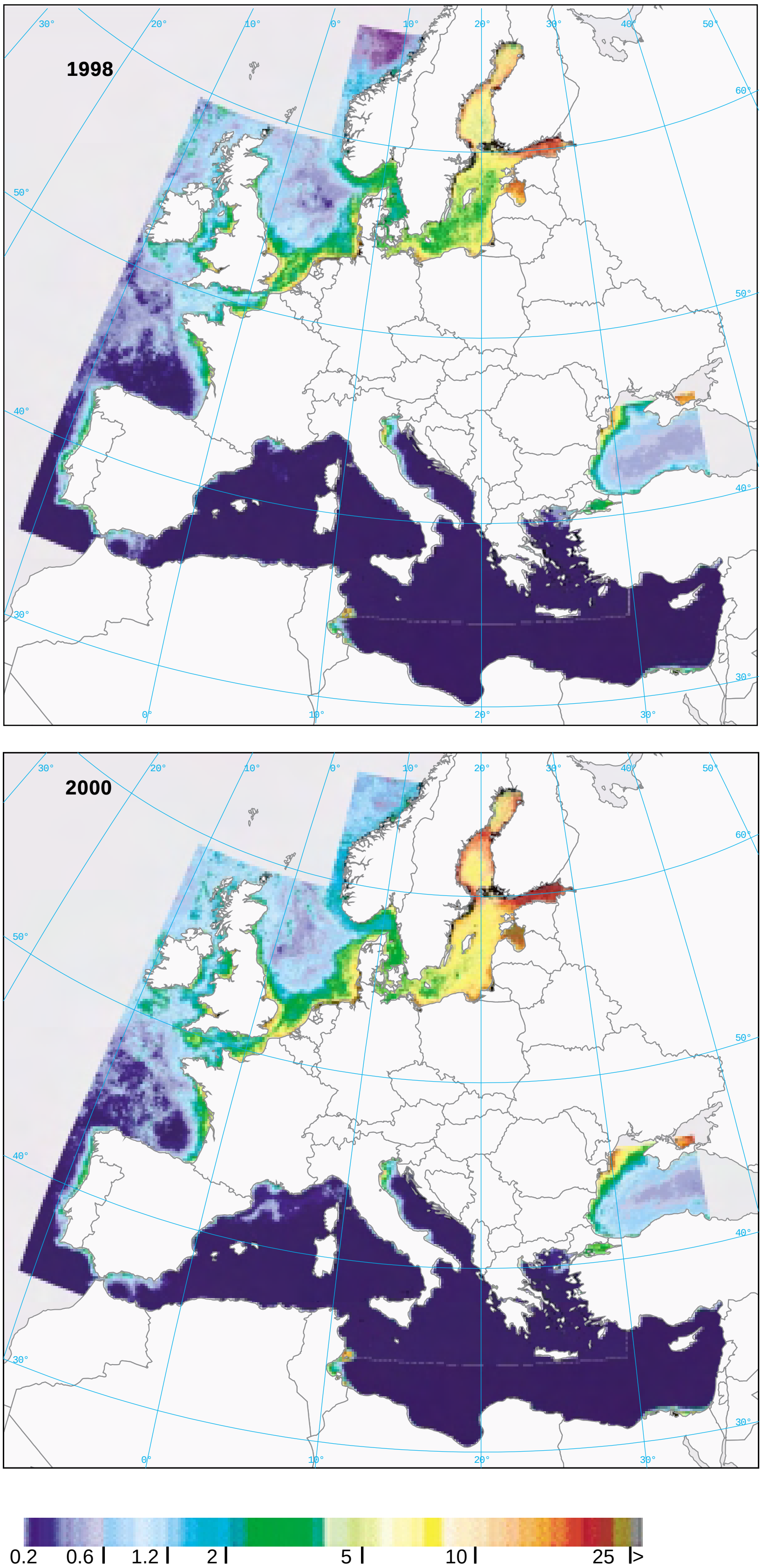
Notes: compared to neighbouring seas from the satellite spring-summer mean chlorophyll images
Source: EEA

No trend is generally apparent in summer surface concentrations of chlorophyll-a in either the coastal waters of the eastern and southern North Sea or the Baltic Sea. Symptoms of eutrophication such as phytoplankton blooms (revealed by satellite images) occur in several coastal areas of Europe.

Quality of information ☆☆

http://reports.eea.eu.int/topic_report_2001_7/en

Map 11.1.	**Mean spring-summer concentrations of chlorophyll-like pigments in European seas determined from satellite observations**



Recent observations in Baltic waters show decreasing chlorophyll-a concentrations in the Mecklenburg Bight, but increasing concentrations in the Arkona Basin, both in the period since 1979.

Satellite imagery provides a means of comparing relative concentrations of chlorophyll-a in European coastal areas. The maps indicate differences particularly in the eastern and southern North Sea and the Baltic Sea. In the latter case, the concentrations appeared to increase between 1998 and 2000 but the results are affected by external factors such as meteorological conditions.

Various initiatives have been taken at the European level to reduce nutrient surpluses on agricultural land and subsequently in water, and thus protect the marine environment from eutrophication. The Nitrates Directive and the Urban wastewater Treatment Directive, for example, aim to reduce nutrient inputs from agricultural runoff and point sources, respectively. The aims of the Water Framework Directive include securing a good ecological quality of coastal waters and implementing this objective is now a key issue for Member States.

Notes: 'spring-summer' covers April to September. Observations are from SeaWiFS satellite. The concentration scale (µg/l) is valid only for oceanic waters and over-estimates the chlorophyll concentrations in coastal seas and the entire Baltic Sea to a large and variable degree, as a result of high concentrations of coloured dissolved organic material (yellow substance).
Source: EEA

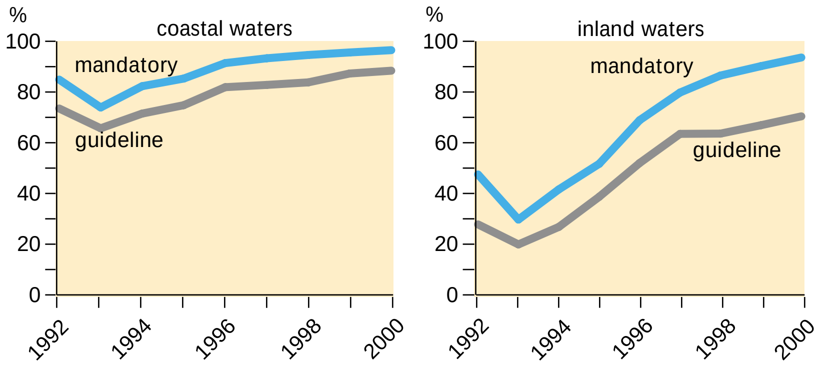
11.7. Bathing water quality

The proportion of bathing areas in Europe that meet the mandatory and guideline values of Directive 76/160/EEC on Bathing Water Quality increased between 1992 and 2000 for both coastal and inland waters. However, despite the legislation having been in place for almost 25 years, only one country (Belgium) achieved 100 % compliance with the minimum mandatory standards in 2000 (note that Belgium only has a short coastline with only 39 sites out of a total of more than 110 000). With respect to the guideline values, 20 % of Europe's coastal bathing waters and 36 % of its inland bathing beaches do not reach these standards. The Netherlands, Greece and Spain had the highest percentage of coastal waters achieving the guideline standards with Belgium and the UK having the lowest.

While the Directive lists a range of parameters to be monitored, robust analytical methodologies have yet to be developed for some of these. For example, human enteric viruses are the most likely pathogens responsible for waterborne diseases from recreational water use but detection methods are too complex and costly to be used in routine monitoring. Instead, the main parameters analysed for the purposes of compliance are the presence of indicator organisms (total and faecal coliforms). Compliance with the mandatory standards for these organisms does not therefore provide a guarantee of no risk to human health. The degree of compliance provides an indication of general pollution levels from effluent discharge.

The revision process of Bathing Water Directive 76/160/EEC started at the beginning of the 1990s. There is a general preference for a totally new Directive. It is the Commission's intention to take the time needed for an in-depth review and to provide a text for a broader consultation. A communication from the Commission to the European Parliament and the Council, Developing a New Bathing Water Policy, was adopted in 2000 (COM(2000) 860 final).

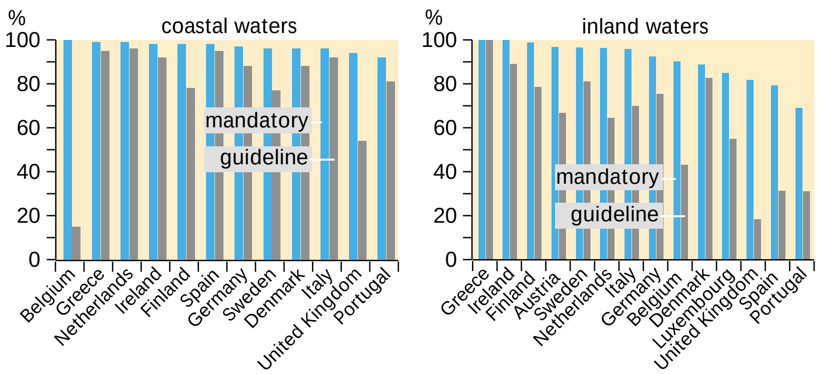
Compliance of EU bathing waters with the Bathing Water Directive — Figure 11.10.



Note: The Directive requires Member States to designate coastal and inland bathing waters and to monitor the quality of these waters throughout the bathing season (May to September in most European countries). The Directive sets both minimum standards (mandatory) and optimum standards (guideline). The indicator has to be considered with some caution, as it reflects water quality at only a limited number of specific locations, against selected parameters and for a limited number of samples.

Source: The European Commission from annual reports by EU Member States

Compliance of EU bathing beaches with the Bathing Water Directive by country, 2000 — Figure 11.11.



Notes: For compliance with the Directive, 95 % of the samples must comply with the mandatory standards. To be classified as achieving guideline values, 80 % of the samples must comply with the total and faecal coliform standards and 90 % with the standards for the other parameters.

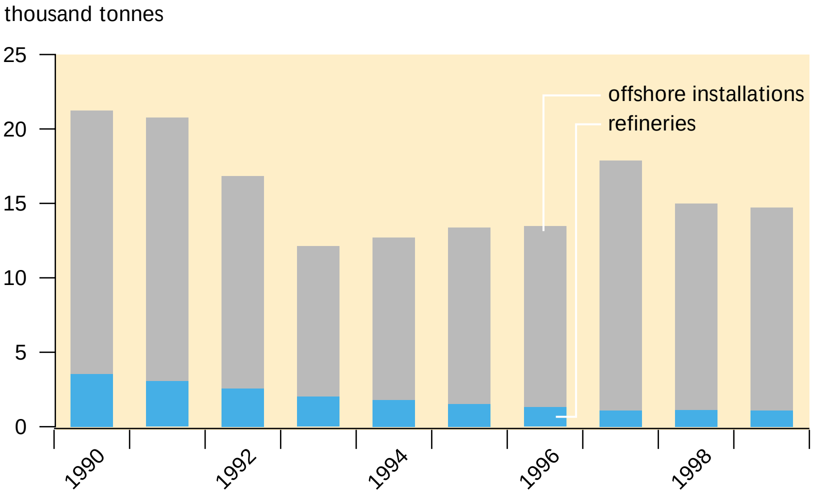
Source: The European Commission from annual reports by EU Member States

The quality of designated coastal and inland bathing waters in Europe improved throughout the 1990s. In 2000, 97 % of coastal bathing waters and 91 % of inland bathing waters complied with the minimum (mandatory) standards. However, 12 % of Europe's coastal bathing waters and 30 % of Europe's inland bathing waters failed to meet optimum (guideline) standards.

Quality of information ☆☆☆

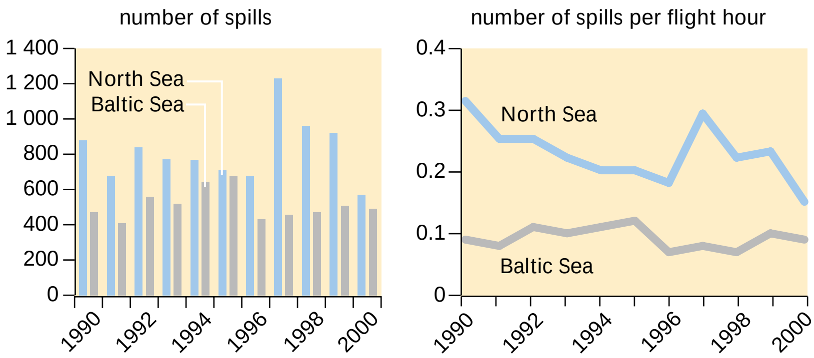
http://www.europa.eu.int/water/cgi-bin/bw.pl

Figure 11.12. **Total discharges of oil from refineries and offshore installations in EU**



Notes: Offshore installation is defined by OSPAR as 'any man-made structure, plant or vessel or parts thereof, whether floating or fixed to the seabed, placed within the maritime area for the purpose of offshore activities'. It includes for example oil and gas exploration and production platforms or ships. Discharges from refineries (1991–1992, and 1994–1999) are based on emission coefficients developed by DHI.
Source: OSPAR; Eurostat; DHI; Concave

Figure 11.13. **Illegal oil discharges from shipping: observed oil slicks from aerial surveillance**



Note: Illegal oil discharges from ships and offshore platforms are regularly observed at sea. Specific aerial surveillance by planes is conducted over 'special areas' defined by international conventions in order to detect oil slicks on the sea surface. No aerial surveillance is conducted over The Mediterranean and the Black Sea.
Source: Bonn Agreement; HELCOM

Oil discharges from coastal refineries and offshore installations have generally decreased, except for Norwegian offshore installations, while production has increased and further improvements are anticipated now new OSPAR regulations have entered into force. The number of illegal oil spills per flight hour in the North Sea declined in the decade to 2000 although numbers in the Baltic Sea remained relatively constant.

Quality of information ☆☆

http://themes.eea.eu.int/Specific_areas/coast_sea/indicators

11.8. Oil pollution from offshore installations and illegal discharges

Despite increased oil production, oil discharges from coastal refineries and offshore installations are decreasing. For example, in 1990 offshore installations of Denmark, The Netherlands and the United Kingdom discharged 17 700 tonnes of oil while producing 102 million tonnes, while in 1999 those installations discharged less than 13 700 tonnes of oil while producing 154 million tonnes. Norway, where oil production doubled over the same period (70 to 145 million tonnes) has not succeeded in reducing discharges, and is responsible for the increase of the total discharges since 1994. Indeed, between 1990 and 1998 the total refinery output across the EU increased by 15 % while discharges decreased by 70 %. Decreases from coastal refineries and offshore installations have resulted from an increase in the use of cleaning technologies and improved wastewater treatment prior to discharge. Further improvements are also anticipated following new OSPAR regulations on drill cuttings that entered into force in 2000.

Illegal oil discharges from ships and offshore platforms are regularly observed at sea. Discharges are prohibited in the North Sea, the Baltic Sea and the Mediterranean and aerial surveillance is undertaken in order to prevent and record any violations. Directive 2000/59/EC aims to ensure a major reduction in marine pollution through the provision of adequate waste reception facilities in all EU ports. While the number of oil spills witnessed in the North Sea declined, the number of oil spills witnessed in the Baltic Sea remained relatively constant in the decade to 2000. Oil spills are largely confined to navigation corridors and may pollute beaches and harm fish, shellfish and bird populations.

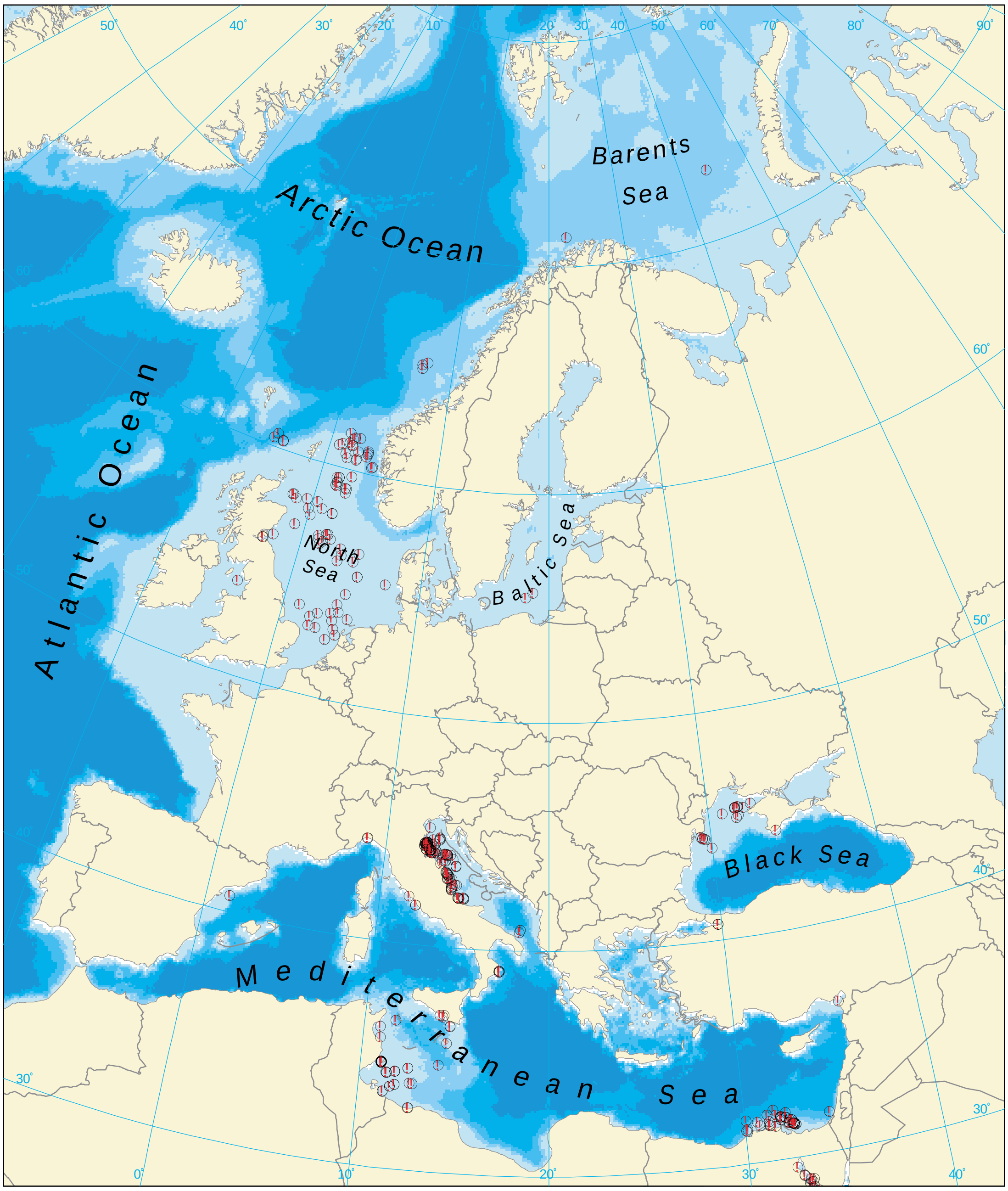
Helcom Clean Sea Guide

'Any discharge of oil or oily mixtures into the Baltic Sea Area is prohibited. Oil means petroleum in any form including crude oil, fuel oil, sludge, oil refuse and refined products. The prohibition applies not only to discharges from the cargo tanks of oil tankers but equally to discharges from the machinery spaces of any ship. Only if the oil content in the effluent does not exceed 15 parts per million can a discharge be permitted. The oil filtering equipment must be provided with arrangements that ensure that any discharge of oil or oily mixtures is automatically stopped when the oil content in the effluent exceeds 15 parts per million. By 1 January 2002 ships of less than 400 tons gross tonnage, flying the flag of a Baltic Sea State, should also comply with adopted guidelines concerning holding tanks/oily water separating or filtering equipment'.

Given the sensitivity of the Baltic Sea Area, it is of utmost importance that illegal discharges from ships are eliminated. Therefore, the Baltic Sea States have agreed that from 1 July 2000 all ships, with some exceptions, are under an obligation to deliver to a port reception facility, before leaving the port, their ship-generated wastes and cargo residues that cannot be legally discharged under the global International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), or under the Helsinki Convention.

Source: http://www.helcom.fi/a/publications/Clean %20Seas %20Guide.pdf

Locations of major offshore installations Map 11.2.



Notes: Locations as mentioned in notices to mariners.
Source: UKHO and SHOM

12. Waste and material flows

policy issue	indicator	assessment
decoupling resource use from economic activity	total material requirement	😐
decoupling waste generation from economic activity	total waste generation	😐
reducing generation and disposal of municipal waste	municipal waste generated and landfilled/incinerated	☹
effectiveness of the Packaging and Packaging Waste Directive	packaging waste	😐
reducing generation of hazardous waste	hazardous waste generated and landfilled	☹

The resource productivity of the EU's economy is improving and total waste generation appears to be decreasing in some countries. The latter trend is due mainly to the stabilisation or even decrease in the generation of industrial and mining waste in those countries. In contrast, consumer and commercial behaviour is resulting in increases in the generation of municipal waste including packaging waste. In some countries the environmentally-sound move from landfilling to recycling can be observed. However, many countries still have a long way to go to meet policy targets and manage materials and waste streams in a more sustainable way.

The generation of waste represents a loss of materials and energy. Excessive quantities of waste result from inefficient production processes, low durability of goods and unsustainable consumption patterns. While total waste quantities indicate a loss of resources to some extent, the hazardous substances contained in products and in waste and their release into the environment determine the priorities for effective waste management, so that extensive environmental hazards can be avoided. In EU policy-making this is expressed in the selection of priority waste streams.

The EU Sustainable Development Strategy and the sixth environmental action programme (6EAP) both recognise the link between resource efficiency and waste generation and mention breaking the link between economic growth, the use of resources and the generation of waste as an important objective. A number of policies and Directives have been put into place in recent years to reduce the generation of waste. In addition, the European Commission is currently preparing a thematic strategy on the sustainable use and management of resources, which will include proposals to reach the 6EAP's objectives.

For wastes that continue to be generated, the 6EAP aims at a situation where:

- the wastes are non-hazardous or at least present only very low risks to the environment and human health;
- most of the wastes are either reintroduced into the economic cycle, especially by recycling, or returned to the environment in a useful (e.g. composted) or harmless form;
- the quantities of waste that still need to go to final disposal are reduced to an absolute minimum and are safely destroyed or disposed of;
- waste is treated as close as possible to where it is generated.

12.1. Total material requirement

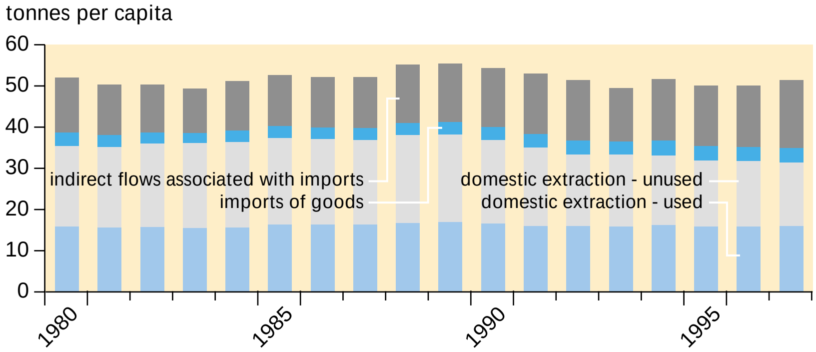
The total material requirement (TMR) indicator comprises the cumulative volume of primary materials (excluding water and air) extracted from nature for the economic activities of a country. TMR is a highly aggregated indicator, with all resource flows aggregated in tonnes. It indicates a generic pressure on the environment, hence cannot be used to indicate specific environmental pressures. From a systems perspective, any flows of material into the economy will lead to output flows sooner or later, many of them at other locations and with a changed composition. Thus, TMR indicates the total volume of material throughput of the economy, that is, the total amount of products, waste and emissions (EEA, 2001; Eurostat, 2001).

The TMR for the EU economy has remained relatively constant since 1980, fluctuating around 51 to 52 tonnes per capita each year and demonstrating some degree of decoupling from economic growth.

Non-renewable resources dominate the EU's TMR and remain at a high level. With the growing importance of external trade and a reduction of domestic resource extraction, imports and associated indirect (hidden) flows (the 'foreign' part of TMR) have increased from around 15 tonnes per capita during the mid 1980s to 20 tonnes per capita in the late 1990s (almost 40 % of TMR). This trend is also reflected in the fact that the amount of mining waste in European countries is falling (reduction of domestic resource extraction).

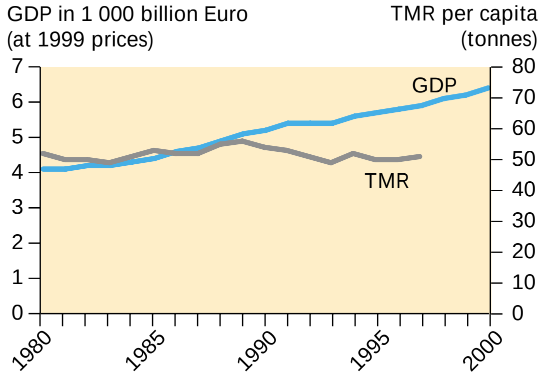
Another trend is that the share of 'hidden' flows not directly entering the EU economy (the sum of unused domestic extraction and the indirect flows associated with imports), has been decreasing slightly, indicating a slightly more efficient use of primary resources. However, this effect is based only on reduced domestic 'hidden flows' (unused domestic extraction), while foreign 'hidden flows' (indirect flows associated with imports) have been increasing.

Composition of Total Material Requirement, EU Figure 12.1.



Source: Eurostat; Wuppertal Institute

Total material requirement per capita versus economic growth, EU Figure 12.2.



Source: Eurostat; Wuppertal Institute

Total use of materials has been relatively de-coupled from economic growth over the past two decades, but the total use of natural resources is still at a high level.

Quality of information ☆☆

http://reports.eea.eu.int/Technical_report_No_55/en

Figure 12.3. **Waste generation and gross domestic product in selected European countries**

Note: Countries analysed are those that have reported total waste generation to Eurostat: Denmark; Germany; Hungary; The Netherlands; Poland; Switzerland; and the UK.
Source: Eurostat

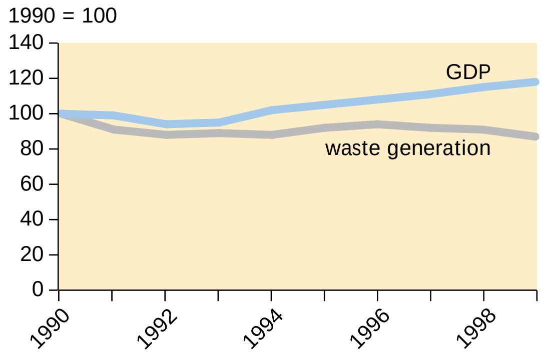
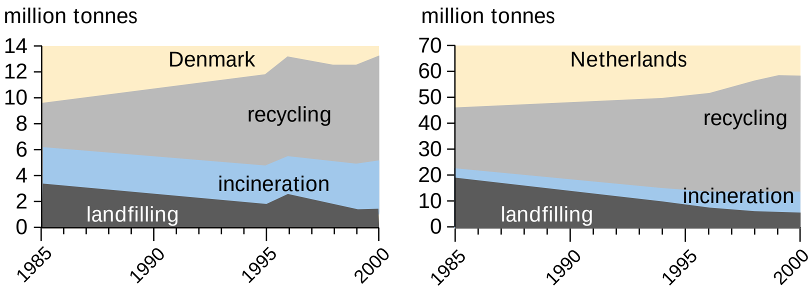


Figure 12.4. **Development in treatment of waste**



Note: Treatment and disposal of waste causes a number of environmental pressures, such as use of land for landfills; leaching of nutrients, heavy metals and other toxic compounds from landfills; low biodegradation of wastes; emission of greenhouse gases from landfills and other treatment of organic waste; air pollution and toxic by-products from incinerators; air and water pollution and secondary waste streams from recycling plants; increased transport causing indirect effects.
Source: EEA

Limited data indicate that total waste generation seems to be de-coupling from economic growth in the countries analysed.

Quality of information ☆

http://themes.eea.eu.int/Environmental_issues/waste/indicators/generation/index_html

12.2. Total waste generation

The overall aim of the European waste management policy is to prevent waste being generated and an objective of the 6EAP is to de-couple waste generation from economic growth.

Waste generation seems to be decreasing in some European countries and amounted at the end of the 1990s to about 3.5 tonnes of solid waste per person per year (excluding agricultural waste), originating mainly from manufacturing, construction and demolition, and mining activities.

Waste generation showed a tendency to de-couple from economic growth, in the same way that economic growth in the EU was achieved without an increase in TMR.

Data limitations prevent a comprehensive assessment of most of the waste streams in Europe. Indicators for some waste streams (e.g. municipal waste, construction / demolition waste) point in the direction of increasing waste generation, but for others the trends are more complex. For manufacturing industries, waste generation appears to be stable in the EEA18 countries whereas in the accession countries there has been a considerable increase of generation from basic metal industries and food manufacturing. Municipal waste quantities in the EEA18 countries, but not in the accession countries, are still increasing. Construction and demolition waste quantities are also increasing and are closely correlated with economic growth. New waste streams have also emerged in recent years, namely those generated by environmental amelioration measures in other fields such as sewage sludge from wastewater treatment plants and flue-gas cleaning residues.

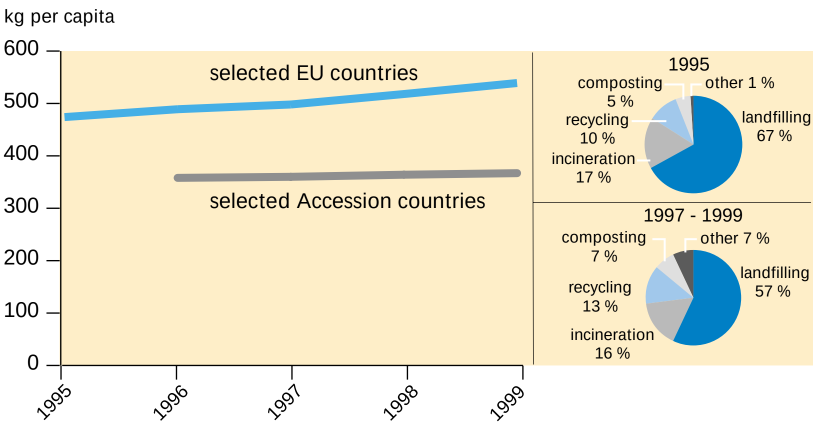
12.3. Municipal waste generated and landfilled/incinerated

Municipal waste makes up approximately 14 % of total waste. Meeting the objective set in the fifth environmental action programme (5EAP), to stabilise the generation of municipal waste per capita, has not been realised. The next programme (6EAP) addresses this issue more broadly, with objectives and options for waste prevention and management aiming at the highest possible re-introduction of wastes into the economic cycle and the safe disposal of minimum waste quantities.

Most EU countries have similar levels of waste generation per capita from daily household and commercial activities, despite variations in income level. In accession countries, this appears to be considerably lower than in EU countries, which may be explained by different consumption patterns, systems for municipal waste collection and disposal, and bases for waste classification and reporting.

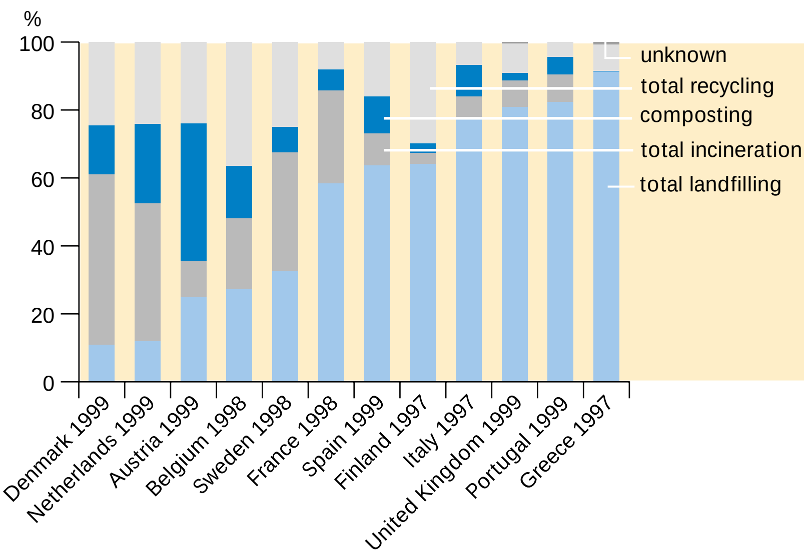
In recent years there has been a reduction in the percentage of waste being disposed of, linked with an increase in recycling rates. However, landfill remains the prevailing option in many EU countries; there is a clear distinction between 'landfilling' and 'non-landfilling' countries, with the choice of options depending on factors such as traditional practice, public acceptance and the availability of land for landfill sites. The EU Landfill Directive (1999/31/EC) promotes the reduction of landfilled waste by making provisions that the quantity of biodegradable material to be landfilled should be reduced to 35 % of 1995 levels by 2016. Biodegradable waste counts for approximately two thirds of total municipal waste quantities. Only a few EU Member States have reached this target (see *Environmental signals 2001*, Chapter 14) whereas in accession countries the fraction of municipal waste going to landfill is generally more than 90 % and in many cases very close to 100%.

Collection and treatment of municipal waste in selected EU and accession countries Figure 12.5.



Notes: Selected EU countries: Belgium; Denmark; Italy; Luxembourg; Netherlands; Portugal; Spain; and United Kingdom. Selected Accession Countries: Czech Republic; Estonia; Hungary; Lithuania; Poland; and Romania.
Source: Eurostat

Treatment of municipal waste, EU Figure 12.6.



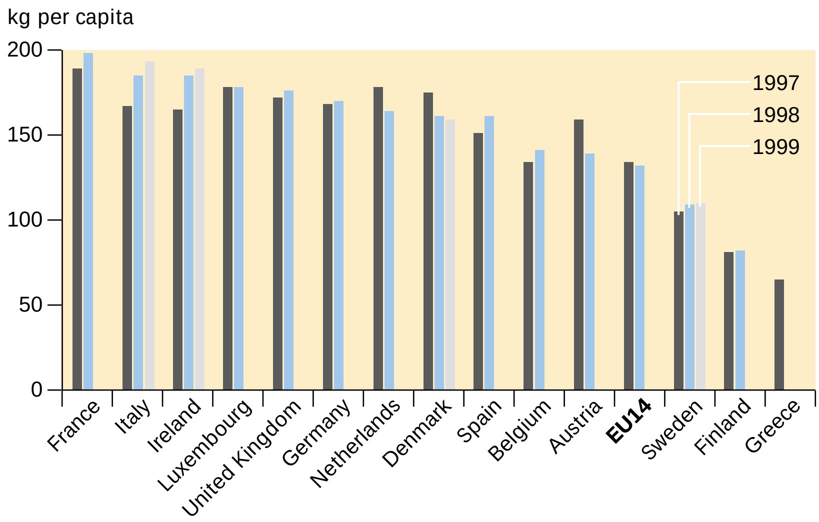
Notes: Using Member States definitions. Recycling schemes are operated in all EU Member States and, on average, 13 % of waste from daily household and commercial activities are collected separately for recycling. The average figure does not reflect the large variations encountered, with an average of 20 % separately-collected waste in the northern part of the EU compared with 5 % in southern Europe.
Source: Eurostat

Generation of municipal waste in EU countries continues to increase and averaged 540 kg per capita in 1999.

Quality of information ☆☆

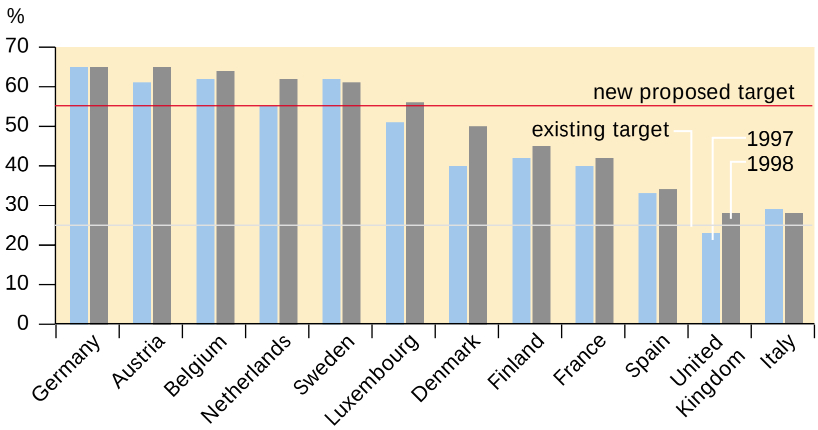
http://themes.eea.eu.int/Environmental_issues/waste/indicators/household_waste/index_html

Figure 12.7. **Packaging material put on the market**



Note: reused packaging is only included when new packaging enters the market on first trip. Variations in the reported use of packaging per capita in Member States may be partly explained by different reporting systems (e.g. different estimates of packaging imported with goods, inclusion/exclusion of reused packaging materials, exclusion of materials such as textile and wood from reporting, and different stock accounting).
Source: European Commission

Figure 12.8. **Recycling of packaging waste**



Source: European Commission

The first aim of the Packaging Waste Directive, to reduce the amount of packaging put on the market, has not been achieved. However, the rate of recycling of all packaging materials in the EU is high, averaging 50 %, thus exceeding the target of 25 %.

Quality of information ☆☆

http://themes.eea.eu.int/Environmental_issues/waste/indicators

12.4. Packaging waste

Packaging materials have only a short useful lifetime and soon become waste that must be treated or disposed of. Packaging waste is one of ten priority waste streams for the EU. The Packaging Waste Directive (94/62/EC) aims, as a first priority, to prevent the generation of this kind of waste.

Based on two or three years' data, only from Austria, Denmark, The Netherlands and Luxembourg, the quantity of packaging put on the market has remained constant or been reduced. In countries with a relative success in waste prevention, instruments such as a substantial tax on goods that are quickly disposed of (such as packaging) and schemes for the reuse of packaging have been introduced, but the decrease is still moderate.

Additional measures from the Packaging and Packaging Waste Directive include the reuse of packaging, recycling and other forms of recovery of packaging waste, with a minimum recycling target for all packaging materials of 25 %. This target has been achieved (the average recycling rate in EU12 is around 50 %). The total recycling rate increased from 1997 to 1998 in all the Member States.

The proposed revision of the Packaging Waste Directive includes a new set of more stringent targets for recycling, including a new overall minimum recycling target of 55 %.

The total recycling rate in Member States in 1998 varied greatly and ranged between 28 % in the UK and Italy to 65 % in Germany. In Germany this was achieved through the specific producer-responsibility scheme applied there ('der grüne Punkt'), introduced in the beginning of the 1990s. Several other Member States subsequently introduced various producer-responsibility schemes and packaging recycling companies have been established. Other countries have improved their collection and recycling systems.

12.5. Hazardous waste

Although hazardous waste forms only a small fraction of total waste generated in Europe, it presents a potential risk to human health and the environment if not managed and disposed of safely. It is therefore one of the priority waste streams in EU policy. The Hazardous Waste Directive (91/689/EEC) defines and provides the framework for the management of hazardous waste. Furthermore, a European Council Decision defines the various hazardous waste types in the European waste catalogue (2000/532/CE, amended by 2001/118/CE).

A few conclusions can be drawn from the available information:

- manufacturing industries and extraction activities generate the largest quantities of hazardous waste;
- a higher level of environmental awareness may have led to the recent increase in hazardous waste generation, as a result of increased separation of hazardous waste;
- each country has a limited variation in the types of hazardous waste collected (in the EU approximately 20 waste types represent about 80 % of total hazardous waste generation). However, the main types of hazardous waste collected are not the same in all countries.

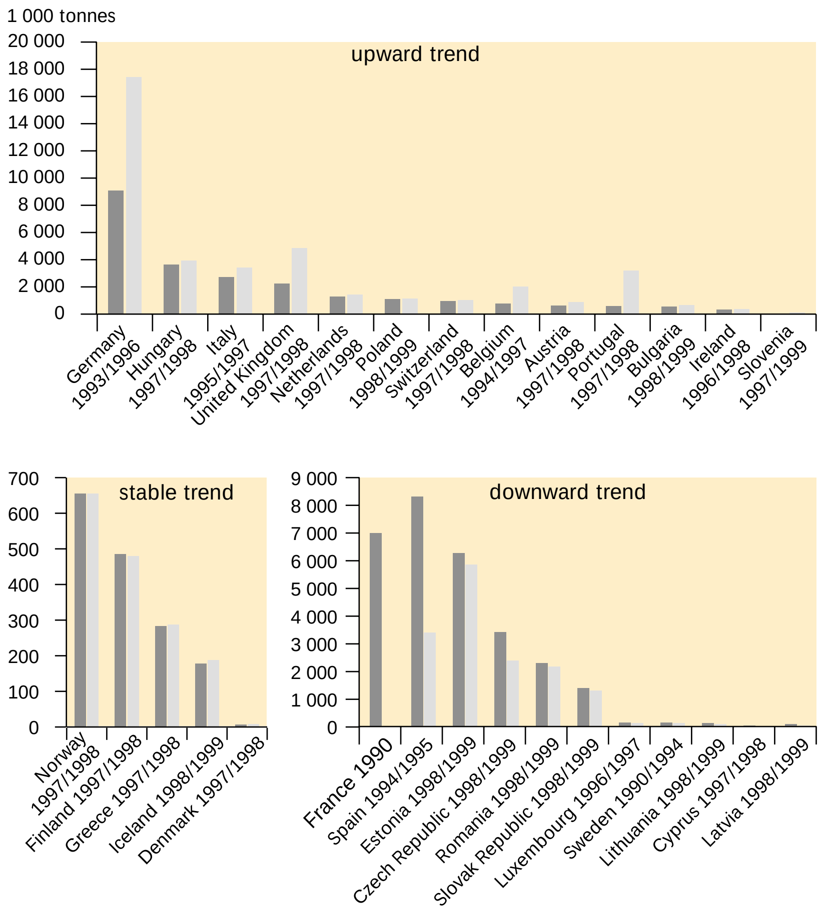
Although recovery, landfill and incineration are the dominant options for hazardous waste management, other methods (physicochemical or biological treatment, permanent storage) are widely used in countries such as Luxembourg, Austria, Italy and The Netherlands.

Adequate information on hazardous waste management is not available, so a reliable assessment of the prevailing situation in Europe cannot be made. The main source of hazardous waste is manufacturing.

Quality of information ☆

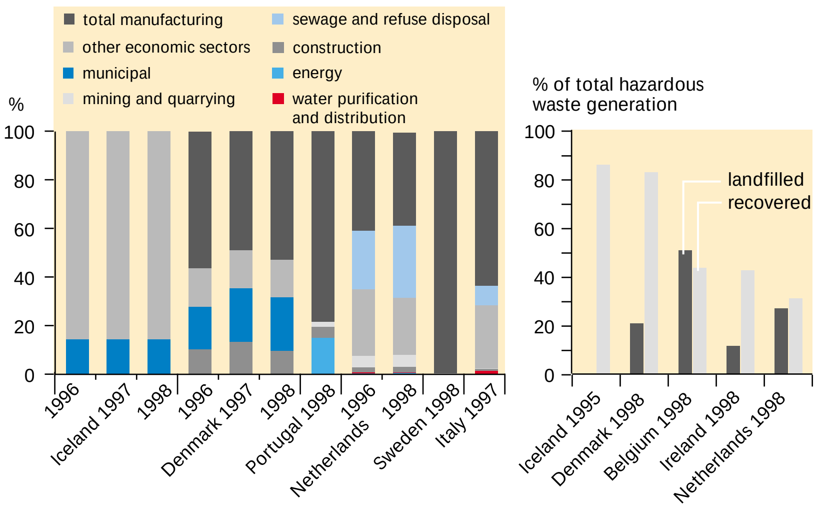
http://themes.eea.eu.int/Environmental_issues/waste/indicators

Hazardous waste generation in Europe, 1990–1999 Figure 12.9.



Notes: More data exist for some countries, though scattered through the 1990s. Statistical data on hazardous waste are weak and not yet available or comparable for all EEA member countries. Additionally, differences in definitions and classification systems (some countries use their own national systems, others use the EU hazardous waste list) preclude reliable data comparisons.
Source: Eurostat

Hazardous waste generation by sector and treatment, 1996–1998, in selected European countries Figure 12.10.



Note: `Other economic sectors` refers mainly to the service sector (including repair and maintenance).
Source: Eurostat

13. Land

policy issue	indicator	assessment
limiting urban sprawl through re-use of land	land take due to urban development	☹
limiting soil sealing	soil sealing	☹
maintaining large natural and semi-natural areas	fragmentation and partitioning of habitats by transport infrastructure	☹

Europe is the third most densely populated area of the world's major regions and arguably its land is the most intensely used. In recent decades the rise of the service economy and the need for food security, together with vastly improved standards of living, changes in societal norms and values, increased personal mobility and increasing demands for housing, have led to widespread conflicts over the use of land. Major ongoing pressures include urban sprawl and the expansion of transport infrastructure to accommodate rising levels of traffic. These have resulted in the sealing of soil surfaces, the fragmentation of habitats and the loss or disturbance of natural areas.

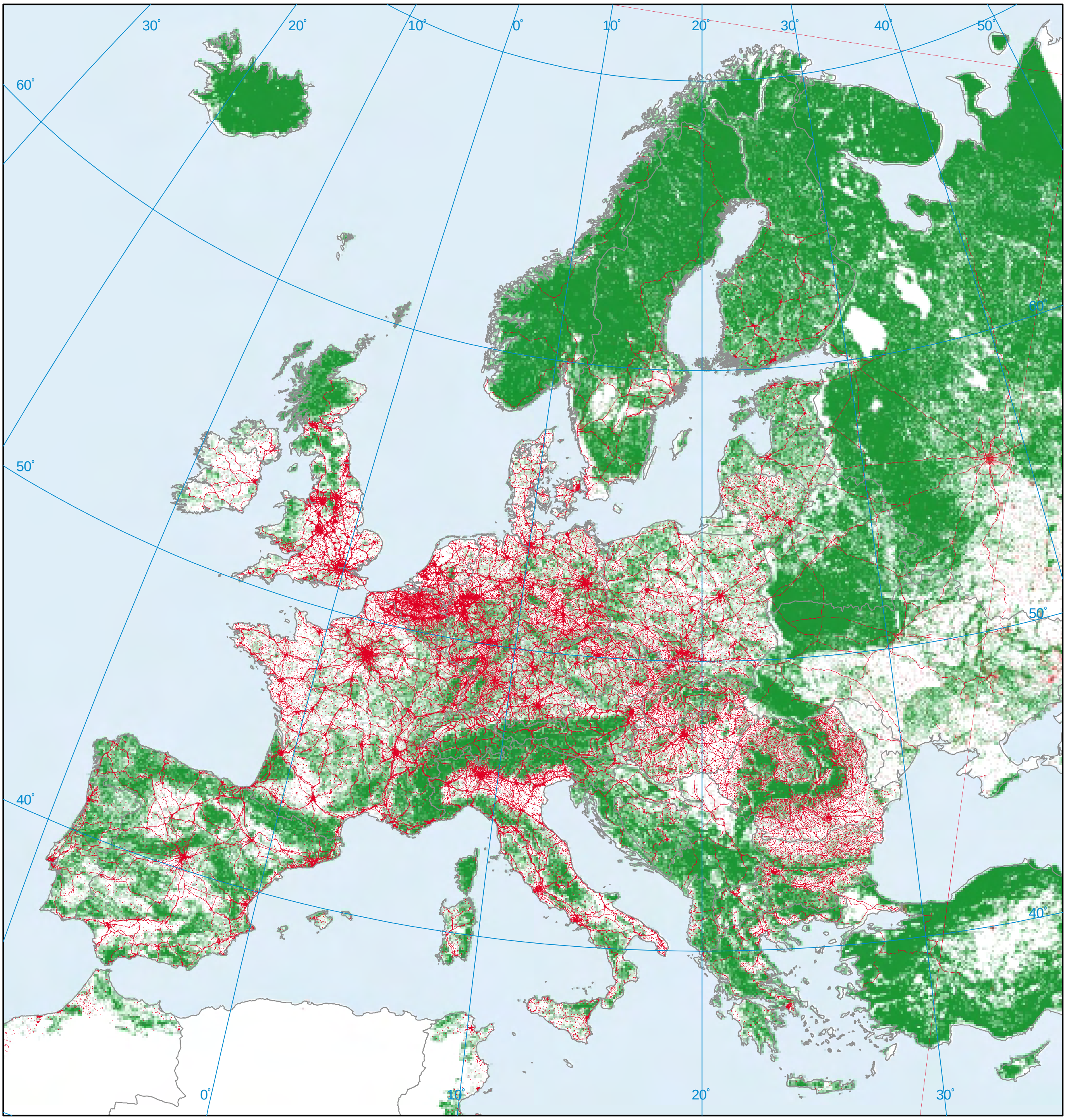
There is a wide range of competing and diverse uses for land in Europe and these are subject to different types and levels of pressure. While the northern, southern, mountainous and some coastal parts of Europe are dominated by natural and semi-natural habitats, in western and central Europe land is largely dominated by urban development and large-scale intensive agriculture and there are no longer any pristine natural areas. Most of the natural habitats are degraded or disturbed as a result of the proximity of human activity.

Several EU-wide policies aim to exert an influence on the pattern of land use in Europe. These include the common agricultural policy, the structural funds and the policies behind the trans-European networks (TENs) and involve substantial budget expenditure. Since responsibility for land-use planning rests with individual Member States, it has proved difficult to ensure a coherent and sustainable approach to the application of these policies across Europe. Moreover, data relating to land use remain inconsistent. Global Monitoring for Environment and Security (GMES), a joint initiative between the European Space Agency and the European Commission, was launched in 2001 and aims to improve the availability of the territorial dimension of environmental data. The European Commission has also started to develop an Infrastructure for Spatial Information in Europe (INSPIRE).

The European Spatial Development Perspective (ESDP), an EU inter-government initiative in 1997, was a major breakthrough for integrated land-use planning in Europe. However, the EU, while respecting the subsidiarity principle, only recently recognised the need for improved policy coherence and a more sustainable approach to land issues. The sixth environmental action programme (6EAP) and the EU sustainable development strategy, for example, recognise the need for improved policy coherence and a more sustainable approach to land-use planning. The 6EAP includes a commitment to 'promoting best practice with respect to sustainable land use planning' while improved policy coherence is a central theme of the sustainable development strategy. A major challenge for the EU will be to achieve coherence across existing policies with a land-use dimension and also to take into account new initiatives such as the European urban strategy (under development) and the draft Communication on Soil Protection (CEC, 2001).

13.1. Land take due to urban development

Pressures from urbanisation and transport on semi-natural areas Map 13.1.



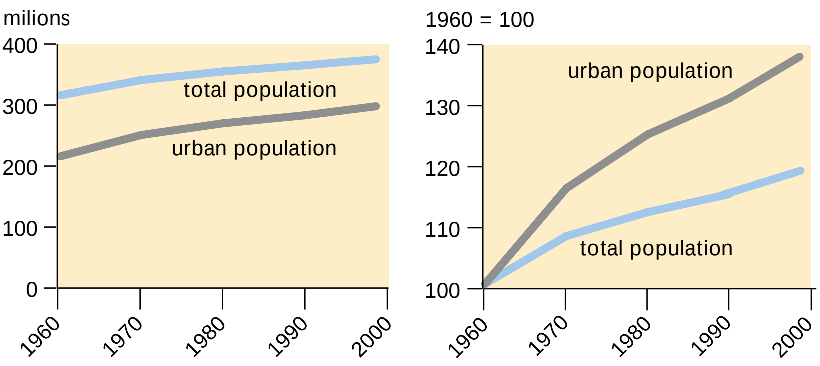
Source: EEA

Urban sprawl is increasing, but there are insufficient data available to enable an assessment of the extent to which the re-use of previously developed land is reducing pressures for development on virgin land.

Quality of information ☆☆☆

http://www.morland.sai.jrc.it
hppt://www.sustainable-cities.org/

Figure 13.1. **Demographic trends, EU**



Source: Eurostat; World Bank

The population of Europe has increased steadily over the past 40 years or so from 315 million in 1960 to 375 million in 1999. Urban populations have increased at twice the overall rate of growth (40 % rather than 20 %). Although population growth in some urban areas has now stabilised, urban development around the periphery of principal urban centres continues, demonstrating a de-centralisation of urban land uses. The increased importance of road transport has stimulated the development of new transport infrastructure and, in particular, increased land take for road development (an average 10 ha of land take per day for new highways during the 1990s). Rising standards of living and increased distances between residential areas and places of employment have contributed to an increase in traffic and the infrastructure needed to accommodate it. At the same time, liberalisation of the EU internal market and globalisation of the economy, and the more complex production and trading networks that they give rise to, have driven the growth in freight transport movements, mainly by road.

In addition, recent decades have witnessed the abandonment of developed land within many cities as a result of industrial decline. This trend, coupled with migration from rural to urban areas over the same period, has led to increased urban expansion, often at the expense of virgin land and green areas.

In Germany, for example, total land take for built-up areas, including transport infrastructure, increased from 350 m² per person in 1950 to 508 m² per person in 1999 and the average area for living increased from 15 m² per person in the 1950 to 38 m² per person in 1995 (Dosch and Beckmann, 2000). These increases may be attributed to changes in values and behaviour as well as population growth. The pattern of low-density expansion of large urban areas into surrounding agricultural and natural areas is defined as urban sprawl, and is illustrated below by the three examples in rural, coastal and mountain environments.

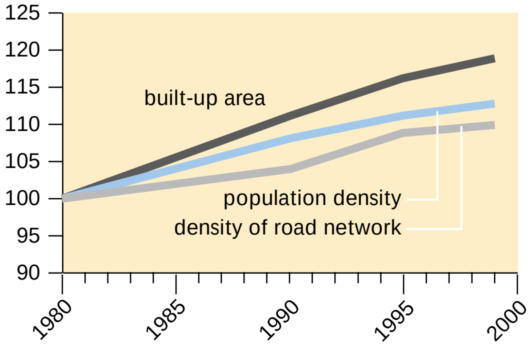
A predominant feature of planning policies for major conurbations in many countries is the concentric evolution of development. Examples of this phenomenon can be seen in London and Paris, where many key services and employment opportunities attract millions of long-distance commuters every day, adding to already high pressures in these areas. A proposal under the European Spatial Development Perspective is to encourage a polycentric evolution of development, whereby dispersed urban areas in a country would be connected to each other to help dissipate pressures across a wider area and revive neglected regions, in particular rural areas.

Sustainable land use in urban areas can be encouraged through targeting development at previously developed sites (‘brownfield’ land) and maintaining and enhancing areas of green space (i.e. the efficient use of land in cities). The Sustainable Cities projects supported by the EU aim at pooling experience and providing guidance to local authorities on achieving sustainable urban development. This initiative, together with Local Agenda 21 initiatives and the new European Urban Strategy (under development), have considerable potential for overlap and the challenge lies in ensuring that a coherent and streamlined approach is developed in order that common objectives are realised and budgets efficiently allocated.

13.2. Soil sealing

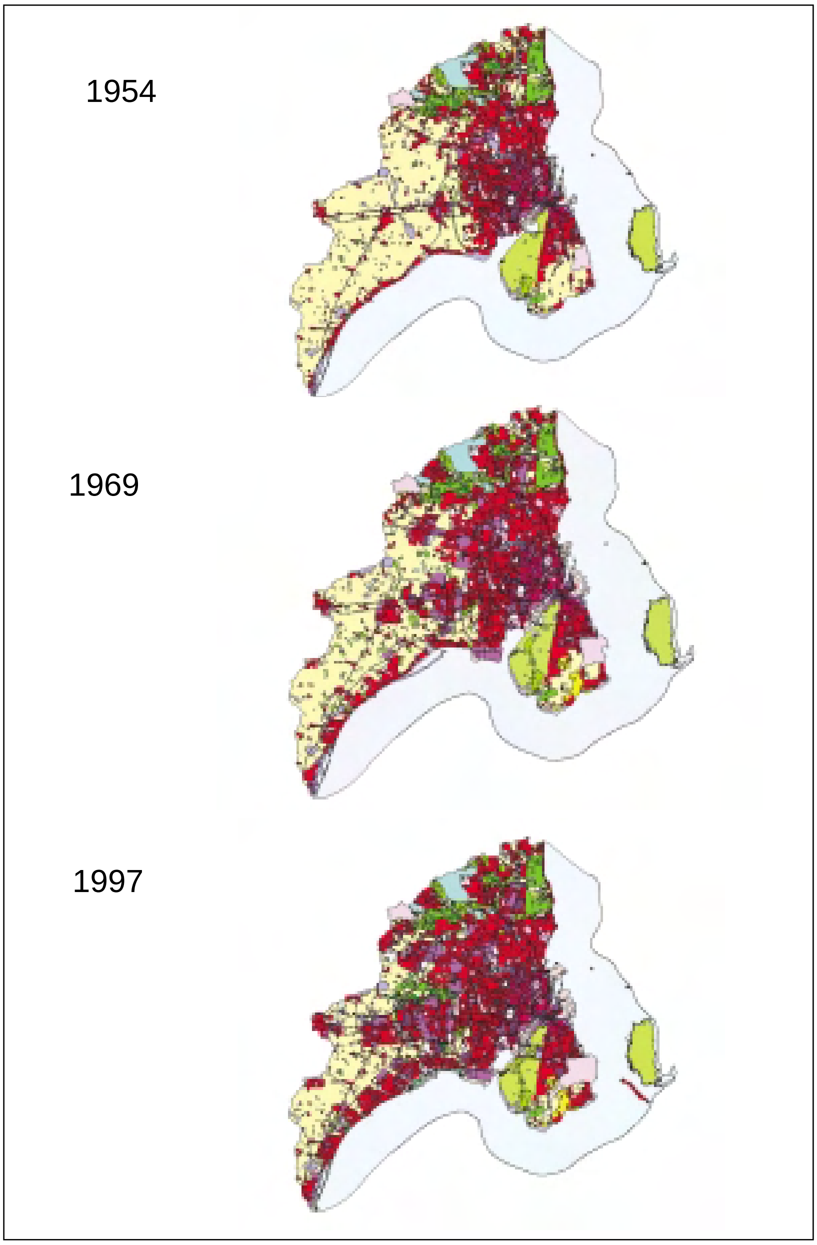
Over the past 20 years the extent of built-up area in many western and eastern European countries has increased by some 20 % and far exceeds the rate of population growth in the EU over the same period (6 %). Due to the lack of precise information, increase in built-up area has been used as a proxy indicator for the amount of soil being sealed and for quantifying land-take by urban expansion.

Built-up area, road network and population increases, selected EEA countries — Figure 13.2.



Notes: Coverage Belgium, Czech, Republic, Denmark, France, Germany, Latvia, Lithuania, The Netherlands, Poland, Slovakia and Spain.
Source: OECD; Eurostat; various national sources

Urban sprawl around Copenhagen — Map 13.2.



- urban fabric
- wetlands
- industrial and commercial areas
- forests and semi-natural areas
- agricultural areas
- water bodies

Notes: Example of urban sprawl along coasts and roads.
Source: JCR - Moland

Soil sealing by built-up areas, as a result of urban sprawl, the construction of transport infrastructure, etc., continues to increase at a faster rate than the population. A decoupling would be desirable instead.

Quality of information ☆

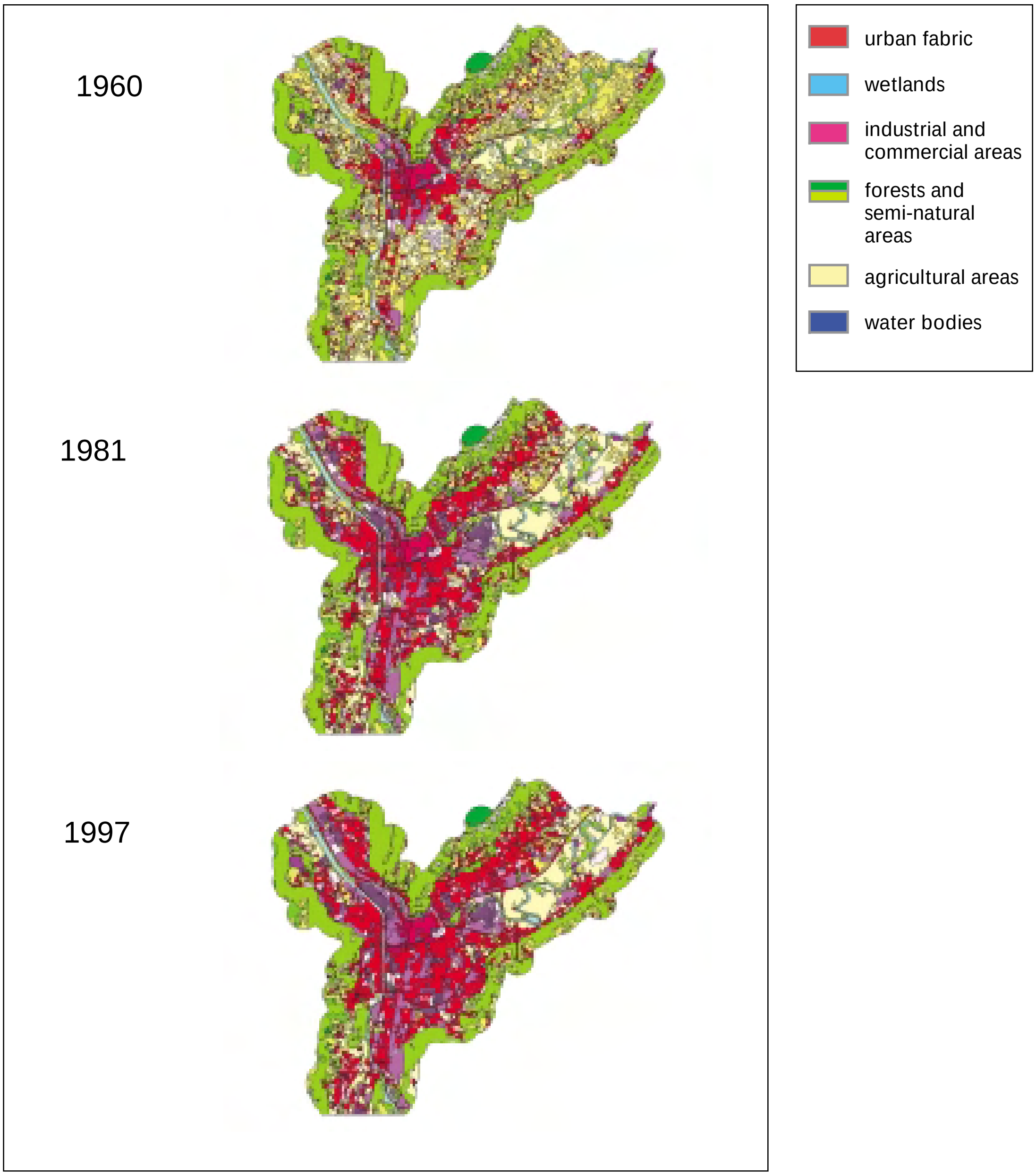
http://www.ubavie.gv.at

Soil sealing refers to the covering of soil as a result of urban development and infrastructure construction; with the result that soil is no longer able to perform the range of functions associated with it. Soil sealing is not adverse per se; rather it is the irreversibility in practical terms of sealing the soil and the consequent loss of soil functions that is significant. It should be noted that built-up areas also include land that is not actually sealed (e.g. gardens and public parks). In Germany, for example, it is estimated that 52.2 % of the soil in built-up areas is actually sealed. However, the impacts of soil sealing go beyond the sealed area and can extend to the surroundings.

Although the geographical coverage of each data set differs substantially, the differences in growth rates are sufficiently large to suggest that the area of built-up land and soil sealing is still increasing at a faster rate than the population. The reasons for this are many, but important ones include increased demand for bigger houses, out-of-town developments like supermarkets and leisure centres, and associated developments of transport infrastructure. In Austria, the yearly increase of soil sealing

Map 13.3. **Urban sprawl around Grenoble**

Notes: Example of urban sprawl along valleys.
Source: JCR- Moland

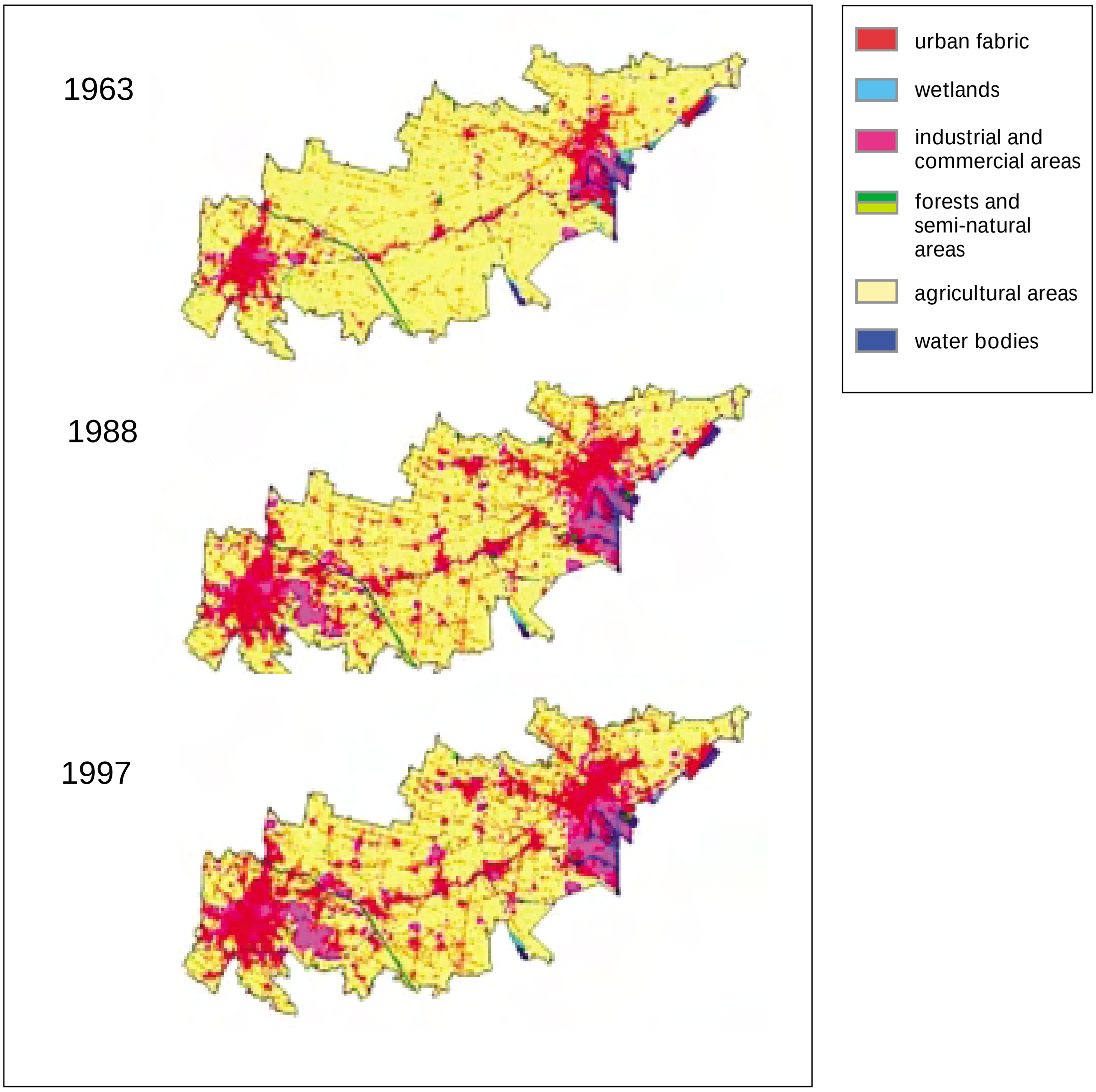


is estimated at 7 to 12 m² per person. For the city of Vienna, it is estimated that, compared to 1 m² of sealed surface for a pedestrian, a biker is needs 7.7 m²/person, public transport between 12 and 17.6 m²/person and a car driver 60 m²/person (UBA, 2001).

Developments in soil sealing are largely determined by spatial planning strategies where unfortunately the effects of irreplaceable soil losses are often not sufficiently taken into account. There is a lack of Europe-wide information. Data on the extent of built-up areas are only available for a limited number of countries and many of these data are not comparable since countries use different methodologies (EEA, 2000). There is also no information about the type of soil being sealed.

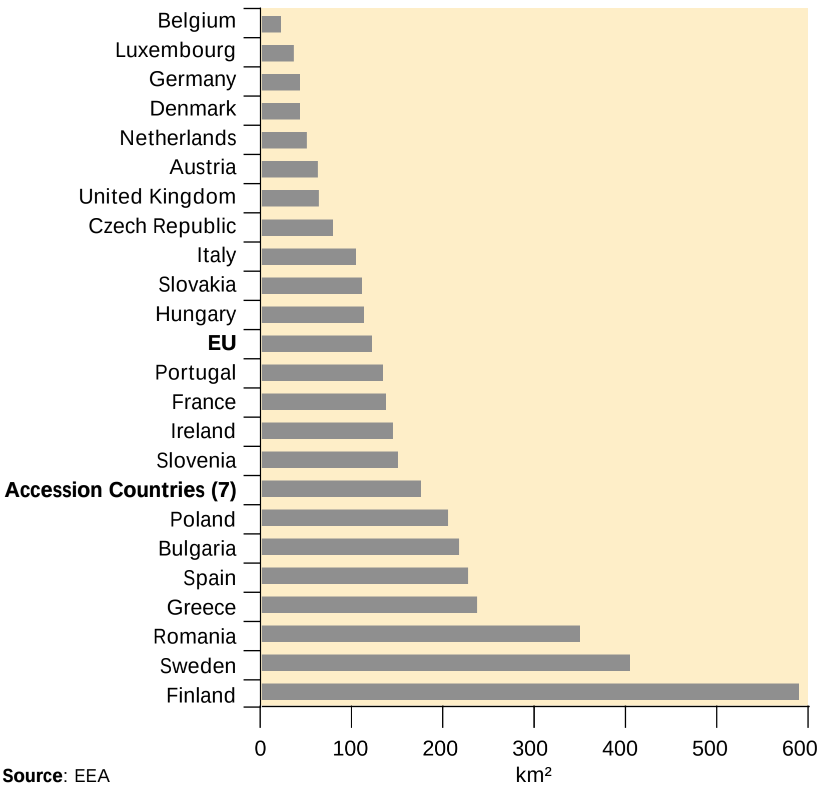
Some decrease in soil availability is inevitable, but if the sealed soil plays a valuable role in food production, nature conservation, recharge of water resources, flood control or any other key function, then the consequences of sealing are damaging to sustainable development.

Urban sprawl between Padua and Venice Map 13.4.



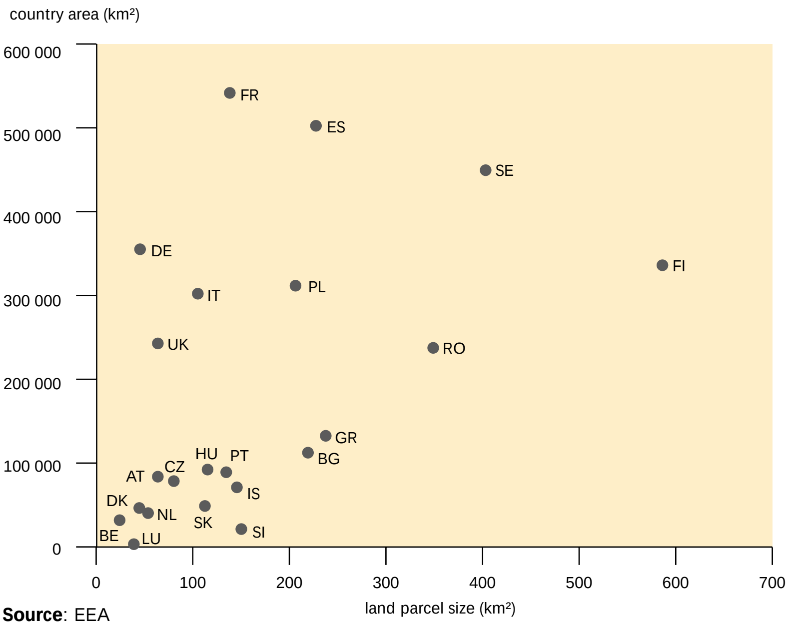
Notes: Example of urban sprawl in rural landscapes.
Source: JCR - Moland

Figure 13.3. **Average size of land parcels, EU and selected Accession countries**



Source: EEA

Figure 13.4. **Average size of land parcels versus total country area, EU and selected Accession countries**



Source: EEA

13.3. Fragmentation and partitioning of habitats by transport infrastructure

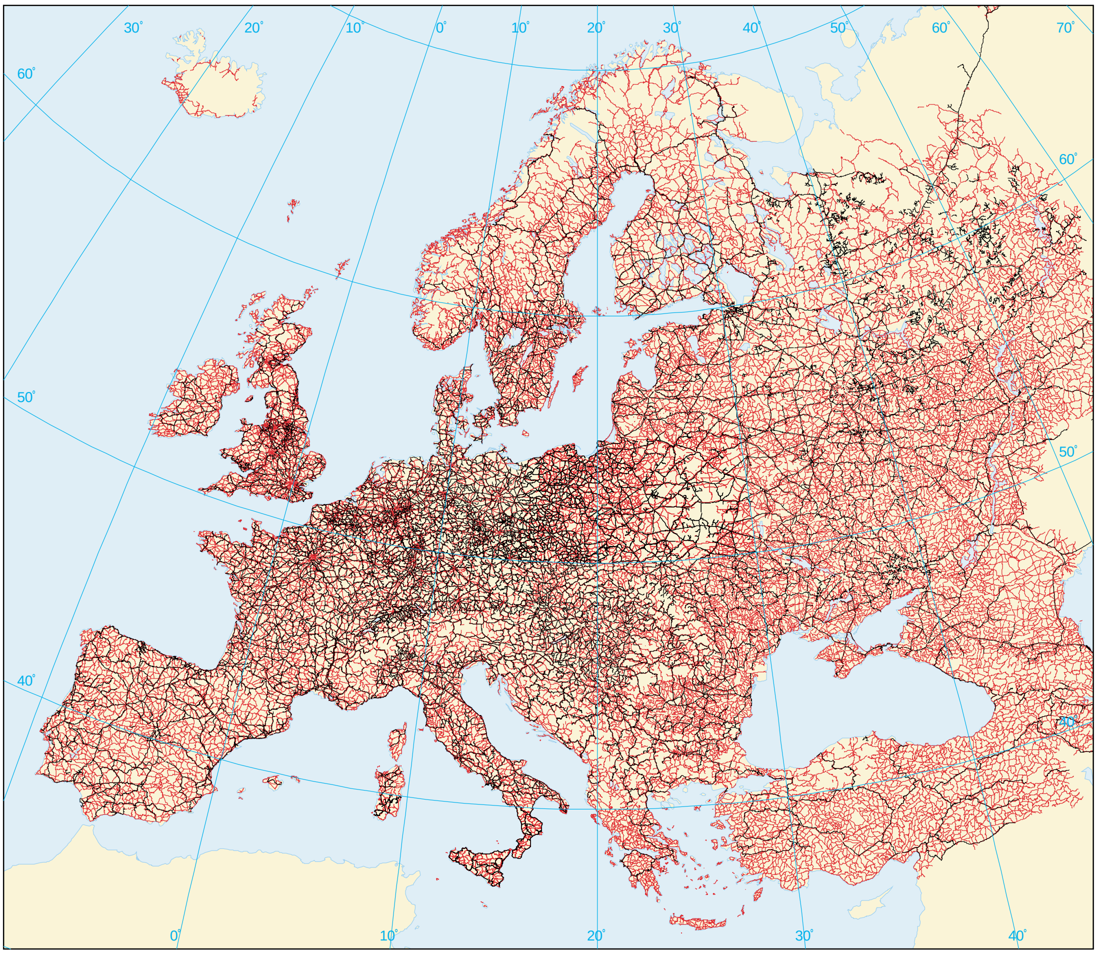
The construction of transport infrastructure (e.g. roads and railways) can lead to the fragmentation of natural or semi-natural areas, which can reduce the resilience of biotopes and their capacity to host wild species. This, in turn, can disrupt the movement of species (e.g. through the elimination of 'wildlife corridors') and reduce the capacity of the habitat to maintain viable resident species populations. Most areas of the EU are highly fragmented as a result of development. For example, the average size of continuous land units that are not dissected by major roads ranges from around 20 km² in Belgium to nearly 600 km² in Finland, with an EU average of about 130 km² (see Environmental signals 2001, Chapter Transport).

Large transport networks have developed rapidly in recent decades. Several factors point to the continuation of this process. For example, in some areas where access to services is at a premium, problems of congestion may lead to more road building, reflecting the lack of balanced modal split for both passenger and freight transport (see Chapter 4). EU enlargement and the integration of new countries into the common market will increase the movement of people and the transport of goods. The need for increased cohesion across Europe suggests that more infrastructure will be built to ensure that peripheral regions are adequately connected with the centre.

The development of transport infrastructures has negative effects on the natural and rural landscape both locally and more widely. Locally, traffic noise on major routes affects the health of citizens as well as the wild fauna. Intensive use of herbicides alongside highways and train lines creates local problems of contamination. The land taken by infrastructures also contributes to soil sealing (see section 13.2).

Natura 2000 is the EU's principal policy instrument for ensuring the conservation of valuable European habitats and comprises a network of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) (see Chapter 14). To ensure the continuing protection of these habitats, the objectives of Natura 2000 must be reconciled with those of other policy areas that have a land-use dimension. In particular, the balanced and polycentric development proposed by the European Spatial Development Perspective should be fully integrated with the objective of sectoral policies for transport and agriculture as well as the environmental objectives of Natura 2000.

Footprint of transport infrastructure Map 13.5.



roads
railroads

Source: EEA

Most areas of the EU are highly fragmented and this has negative implications for biodiversity. Transport infrastructure is a major cause of fragmentation and transport policies should be reconciled with conservation policies.

Quality of information ☆☆

http://themes.eea.eu.int/Sectors_and_activities/transport/indicators/consequences/fragmentation/index_html

14. Forest

policy issue	indicator	assessment
influence of land-use policy	total forest area and 'naturalness'	
sustainability of wood production	annual fellings and increment of growing stock	
reducing impacts of forestry	origin and impacts of tree planting material	
reducing pollution stress, and other impacts, on forest ecosystems	forest condition	
conserving biodiversity	threatened forest species and protection of forest habitats	
- " -	level of protection of forests	

The area of forests in EU and Accession Countries is increasing and annual fellings are considerably lower than what is required for sustainable wood production. However, while not a major contributor to total tree planting in Europe, non-native species are extensively used in some countries and their environmental effects need to be better evaluated.

The condition of European forests deteriorated continuously between 1986 and 1995, as shown by the defoliation of trees in the large UNECE ICP Forest monitoring programme. Conditions subsequently stabilised at a high level of damage, with almost a quarter of sample trees damaged.

Europe's forest biodiversity is under pressure, with a significant proportion of the protected species and habitats under European Directives being forest-related. These Directives also prescribe clear responsibilities for conserving threatened species, as well as 59 specific forest habitat types, providing the framework for the progressive protection of forests.

Most of the European land area is potentially forest. Since prehistoric times, European forests have been cleared for agriculture, including grazing by livestock, resulting in large areas with no or only fragmented forests. The industrial exploitation of forests in the late 1800s for timber (and later pulp) created, in many European countries, a general concern about the sustainability of the wood resource, which resulted in a number of National Forest Laws during the 1900s. More recently these Forest Laws are being developed into a framework of general resource management, also including biodiversity.

The fragmentation of forests by agricultural clearing has been exacerbated by land take for urban development and infrastructure (see chapter 13), as well as by large-scale and repeated fires in Mediterranean regions. In addition, human activity has utilised most of the remaining forest. In the late 1990s, this trend was partly reversed by afforestation and spontaneous regrowth on former agricultural land.

Long-range atmospheric pollution (see chapter 10) was recognised as a new major threat to European forests in the 1980s and 1990s, as large-scale crown damage and even total die-off of stands was noted. Climate change will cause long-term effects on forest ecosystems, but may also result in short-term effects, such as those resulting from the creation of carbon sinks as mitigation measures (see chapter 9).

Forests are a key repository of biological diversity and the species, communities and ecosystems they form play a central role in the functioning of the biosphere. On the political arena, a global concern for the loss of biodiversity was introduced at the UN Conference on Environment and Development in Rio 1992. Forestry and biodiversity issues were among the priorities, resulting inter alia in the Convention on Biological Diversity, the Forest Principles and a forest component of Agenda 21. In Europe, activities to implement these commitments have resulted, for example, in the 'Environment for Europe' process endorsed by the Environment Ministers and the Ministerial Conferences for Protection of Forests in Europe (MCPFE) set up by the Forest Ministers.

MCPFE has developed a set of *Pan-European Criteria, Indicators and Operational Level Guidelines for Sustainable Forest Management*, which also are implemented in current certification schemes. The EU has implemented these concerns in, for example, the Habitats Directive (92/43/EEC), the Community Forestry Strategy and Community Biodiversity Strategy and, most recently, the Biodiversity Action Plans. If all the existing instruments are adequately implemented, the biodiversity of European forests has a potential to recover.

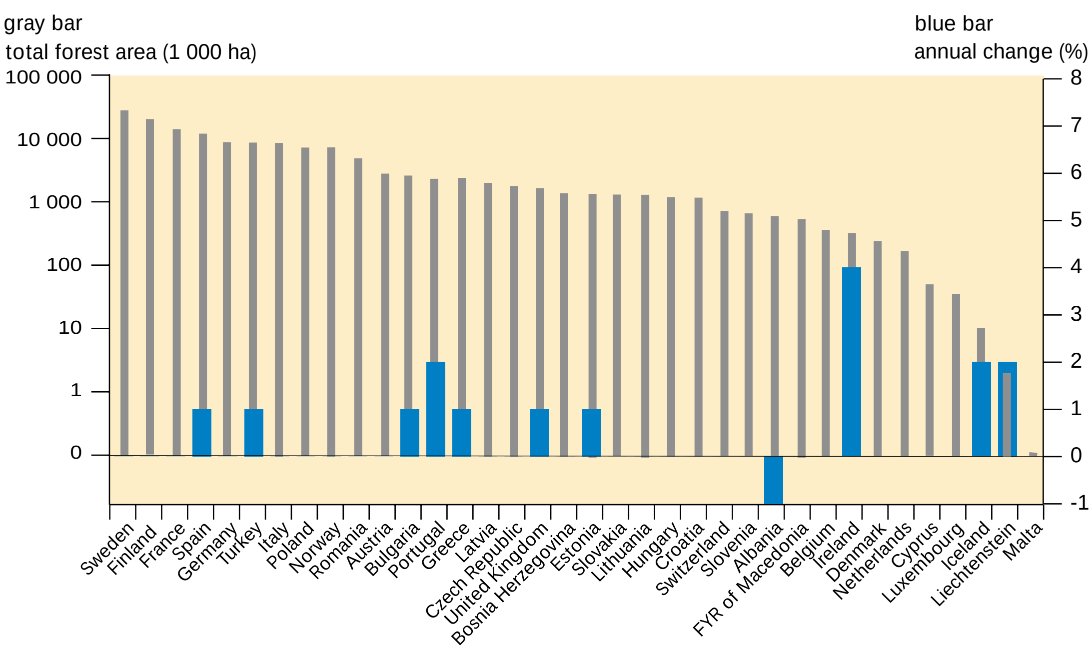
Pan-European Forest Certification (PEFC)

The Pan European Forest Certification (PEFC) Council was launched in June 1999. The PEFC scheme, a voluntary private-sector initiative, aims to provide assurance to the customers of woodland owners that the products they buy come from independently certified forests managed according to the Pan European Criteria as defined by the resolutions of the Helsinki and Lisbon Ministerial Conferences of 1993 and 1998 on the Protection of Forests in Europe. The following European countries are currently members of the PEFC council: Austria, Belgium, Czech Republic, Denmark, France, Finland, Germany, Ireland, Italy, Latvia, Norway, Portugal, Spain, Sweden, Switzerland and the UK.

The purpose of the PEFC scheme is to promote an internationally-credible framework for forest certification schemes and initiatives in European countries, in the first instance, which will facilitate mutual recognition of such schemes. The PEFC Technical Document and Statutes define the basic requirements of forest certification and the set-up of institutional arrangements at Pan-European and national and sub-national levels. Timber from certified forests that meet the PEFC criteria and requirements have access to the PEFC logo.

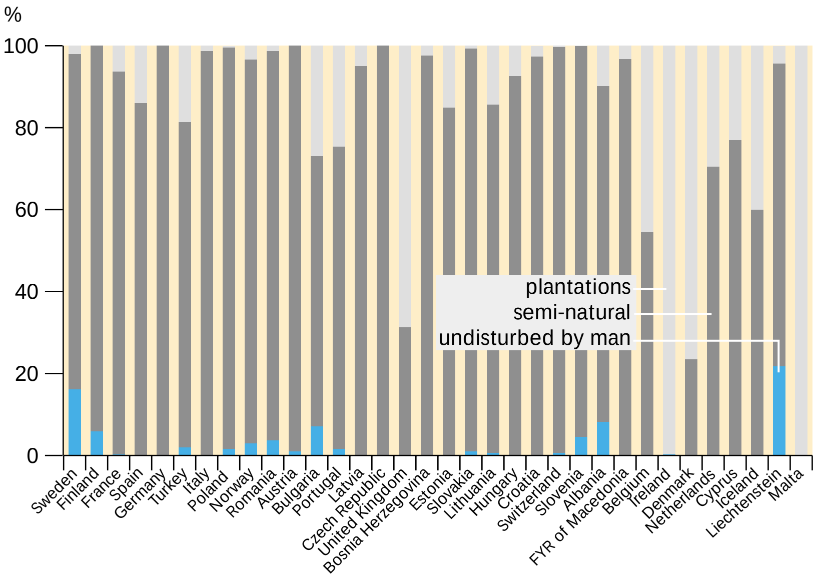
Source: www.pefc.org

Annual change in total forest area Figure 14.1



Notes: Calculation of annual change is based upon two reference periods; most countries compared data for a period of 1-5 years in mid-late 1990s with an earlier reference period that was generally 5-10 years before.
Source: TBFRA, 2000

Figure 14.2. **Forest land in categories of 'naturalness'**



Notes: Categories defined by TBFRA (2000), but country differences in interpretation exist. No data available for Greece and Luxembourg. Country order according to total forest area.
Source: TBFRA, 2000

The area of forest in EU and Accession Countries is increasing, however, the benefits of afforestation must be evaluated against resulting gains and losses in biodiversity.

Quality of information ☆☆

http://www.unece.org/unece/trade/timber/fra/pdf/contents.htm

14.1. Total forest area and 'naturalness'

The average annual increase in forest area in the EU and Accession Countries amounted to approximately 0.5 million ha / year (18 % as aggregate annual change), with the Mediterranean countries, in particular Spain, France, Portugal, Turkey, Greece and Italy, reporting the largest increase in absolute area (6.8 % as aggregate annual change). In these countries a large-scale conversion of other wooded or agricultural land to forest is taking place, either actively by afforestation / planting programmes or by decreasing grazing pressure and thus allowing regrowth through natural succession. The countries with the largest relative increase in forest area (between 2 and 4 %) are Portugal, Iceland and Ireland. Only Albania and Belgium reported a slight decrease in forest area (8000 and 1000 ha / year respectively, -0.6 and -0.2 % in relative terms).

However, increased afforestation is not always positive for biodiversity, depending on the structure and composition of the newly created forests as well the management regime envisaged. Furthermore, in Mediterranean countries, as well as in mountainous areas, afforestation often results in a reduction of biodiversity-rich grasslands. The effects of this need to be balanced against the potential long-term gains of biodiversity related to the newly created forests.

Most of the forest area (90 %) is classified as 'semi-natural', with the remaining 6 % classified as plantations. Countries with considerable proportions of plantations of their total forest area are Ireland, Denmark, the UK and Malta. The proportion of forest undisturbed by man in the majority of countries averages between zero and 1 %, with most of the undisturbed forests being located in Sweden and Finland (5.5 million ha). Other countries reporting important remnants of undisturbed forests include Bulgaria, Norway, Romania and Turkey. Outside the Nordic countries, these remnants tend to be small, but are highly valuable for their ecological richness.

14.2. Annual fellings and increment of growing stock

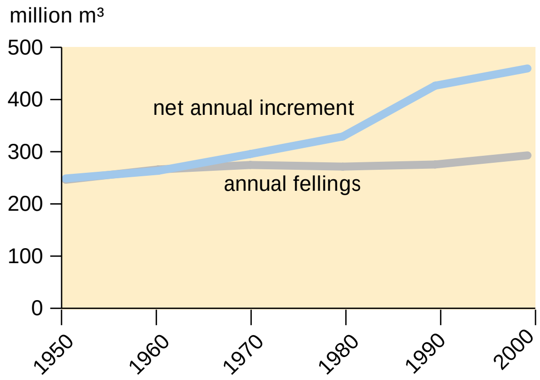
The ratio of annual fellings to annual increment of the growing stock of forests has for decades been used as a measure of the sustainability of forestry with respect to the overall wood resource. Nearly 90 % of the annual increment is potentially available for wood supply in the EU and accession countries. In some countries the share of the increment reaches 99-100 % (e.g. Belgium, Denmark, France, Ireland, Luxembourg and the UK). These figures reflect a low percentage of forests exempt from forest management, as well as the long history of silvicultural traditions in Europe.

With the exception of Cyprus, actual fellings remained below the sustainability level set by the increment of growing stock. For the EU and Accession Countries overall, average annual fellings are only 60% of the net annual increment of the growing stock for forest available for wood supply.

For the EU, long time-series data show only a slight increase for annual fellings, while the annual increment increased steadily after the 1960s. There are several reasons that may contribute to this:

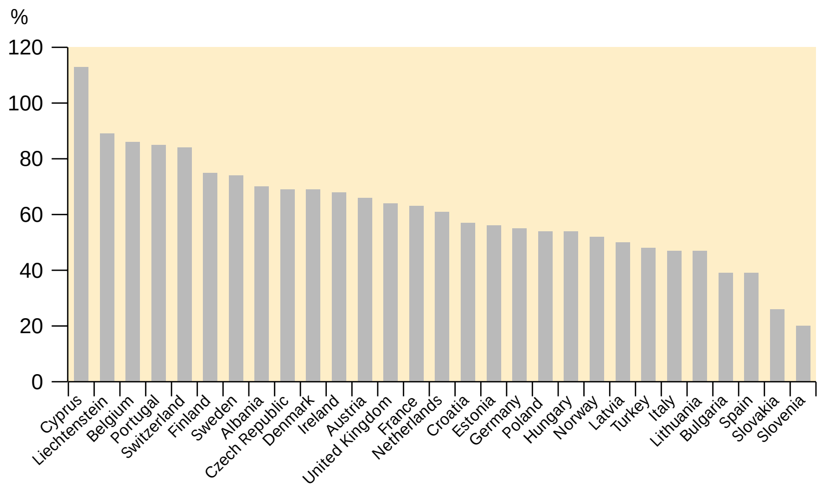
- forest management modifying the forest structure by altering the density of the stands, the distribution of age classes, the tree species composition, active regeneration measures and shortening of rotation periods;
- intensification measures like drainage of peatlands and wet forest or fertilisation;
- environmental changes, in particular the deposition of nitrogen;
- methodological aspects behind the presented data, such as changed definitions applied to increment, forest area or growing stock. More accurate measurement methods over time can also be responsible for altering the increment figures.

Net annual increment and annual fellings, EU Figure 14.3.



Notes: No data available for annual fellings in 2000 for Greece and Luxembourg
Source: Kuusela, 1994; TBFRA, 2000

Annual fellings as percentage of annual increment of growing stock Figure 14.4.



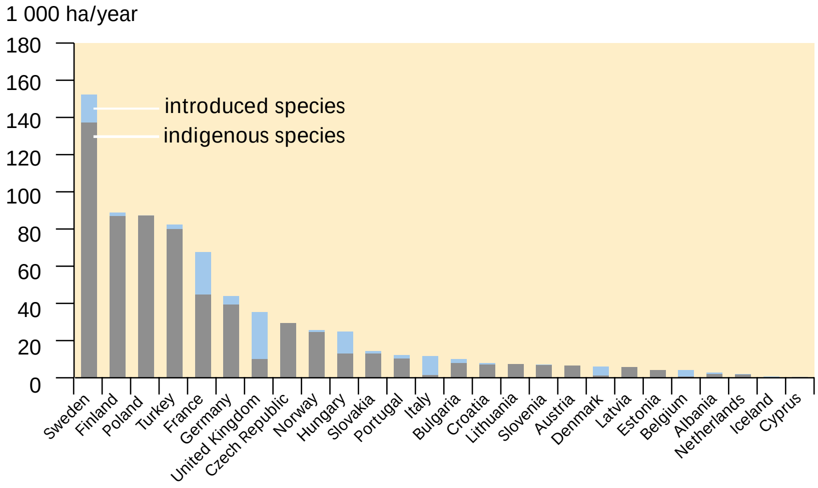
Notes: Year of data assessment varies between countries (1986-1996). No data available for Bosnia-Herzegovina, Greece, Luxembourg, Malta, Romania and the FYROM. Annual fellings do not include annual fellings of natural losses where countries have reported this figure.
Source: TBFRA, 2000

Overall, the sustainability of wood production in the EU and Accession Countries is indicated by the fact that annual fellings represent only approximately 60 % of the net annual increment of the growing stock for forest available for wood supply. Reasons for the steady increase in net annual increment since the 1960s include improved management and draining, and nitrogen deposition.

Quality of information ☆☆

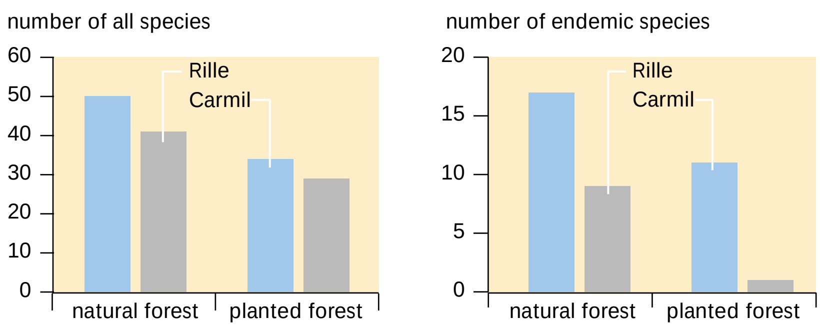
http://www.unece.org/unece/trade/timber/fra/pdf/contents.htm
http://www.efi.fi/efidas/

Figure 14.5. **Origin of tree planting material**



Note: Other countries that are also known to use introduced tree species, such as Ireland, Spain and Malta, are not included in the data set.
Source: TBFRA, 2000

Figure 14.6. **Richness of insects in forest soils**



Notes: This case study illustrates the effects of introducing new tree species on Collembolan species richness in soils of native beech forest versus conifer plantations in Ariège Pyrenees. The group of Collembola insects is a very important component of soil biodiversity. They play a major role in the breakdown of litter, soil constitution and structure. Comparison between forest stands in two different sites surveyed, Carmil and Rille in the French Pyrenees, show the same trends.
Source: Deharveng, 1996

With noticeable exceptions, forests in the EU Accession Countries are planted mainly with indigenous species. The effects on biodiversity of introducing non-native tree species need to be better evaluated.

Quality of information ☆☆

http://www.unece.org/unece/trade/timber/fra/pdf/contents.htm

14.3. Origin and impacts of tree planting material

The vast majority of forest planting in the EU and Accession Countries uses indigenous tree species. However, in some counties the use of introduced species is more common (e.g. Belgium, Denmark and the UK). France, Germany, Hungary and Sweden use planting material of both native and introduced origin.

Introduced, non-native, species commonly used for plantations in Europe include conifers like *Picea sitchensis* and *Pinus contorta* and deciduous trees such as *Eucalyptu* and *Populus* species. Only a few of the introduced tree species used so far in Europe have been shown to be invasive and / or harm the original biodiversity. A study in the Pyrenees of the effects of introduced species on soil biodiversity, for example, showed a decrease in species diversity of the soil Collembola in the planted pine stands compared to native beech forest. The effect on endemic species was particularly dramatic.

Several studies have been performed on bird communities. In Portugal, Eucalyptus plantations have been shown to have impoverished bird communities compared to those in native stands, while the changes were shown to be more complex in *Pice sitchensis* plantations in Ireland (Dias et al., 2000; O'Halloran et al., 1998; Rego, 2001). In northern Sweden, introduced *Pinus contorta* was compared to native Scots pine, using the Pied Flycatcher as an indicator. No change in population sizes was recorded, but other population parameters related to reproductive success were significantly lower in the plantations with introduced pine (Sjoberg et al., 1993).

From these case studies, it appears that to avoid unwanted changes in biodiversity, every introduction of non-native forest tree species needs to be carefully assessed with respect to biodiversity effects and evaluated taking into account potential risks. Long-term research and monitoring is needed to better understand the effects of non-native species.

14.4. Forest condition

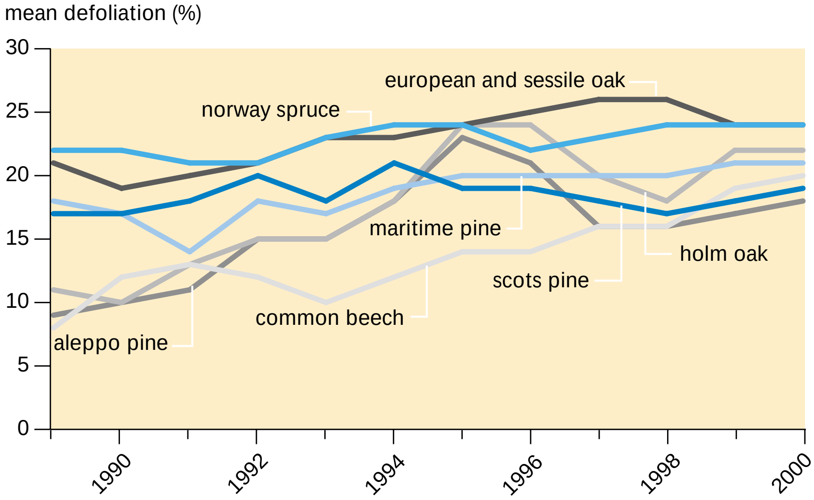
For 15 years, the conditions of European forests have been under close observation by one of the world's largest biomonitoring systems run by ICP Forests - the International Co-operation Programme on Assessment and Monitoring of Air Pollution Effects on Forests operating under the United Nations Economic Commission for Europe (UNECE).

European forests showed a continuous deterioration in condition between 1986 to 1995, as indicated by crown condition. Results since 1995 show a stabilisation at a high level of damage, with almost a quarter of the sample trees rated as damaged in 2001. Improving trends during recent years were identified in the Mountainous North, Temperate Boreal and Subatlantic regions. The sharp increase in the observed damage in the Continental region may be explained mainly by weather extremes. Local experts have linked the alarming increase in the Atlantic South region to, for example, forest fires.

An earlier recorded improvement in defoliation of the Scots pine starting in 1994 has reversed since 1998. This is mainly due to a slight worsening of the conditions in the Continental, Mountainous South and Atlantic North Climatic regions. Mean defoliation of Norway spruce, as well as of European and sessile oaks, has fluctuated at a high level of damage during the past decade. An alarming increase in the number of trees in defoliation classes 2 to 4 (defoliation >25 %) occurred in the Atlantic South region, mostly Spain. This applies to all the common tree species recorded. Local experts link this defoliation with forest fires and fellings, partly in connection with construction measures.

The most important causes of damage include weather extremes, insects and fungi, and air pollution. Nitrogen deposition (median of 14 kg per year per hectare at 309 plots) is now greater than sulphur deposition (9 kg per year per hectare), with higher deposition in western than in northern or southern European forest ecosystems. Both substances cause changes in the acidity of soils and thus influence the uptake of minerals by trees. Acid deposition can cause direct damage to leaves and needles. High nitrogen deposition in European forests results in trees becoming more susceptible to extreme weather conditions and insect attacks. Current ozone concentrations (see section 10.6), notably in southern Europe, have been shown to reduce tree growth, cause visible leaf injury and affect semi-natural vegetation.

Development of mean defoliation for European main tree species Figure 14.7.



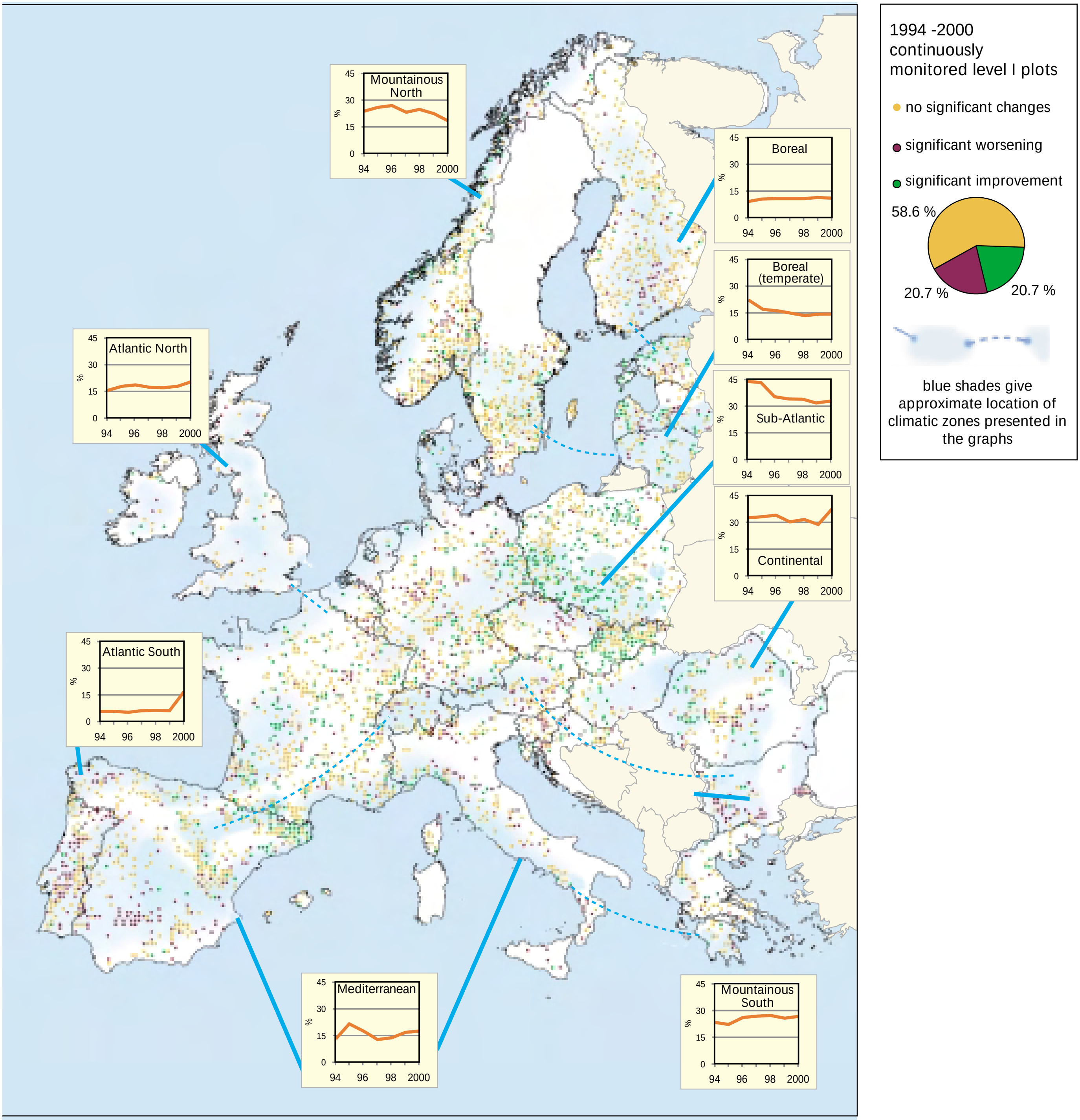
Source: UNECE and European Commission, 2001

European forests showed a continuous deterioration in condition between 1986 and 1995, using crown condition as an indicator. Results since 1995 show a stabilisation at a high level of damage, with almost a quarter of the sample trees rated as damaged.

Quality of information ☆☆☆

www.icp-forests.org

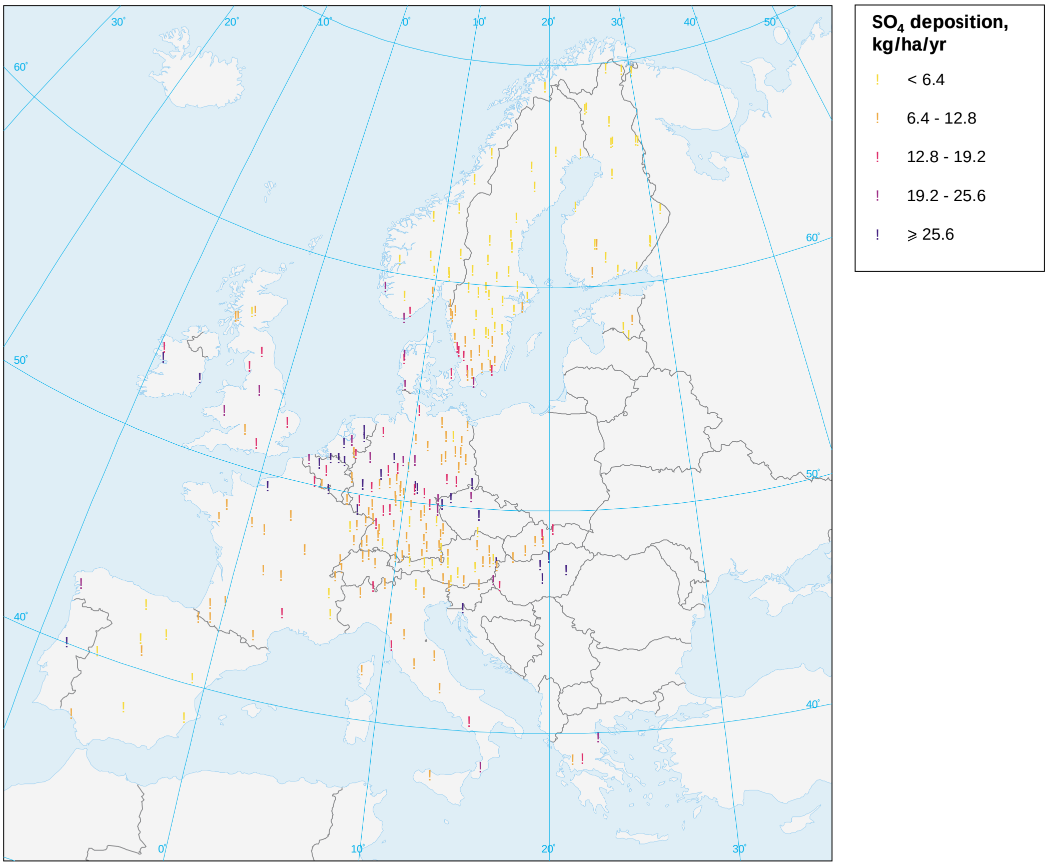
Map 14.1. Changes in defoliation of main tree species, 1994-2000



Source: UNECE and European Commission, 2001

Average total deposition of sulphate, 1995-1998

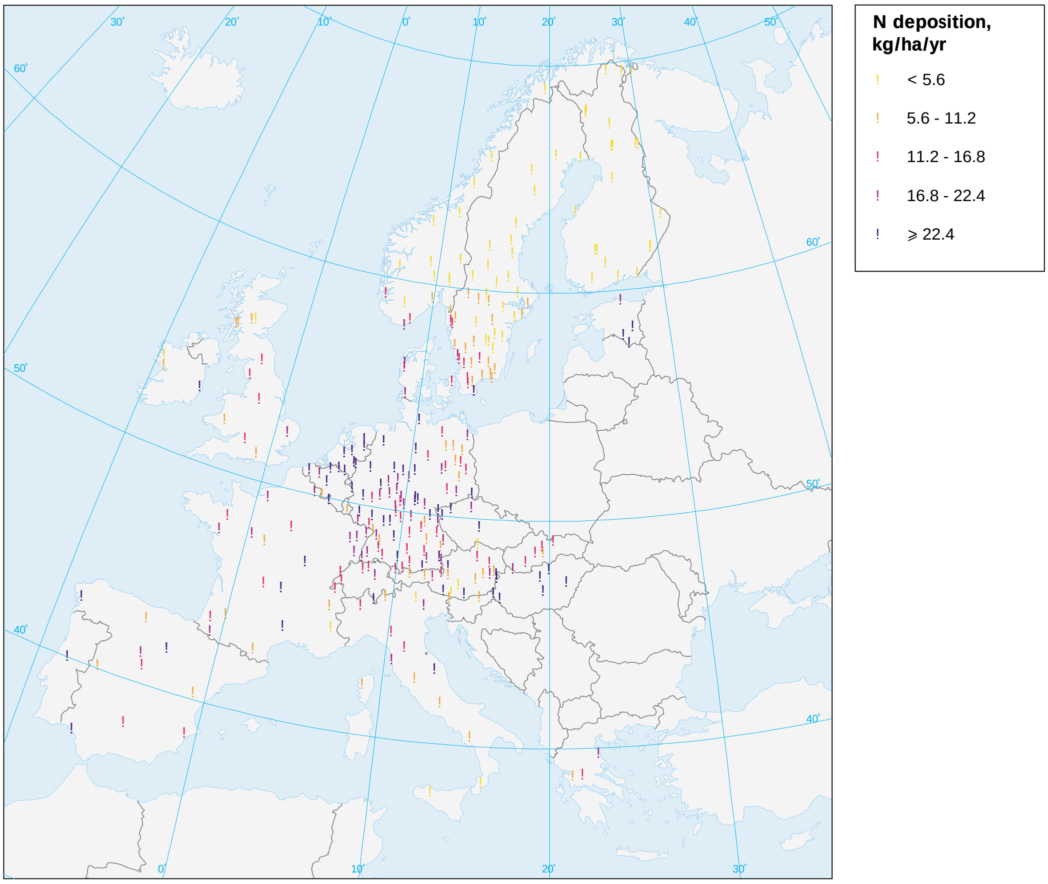
Map 14.2.



Notes: At 309 intensive monitoring plots.
Source: UNECE and European Commission, 2001

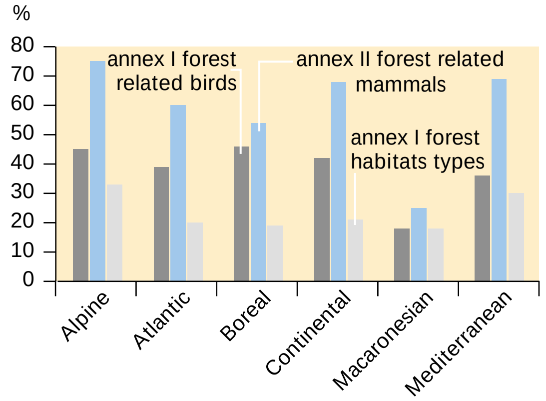
Average total deposition of nitrogen, 1995-1998

Map 14.3.



Notes: At 309 intensive monitoring plots.
Source: UNECE and European Commission, 2001

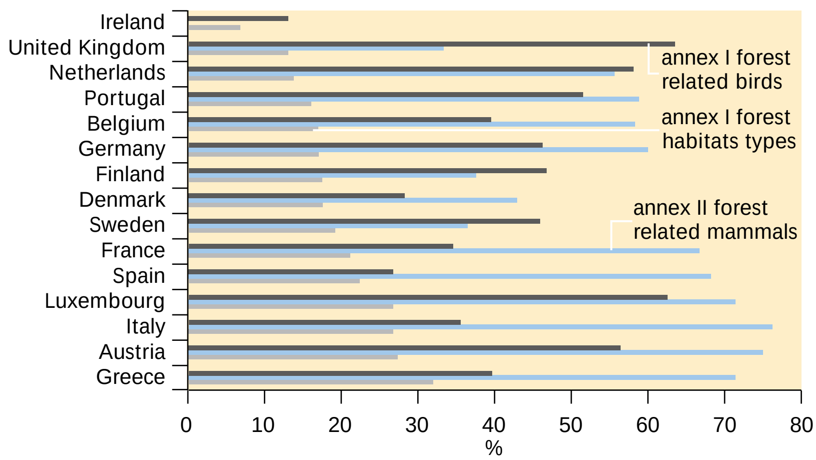
Figure 14.8. **Proportion of forest-related species and habitats of European concern in relation to all species and habitats of EC Directives per biogeographic region**



Note: For details of biogeographical regions see http://www.europa.eu.int/comm/environment/nature/map.htm. The proportion of forest-related species and habitats of European concern varies according to the biogeographical context. Annex II mammals related to forests are dominant in most biogeographic regions (except Macaronesia), while the situation for birds and habitats is more varied. It is interesting to note that, in proportion, the number of Annex I forest-related habitats in the Boreal region is quite low, which means that there is a significant number of other habitats of European concern are present in this region, for instance coastal habitats and wetlands. In contrast, up to 30 % of habitats of European concern present in the Alpine and the Mediterranean regions are forest-habitat types. Responsibility for the conservation of these species and habitats is shared differently within EU countries, Portugal and Spain having, for instance, a special responsibility for priority forest-related bird species.

Source: EEA

Figure 14.9. **Proportion of forest-related species and habitats of European concern in relation to all species and habitats of EC Directives per EU Member State**



Source: EEA

While forest biodiversity is still under threat, EU Directives prescribe clear responsibilities for conservation of forest species and habitats.

Quality of information ☆☆☆

http://europa.eu.int/comm/environment/nature

14.5. Threatened forest species and protection of forest habitats and species

Europe's forests, which are under threat from a variety of sources, are an important biodiversity resource. At the pan-European level, 40 % of threatened bryophytes (mosses, liverworts and hornworts) and 30 % of breeding bird species that are considered to have an unfavourable status are forest-related. Large carnivores, whose populations have been declining in several European countries over recent decades (e.g. bear, lynx, wolf, wolverine), are very dependant on forests. Invertebrates, including insects associated with dead wood and soils, are a major component of forests biodiversity and biomass, however, it is more difficult to assess their decline.

Specific actions have been taken for species and habitats of special European concern. This is being done through the Bern Convention at the Pan-European level and EU legislation. Under the Bird Directive, EU countries that host bird species listed in Annex I of this Directive have to designate Special Protection Areas (SPAs) in order to ensure their 'favourable conservation status'. Under the Habitats Directive they have to designate Special Areas of Conservation (SACs) for habitats listed in Annex I and species listed in Annex II. SPAs and SACs will constitute the NATURA 2000 network. Forests are important for protected species and habitats, for example:

- out of 181 bird species listed in Annex I of the Bird Directive, 65 are forest-related (36 %), of which seven are considered a priority;
- out of 41 mammal species listed in Annex II of the Habitat Directive, 25 are forest-related, of which eight are considered a priority;
- out of 198 habitat-types listed in Annex I of the Habitat-Directive, 59 are forest-types (30 %), of which 21 are considered a priority.

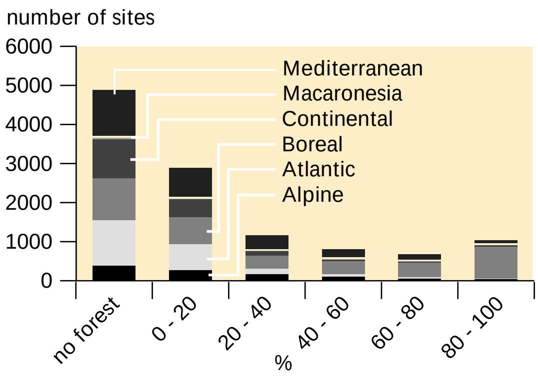
14.6. Level of protection of forests

Protection of forests is part of a growing number of regulations, initiatives and programmes, at the national, European and international level. At the pan-European level, protection of forests for biodiversity purposes is a key aspect of the Pan-European Process on the Protection of Forests in Europe. At the EU level, the Habitats Directive (92/43/EEC) takes into account conservation of forest biodiversity. To date, the number of sites proposed for one or more of the 59 specific forest habitat types listed in Annex I of the Habitat Directive is around 7 800, of which around 5 300 include priority forest habitat types. The importance of forest cover in sites proposed under the Habitat Directive varies depending on the biogeographic context. For example, forests are a very important component of proposed sites in the Boreal region, however they are less important in the Alpine and the Mediterranean regions.

In the Macaronesian region, the low percentage of forest area in the sites proposed is due partly to the importance of the marine area, which represents 35 % of the total surface area. In this region, forests include endemic types such as the Canary Island pine forest and the Macaronesian laurel woodland, both extremely rich in floral and faunal species, many of which are endemic in this part of the world.

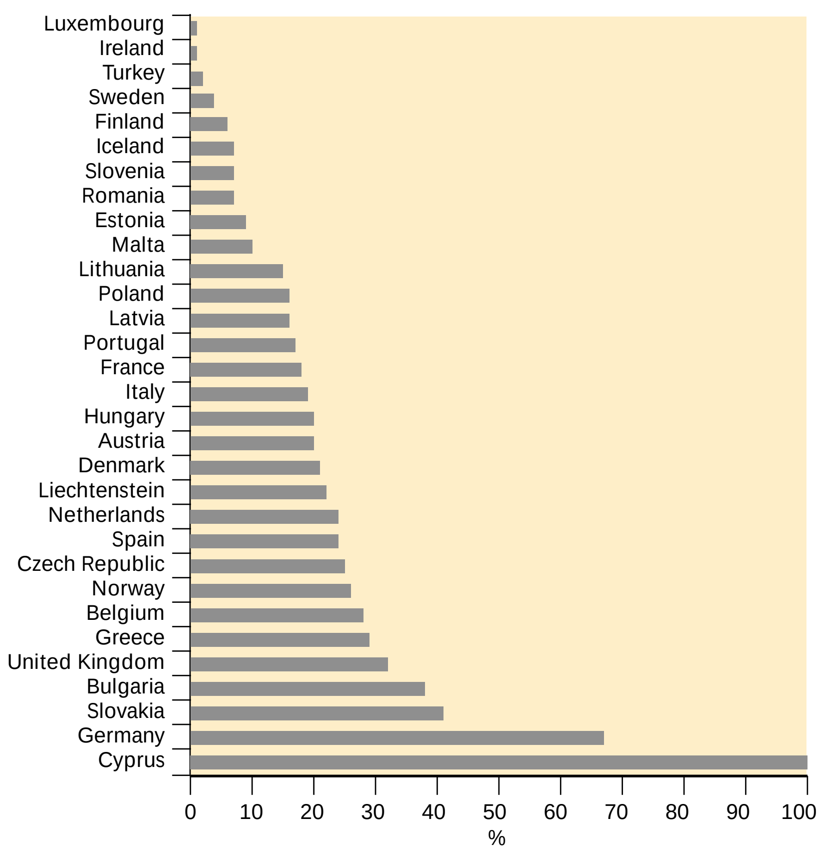
Many sites to be designated as part of the NATURA 2000 network already have a protection status at the national level, with specific national designations types such as ‘national parks’, ‘nature reserves’ and ‘strict forest reserves’. A joint programme between EEA, Council of Europe and UNEP-WCMC is currently producing an inventory of these designations types. For protected forests, a preliminary assessment is given in TBFRA, 2000.

Forest cover in sites proposed under the Habitats Directive within biogeographical regions Figure 14.10.



Note: For details of biogeographical regions see http://europa.eu.int/comm/environment/nature/map.htm.
Source: EEA

Forest area protected in Europe Figure 14.11.



Source: TBFRA, 2000

Progressive protection of forests is taking shape.

Quality of information ☆☆

http://www.europa.eu.int/comm/environment/nature/natura.htm

15. Environmental taxes

policy issue	indicator	assessment
reflecting full environmental costs in market prices	revenue from environmental taxes	😐
introducing ecological tax reform	ratio of revenue from environmental taxes to revenue from other taxes	😐
use of environmental taxes	introduction of environmental taxes	🙂
effectiveness of taxes	some indications of effectiveness	😐

The proportion of tax revenue derived from environmental taxes grew slowly in the decade to 1995, but has since levelled off. Pollution and resource tax revenues tend to have grown more than average, but still contribute a very small share. Revenue from transport taxes has remained more or less constant. The overall share of revenue from environmental taxes in total revenue from taxes and social contributions varies between Member States, ranging between 5 % and 10 %.

The share of total revenue from labour taxes has remained more or less constant in recent years. A shift of taxes away from labour onto the environment is one of the elements of ecological tax reform, and can benefit both environmental quality and employment. Several countries have started the process of ecological tax reform; most of these have applied carbon dioxide taxes, which now operate in half of EU Member States. While some of these taxes are effective, their impact remains relatively small. Overall, many new tax systems appeared in the second half of the 1990s.

Environmental taxes can be defined as compulsory payments levied on tax bases deemed to be of particular environmental relevance (OECD, 2001). They help ensure that the market price for a particular product or process reflects its environmental costs more closely, while at the same time creating revenue that can be used to reduce other taxes (e.g. on labour). Imposing environmental taxes can help to reduce the demand for relevant products and processes and the associated pressure on natural resources. The revenues raised through environmental taxation may also be used to finance environmental activities such as wastewater treatment and waste collection and processing.

If the burden of taxation is shifted away from labour and other production costs towards the environmental costs of products and processes, this can reduce the distorting impact of taxation on the economy and benefit the environment (thus providing a 'double dividend'). By ensuring that environmental taxes integrate environmental concerns into sectoral policies, they can be important tools for sustainable development. This is clearly dependent on the effective implementation of the environmental tax. However, this is hindered by resistance to new and expanded taxes, mainly for reasons of competition. For example, the European Commission's proposal to increase minimum taxes on all forms of energy apart from renewable sources has not been approved by all Member States.

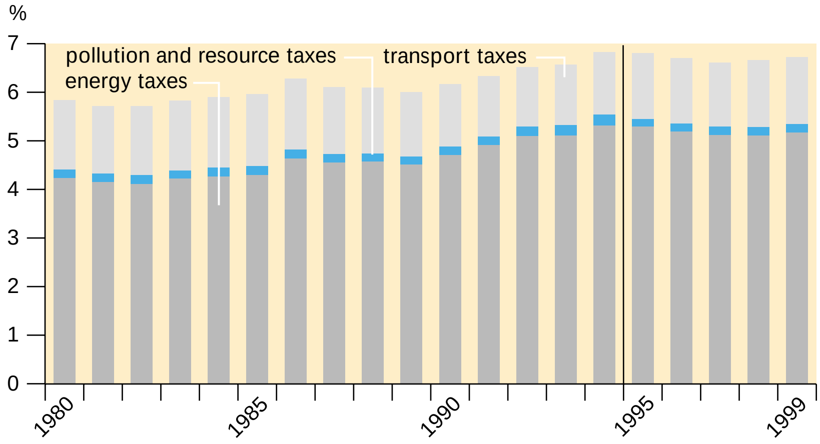
15.1. Revenue from environmental taxes

There is no comprehensive overview of the effectiveness of environmental taxes in EU Member States, however data on tax revenues are collected on an annual basis and provide an indication of the importance attached to environmental taxes and the way in which they have developed over time. Revenue from environmental taxation, expressed as a share of total tax revenue and social contributions, remained more or less constant during the 1980s, increased slightly in the first half of the 1990s, and has since levelled off. Of the three main categories of environmental taxation, energy taxes (including excise duties on car fuels and carbon dioxide taxes) contribute most revenue, followed by transport taxes. Taxes on pollution and resources continue to be of minor importance in terms of revenue raised. This trend can be recognised in most Member States, although there are some striking differences between countries.

Four countries, Denmark, Ireland, The Netherlands and Portugal, raise around 9-10 % of their total tax revenue from environmental taxes. In contrast to other Member States, energy taxes do not dominate and significant revenues are generated through taxes on transport. Only in The Netherlands does more than 1 % of total tax revenue and social contributions come from pollution and resource taxation, although the share is also relatively high in Belgium and Denmark. The share of total revenue derived from environmental taxes is less than 6 % in Belgium, Germany, France, Austria and Sweden.

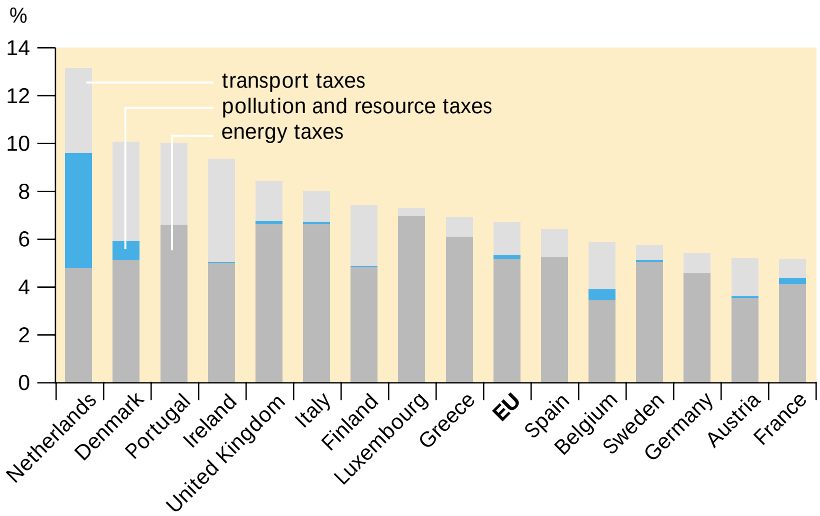
It is important to note however that only environmental taxes (defined as unrequited payments) and not environmental user charges (defined as payments for which a service is returned, such as fees for waste collection) are included in these graphs. Revenues from environmental charges can be significant and might alter the overall picture but unfortunately sufficient data are currently unavailable.

Revenue from environmental taxes, EU15 Figure 15.1.



Note: Percentage of total revenue from taxes and social contributions. The vertical line indicates a change of definitions used.
Source: Eurostat

Revenue from environmental taxes by country, 1999, EU15 Figure 15.2.



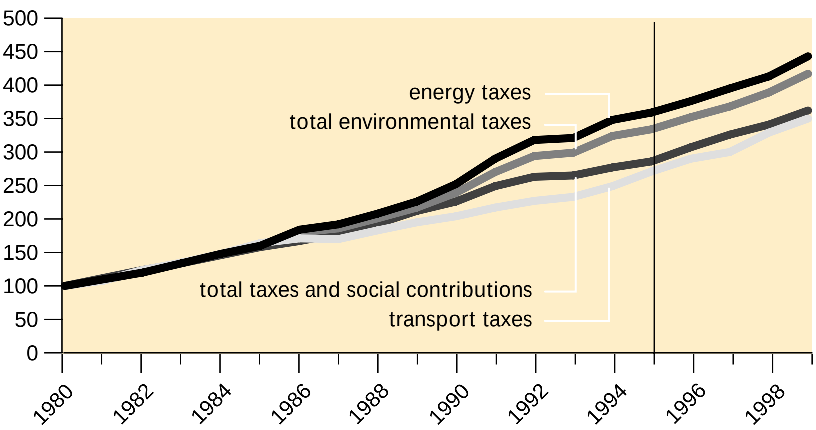
Note: Percentage of total revenue from taxes and social contributions.
Source: Eurostat

Environmental taxation generates between 5 % and 10 % of total tax revenues in the EU Member States. Its share has not increased further in the second half of the 1990s.

Quality of information ☆☆

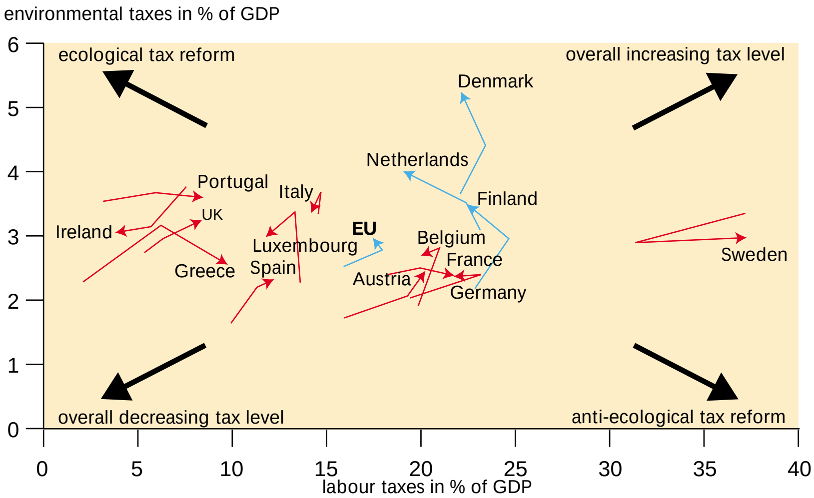
http://www.europa.eu.int/comm/dgs/eurostat/index_en.htm

Figure 15.3. **Revenue of environmental taxes, compared with total taxes and social contributions, EU15**



Note: the vertical line indicates a change of definitions used.
Source: Eurostat

Figure 15.4. **Ecological tax reform in EU Member States**



Source: Eurostat, European Commission, EEA

Indications of ecological tax reform have recently begun to emerge in the EU, although this is limited to certain Member States.

Quality of information ☆☆

http://www.europa.eu.int/comm/dgs/eurostat/index_en.htm

15.2. Ratio of revenue from environmental taxes to revenue from other taxes

The 1990s witnessed a general trend towards reducing the cost of labour in order to reduce unemployment. Moreover, the European Commission has proposed a further reduction of taxation of 1 % of GDP by 2005. The Commission has also urged the Council of the European Union and the European Parliament to adopt the existing proposal on energy taxation in the near future. Increased revenue from environmental taxes could replace revenue lost from other taxes.

Ecological tax reform (ETR) covers three main components:

- a shift in the fiscal burden away from labour costs towards environment and natural resource costs;
- an increase in the number of taxes and charges and an adaptation of existing schemes to better internalise external environmental costs and cover the costs of environmental services;
- the removal of tax advantages that give rise to environmental degradation.

The revenues from environmental, particularly energy, taxes grew faster than the revenues of all taxes and social contributions in the period 1985 to 1999. Since 1995 labour taxes in the EU have decreased from 23.8 to 23.0 % of GDP. Environmental taxes show a tiny increase from 2.77 to 2.84 % of GDP. This may indicate the start of an overall ecological tax reform. This trend is most evident in Denmark, Finland and The Netherlands. Some of the other Member States show increasing environmental tax revenues but coupled with increasing labour taxes.

15.3. Introduction of environmental taxes and some indicators of their effectiveness

Environmental tax bases in European countries Table 15.1.

	A	B	DK	FI	FR	GE	GR	ICL	IRL	IT	L	NL	NO	P	SP	SW	UK
Air/Energy																	
Carbon dioxide*			1992	1990		1999				1999		1992	1991			1991	2001
Sulphur dioxide			new		existing					existing							
Nitrogenoxides					existing					existing						existing	
Fuels	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing
Sulphur in fuels			existing										existing			existing	
Transport																	
Car sales and use	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing	existing
Diff. annual car tax			new			new							new				
Water																	
Water effuent	existing	existing	existing	existing	existing	existing			existing	existing		existing	existing		existing	existing	
Waste																	
Waste-end	new		existing	new	new		new			new		existing				new	
Dangerous waste			existing	existing		existing		existing									
Noise																	
Aviation noise						existing				existing		existing	existing				
Products																	
Tyres	existing		new	new								new					
Disp. razors																	
Beverage cont		existing	existing	existing									existing			existing	
Disp. Cameras		existing															
Packaging	new									new							
Bags			existing					existing		existing							
Disp. Tableware			existing														
Pesticides		new	existing	existing									new			existing	
CFCS	existing		existing														
Batteries	new	new	existing							new						existing	
Light bulbs			existing														
PVC/phtalates			new														
Lubrication oil				existing						existing			new				
Fertilisers																existing	
Paper, board					existing												
Polyethene																	
Solvents			new										new				
Minerals (P, N)		existing	existing									existing					
Resources																	
Raw materials			existing													existing	new

existing in 1996 new in 2000 * Year of introduction

Source: EEA; OECD/EU

An increasing number of environmental taxation systems are being introduced throughout the EU with the aim of improving environmental quality in an efficient way and reducing the burden of taxation on labour and other production costs.

There are some indications of the effectiveness of environmental taxes, but evaluative studies are generally lacking.

Quality of information ☆☆

http://reports.eea.eu.int/Environmental_Issues_No_18

Following a shift away from labour taxation towards the taxation of environmental costs, the second component of ecological tax reform is to increase the use of environmental taxes. Several Member States, including Denmark, Finland, Germany, Italy, The Netherlands, Sweden, and the United Kingdom, have begun to introduce fiscal measures with the aim of improving the quality of the environment and an additional aim of starting to reduce the burden of distorting taxation on the economy. Note that this table also includes environmental charges, defined as requited payments for services rendered.

Most Member States have introduced taxes on carbon dioxide into the framework of ecological tax reform. Other taxes developed post-1996 include taxes on waste destined for landfill and incineration, and on products such as batteries, packaging, ethylene, pesticides, tyres and solvents.

Ireland introduces plastic bag levy

It is conservatively estimated that some 1.2 billion plastic shopping bags were provided free of charge to Irish consumers at retail outlets annually (approximately 325 bags per person per year). These are a visible and persistent component of litter and can impact on habitats and wildlife. In the light of this, on 4 March 2002 an environmental levy charged at 15 cents per bag on plastic shopping bags (also known as the 'plastax') was introduced. The levy is the first of its kind and the Irish Government hopes that consumers will respond to the measure by significantly reducing consumption of plastic bags dispensed at retail outlets. The levy will apply at the point of sale in supermarkets, shops, service stations and all sales outlets. Retailers will be obliged under law to pass on the full amount of the levy as a charge to customers at the check-out. The levy will apply to all plastic bags except smaller bags that are used to contain non-packaged goods (e.g. fruit and vegetables) and, for food safety reasons, smaller bags which are used to contain fresh meat, fish and poultry. Reusable bags costing more than 70 cents will also be exempt as will bags supplied to passengers in ports and airports as well as on board commercial ships and aircraft. Revenues raised from the plastic shopping bag levy will be assigned to a new Environment Fund - which will also receive funding from the proposed landfill levy. This fund will be used for supporting appropriate waste management, litter and other environmental initiatives.

Source: http://www.environ.ie

The use of environmental taxes varies considerably across Member States, for example Ireland, The Netherlands, Portugal and the UK operate few pollution and resource taxes, but are among the countries with the highest share of environmental tax revenue originating from the energy and transport sectors.

Environmental taxes may be introduced with accompanying subsidies or tax exemptions that are environmentally beneficial. The UK introduced the Climate Change Levy scheme in 2001, drawing on the experience of others. The scheme includes climate change agreements with energy-intensive sectors, which provide for an 80 % discount of the levy if commitments are being made to improve energy efficiency and reduce environmental impact. Similar provisions can be found in the Danish system of carbon dioxide taxation that has been in operation since the early 1990s. Another tool applied in connection with the climate change levy in the UK is the system of enhanced capital allowances for machinery and plant. This enables businesses to take relief on the full costs of relevant investments in the first year, which results in a cash flow boost. Such a scheme has been run successfully in The Netherlands since the early 1990s.

The environmental effectiveness of taxation is the subject of increasing study (EEA, 2001). Retrospective evaluations of existing tax systems sometimes show positive impacts, but are not always decisive, due to data and methodological problems. Studies have demonstrated the effectiveness of carbon dioxide taxes in Scandinavia and The Netherlands.

Insufficient data are currently available on the third component of ecological tax reform, reducing the use of environmentally harmful subsidies.

Technical annex: Quality of information

Key:
Overall quality of information score:
☆☆☆ 'high', ☆☆ 'medium' or ☆ 'low'

Chapter 3: Households

Indicator	Overall score	Comments
3.1. Some indicators of household eco-efficiency	☆☆	Data for carbon dioxide emissions is based on emissions from fossil fuel use by households which provide a relatively low estimate of total greenhouse gas emissions from households (due to the fact that emissions from private transport are excluded).
3.2. Water and energy consumption	☆☆	Consistency of definitions and information over countries, data sources and over time is not guaranteed.
3.3 Purchase of eco-labelled products	☆☆☆	Based on precise figures collected by the European Commission.

Chapter 4: Transport

Indicator	Overall score	Comments
4.1. Passenger and freight transport volumes	☆☆	Data on passenger-km and tonne-km are calculated rather than directly measured. Some modes are excluded due to a lack of historical data. Passenger and freight transport intensity: country breakdowns for short sea shipping and intra and extra European flights are missing. Vehicle-kilometre would be a more suitable indicator to monitor decoupling, but statistics are very incomplete.
4.2. Modal split in passenger and freight transport	☆☆	Passenger modal split: motorcycle and waterborne modes are excluded due to a lack of data; country breakdown of intra and extra European flights missing. Freight modal split: country breakdown of short-sea shipping statistics is missing.
4.3. Transport eco-efficiency	☆☆	Carbon dioxide and air pollutant emissions from international air and ship traffic are excluded in line with international agreements. Energy and emission data lack a breakdown in passenger and freight transport.
4.4. Uptake of cleaner technologies and fuels	☆☆	Data on the share of the fleet complying with certain emissions standards have been modelled.
4.5. Differentiation of transport taxes and charges	☆☆	Miscellaneous sources.
4.6. Real changes in fuel prices	☆☆☆	Based on quarterly statistics from European Commission Oil Bulletin: http://europa.eu.int/comm/energy/en/oil/bulletin_en.html

Chapter 5: Energy

Indicator	Overall score	Comments
5.1. Energy intensity of the economy	☆☆☆	Data from Eurostat
5.2. Eco-efficiency of the energy industry	☆☆	Data values for transformation output are provisional for 1998 and 1998. Officially reported emissions data following agreed procedures. Weighting factors have been used so that emissions can be combined in terms of their polluting effects.

5.3. Emissions from electricity production	☆☆	Officially reported emissions data following agreed procedures. Data and analysis are the preliminary results of ongoing work to refine and improve associated statistics and methodology. The results must not be regarded as accurate estimates of absolute values.
5.4. Total energy consumption by fuel	☆☆☆	Data from Eurostat
5.5. Share of total energy and electricity obtained from renewables	☆☆☆	Data for individual biomass and waste energies are only available for 1990, 1996-1999. Biomass data for Germany and Italy suggest a large increase in wood use for households between 1996 and 1999. This is due to improved data collection methods which result in more accurate data collection than in previous years.
5.6. Share of combined heat and power in gross electricity production	☆☆☆	1998 data for combined heat and power electricity generation in Greece is an estimate, and data for Germany for 1994 is from 1995 and there is no data for Luxembourg in 1994.
5.7. Real energy prices	☆☆☆	Note that changes in data sources and methodologies used have resulted in some changes in prices presented here compared with Environmental signals 2000.
5.8. Energy tax levels	☆☆☆	There are some differences in the level of the prices shown here to those in Environmental Signals 2000 due to a change of data sources and the use of different methodologies to calculate average EU prices.

Chapter 6: Agriculture

Indicator	Overall score	Comment
6.1. Agriculture eco-efficiency	☆☆	There are some concerns regarding the reliability and consistency of some of the data which is collected by Member States using different types of survey for the various eco-efficiency parameters. The use of gross value added may under-represent the increase in agricultural eco-efficiency since the ratio of output to input prices may be declining more strongly in agriculture than in other sectors.
6.2. Bird population trends in relation to farming intensity	☆☆	FAO and RSPB data are generally reliable. Historical bird census data in different countries may show inconsistencies and are only partly sufficiently quantified.
6.3. Areas vulnerable to nitrates	☆☆	The adequacy scores for the Member State measures under the Nitrates Directive are based on semi-quantitative criteria that are subject to interpretation.
6.4. Structure of Common Agricultural Policy support	☆☆☆	Financial information provided by the European Commission on the EU budget is considered reliable.
6.5. Developments in organic farming	☆☆	The data on organic farming area come from one source even though accuracy still varies between countries and is not complete over the whole time series.

Chapter 7: Fisheries

Indicator	Overall score	Comments
7.1. Size of the fishing fleet	☆☆	The datasets are fragmented both temporally and spatially.

7.2. Status of fish stocks	☆☆	The datasets are based on time series that can give a good account of the state of a stock, but different approaches are being used in the Mediterranean and the NE Atlantic to determine if a stock is outside safe biological limits.
7.3. North Sea cod stock	☆☆☆	The most serious cause of uncertainty lies within information and types of data not being reported (discard, unrecorded landings, fraudulent reporting).
7.4. Aquaculture production	☆☆	The data are provided by official national data sources and have had some initial validation.

Chapter 9: Climate change

Indicator	Overall score	Comment
9.1. Total emissions of greenhouse gases	☆☆☆	Officially reported data following agreed procedures but fluorinated gas emissions not yet reported by all Member States and the quality of emissions estimates for nitrous oxide and methane should be further improved by Member States.
9.2. Emissions of greenhouse gases by sector and gas	☆☆☆	Officially reported data following agreed procedures but fluorinated gas emissions not yet reported by all Member States and the quality of emissions estimates for nitrous oxide and methane should be further improved by Member States.
9.3. Global and European mean temperature	☆☆☆	Reliable data with low uncertainty.

Chapter 10: Air pollution

Indicator	Overall score	Comments
10.2 Urban air quality exceedances for ozone	☆☆☆	Improvement in coverage over space and time and extrapolation to the total urban and rural population is required for the future.
10.3 Urban air quality exceedances for particulates	☆☆☆	Improvement in coverage over space and time and extrapolation to the total urban and rural population is required for the future.
10.4 Urban air quality exceedances for sulphur dioxide	☆☆☆	Improvement in coverage over space and time and extrapolation to the total urban and rural population is required for the future.
10.5 Urban air quality exceedances for nitrogen dioxide	☆☆☆	Improvement in coverage over space and time and extrapolation to the total urban and rural population is required for the future.
10.6 Exposure of agricultural crops and forests to ozone	☆☆☆	Improvement of coverage in space and time is required for the future.
10.8 Aggregated emissions of acidifying substances	☆☆	Countries need to fill some data gaps to improve the completeness of the time series of their estimates.
10.9 Aggregated emissions of ground-level ozone precursors	☆☆	Countries need to fill some data gaps to improve the completeness of the time series of their estimates.
10.10 Particle emissions	☆☆	The emission data for primary PM_{10} is not as robust as that for other air pollutants and the factors used in the estimation of secondary PM_{10} emission are based on assumptions about the deposition and reactions of the precursor pollutants.

Chapter 11: Inland and coastal waters

Indicator	Overall score	Comments
11.1. Water use versus resources	☆☆	Consistency of definitions and information over countries, data sources and over time is not guaranteed. Comparisons should be made with some precaution.
11.2. Organic pollution in rivers	☆☆☆	Generally good, some data still requires validation
11.3. Waste water treatment	☆☆	There are some variations in the definitions of different classes of treatment between countries and not all countries provide data for all years.
11.4. Nutrients in rivers	☆☆☆	Generally good data although some data still requires validation
11.5. Nutrients in coastal waters	☆☆☆	The test for trend at sampling points is a robust and accepted approach, accuracy partly influenced by the number of sampling points for which data are available.
11.6. Chlorophyll-a in marine and coastal waters	☆☆	This assessment only allows the analysis of trends. The accuracy on country level is largely influenced by the number of stations for which data are available. The trend detector is a robust and accepted approach.
11.7. Bathing water quality	☆☆☆	Generally high quality information, note that no data is yet available for EU accession or EFTA countries.
11.8. Oil pollution from offshore installations and illegal discharges	☆☆	Not all countries report data on organic-phase drilling fluids. Data calculations for discharges from refineries need to be checked. Coverage of the Mediterranean and the Black Sea is missing from the offshore installations discharges.

Chapter 12: Waste and material flows

Indicator	Overall score	Comments
12.1. Total material requirement	☆☆	Data sources for indirect flows associated with imports have to be internationally improved.
12.2. Total waste generation	☆	Data provision and statistical improvements are needed in all Member States, the proposed waste statistic regulation will when implemented make countries provide the necessary information.
12.3. Municipal waste generated and landfilled/incinerated	☆☆	The proposed Council Regulation on Waste Management Statistics will provide some of the necessary statistical improvement for this indicator.
12.4. Packaging waste	☆☆	To ensure data comparability clarification is needed on the methods used to estimate the quantities of packaging put on the market and recycling and recovery rates.
12.5. Hazardous waste	☆	Adequate information on hazardous waste management is not available, so a reliable assessment of the current situation in Europe cannot be made.

Chapter 13: Land

Indicator	Overall score	Comments
13.1. Land take due to urban development	☆☆☆	Corine land cover: exhaustive but coarse scale. Moland/Murbandy: good scale but 24 cities only.
13.2. Soil sealing	☆	Statistical data based on national surveys with different methodologies and results may vary across countries.
13.3. Fragmentation and partitioning of habitats by transport infrastructure	☆☆	Roads of GISCO database not consistent over countries; frequent updating needed.

Chapter 14: Forest

Indicator	Overall score	Comments
14.1.Total forest area and "naturalness"	☆☆	Certain differences in data accuracy still remain between countries because of different methodologies and reference periods upon which estimate of annual change is based vary somewhat between countries. Interpretation of 'plantations' still varies between countries due to difficulties to apply FAOs global definition for European planted forests which are subject to diverse management regimes.
14.2. Annual fellings and increment of growing stock	☆☆	Comparison of data from different time periods — comparing countries should be made with caution.
14.3. Origin and impacts of tree planting material	☆☆	Dataset incomplete, some missing countries may plant non-native species to a large extent.
14.4. Forest condition	☆☆☆	Data set provided by ICP Forest, running one of the biggest biomonitoring networks worldwide.
14.5 Threatened forest species and protection of forest habitats and species	☆☆☆	Data reported in the framework of the EC Habitats Directive
14.6. Level of protection of forests	☆☆	There are some uncertainty associated with the assessment of the surface area covered by habitats and differences in interpretation of 'protected forests' by countries.

Chapter 15: Environmental taxes

Indicator	Overall score	Comments
15.1. Revenue from environmental taxes	☆☆	Provisional data from Eurostat
15.2. Ratio of revenue from environmental taxes to revenue from other taxes	☆☆	Structures of the Taxation Systems in the European Union 1990-1997 (DG TAXUD & Eurostat). The data for 1997 have been extrapolated to 1998 and 1999, using the short-term economic forecasts from the Commission Services
15.3. Introduction of environmental taxes and some indications of effectiveness	☆☆	EEA (2000) Environmental taxes — Recent developments in tools for integration; OECD/EU database for environmental taxes

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Technical annex: Acronyms, abbreviations and symbols

AC	Accession countries
ACFM	ICES Advisory Committee on Fishery Management
BOD	Biological oxygen demand
CAFE	Clean Air for Europe Programme
CAP	Common Agricultural Policy (EU)
CEC	Commission of the European Communities
CFCs	Chlorofluorocarbons
CFP	Common Fisheries Policy
CHP	Combined heat and power
CLRTAP	Convention on Long Range Transboundary Air Pollution (UNECE)
CO_2	Carbon dioxide
DEPA	Danish Environmental Protection Agency
DG	Directorates General (of the European Commission)
DPSIR	Driving forces, pressures, state, impacts, responses
EAGGF	European Agricultural Guarantee and Guidance Fund
EC	European Community
ECCP	European Climate Change Programme
ECMT	European Conference of Ministers of Transport
ECPA	European Crop Protection Association
EEA	European Environment Agency
EFTA	European Free Trade Association
EIA	Environmental Impact Assessment
EMAS	EU Eco-Management and Audit Scheme
EMEP	Cooperative Programme for Monitoring and Evaluation of the Long Range Transmission of Air Pollution in Europe
ESDP	European Spatial Development Perspective (EU intergovernmental initiative)
ETR	Ecological tax reform
EU	European Union
Eurostat	Statistical Office of the European Union
FAO	UN Food and Agriculture Organisation
FGD	Flue gas desulphurisation
FIFG	EU Fisheries Instrument for Fisheries Guidance
FYROM	Former Yugoslav Republic of Macedonia
5EAP	Fifth Environmental Action Programme
6EAP	Sixth Environmental Action Programme
GDP	Gross domestic product
GIEC	Gross inland energy consumption
GMES	Global Monitoring for Environment and Security
GVA	Gross value added
HELCOM	Helsinki Commission
HFCs	Hydrofluorocarbons
ICCAT	International Commission for Conservation of Atlantic Tuna
ICES	International Council for the Exploration of the Sea
ICWS	International Centre for Water Studies
IEA	International Energy Association
IMW	Industrial and municipal waste
INSPIRE	Infrastructure for Spatial Information in Europe (European Commission)
IPM	Integrated pest management
IPP	Integrated product policy (European Commission)
IPCC	Intergovernmental Panel on Climate Change
IPPC	Integrated Pollution Prevention and Control (EU Directive)

IVM	Institute for Environmental Studies (Vrije University, Amsterdam)
MAGPs	EU Multi Annual Guidance Programmes
MCPFE	Ministerial Conference for Protection of Forests in Europe
NECD	National Emissions Ceilings Directive (European Union)
NH_3	Ammonia
NMVOCs	Non-methane volatile organic compounds
NOx	Nitrogen oxides (including nitric oxide, NO and nitrogen dioxide, NO_2)
NTUA	National Technical University of Athens
NVZs	Nitrate vulnerable zones (European Union)
OECD	Organisation for Economic Cooperation and Development
OPEC	Organisation of Petroleum Exporting Countries
OSPAR	Joint Oslo and Paris Commissions
PEFC	Pan-European Forest Certification
PM_{10}	Particulate matter < 10 microns in size
REC	Regional Environmental Centre (Budapest, Hungary)
RIVM	National Institute of Public Health and Environmental Protection, The Netherlands
SACs	Special Areas of Conservation
SBL	Safe biological limits
SHOM	Service Hydrographique et Océanographique de la Marine, France
SO_2	Sulphur dioxide
SPAs	Special Protection Areas
TAC	Total allowable catch (EU Fisheries policy)
TENs	Trans-European (transport) Networks
TERM	Transport and Environment Reporting Mechanism (EU)
TMR	Total material requirement
TOFP	Tropospheric ozone forming potentials
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UNECE	United Nations Economic Commission for Europe
UNECE ICP	UNECE International Co-operation Programme on Assessment and Monitoring of Air Pollution Effects on Forests
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value added tax
WCMC	World Conservation Monitoring Centre
WHO	World Health Organisation

Symbols and units

d	day
^oC	degrees celsius
g	grammes
h	hour
ha	hectare
Hkg/ha	one hundred kilogrammes per hectare
kg	kilogrammes
km	kilometre
km^2	square kilometre
kt	kilotonnes
kW	kilowatts
l	litre
$\mu g/m^3$	microgrammes per cubic metre
µgN/l	microgrammes of nitrogen per litre

μgP/l	microgrammes of phosphorus per litre
m^2	square kilometres
m^3	cubic metres
mg	milligrammes
mg/m^3	milligrammes per cubic metre
Ml	megalitre
Ml/day	megalitres per day
ppb	parts per billion (parts per 1000 million)

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