ENVIRONMENT IN THE EUROPEAN UNION

1995

Report for the Review of the Fifth Environmental Action Programme

EUROPEAN ENVIRONMENT AGENCY

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NOTE TO THE READER

Translations into other European languages are planned.

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1995

Report for the Review of the Fifth Environmental Action Programme

Edited by Keimpe Wieringa

The update to the 1992 report on the state of the environment in the European Union requested by the European Commission

Prepared by
the European Environment Agency
in cooperation with Eurostat

Cover design and lay-out: Joy Raun Grafisk Design
Photo credit: Foci Image Library
Production maps: PCS Mapping & DTP
English editing: Karl Maybach
Printing: Notex tryk

Cataloguing data can be found at the end of this publication

Luxembourg : Office for Official Publications of the European Communities

ISBN 92-827-5263-1

© EEA, Copenhagen, 1995

Printed in Denmark on recycled and chlorine-free bleached paper

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FOREWORD

At the end of 1994, the European Commission requested the European Environment Agency to prepare a new state-of-the-environment report for the European Union to update the one presented in 1992, and to contribute to the review of the Fifth Environmental Action Programme, which is to be completed by the end of 1995.

This was the first such request that the Agency had received since being established; the importance of the framework of the Environmental Action Programme for establishing the Agency's work programme priorities gave this task particular importance. The form of the report, the timing and the process by which it was to be developed and executed, was decided upon in co-operation with the Commission (DG XI) at the beginning of 1995. The project was started in March 1995.

It is a major effort in normal circumstances to pre-pare a state-of-the-environment report, since it is an activity that normally involves a wide cross-section of actors in different disciplines; with the Agency established but not yet fully up and running with its complement of staff, this was particularly so. To the Agency's advantage, we had available the results of the comprehensive report *Europe's Environment: The Dobříš Assessment* on which to base much of the work. Focus had to be given to the targets and the themes of interest in the 5EAP and, wherever possible, the information had to brought fully up to date.

The Agency conducted the task with the following contractors:

- Dutch National Institute of Public Health and Environmental Protection (RIVM);
- Danish National Environmental Research Institute (NERI);
- Environmental Resources Management (ERM);
- DHV Milieu & Infrastructuur (DHV);
- Danish Environmental Protection Agency (DEPA); and
- Institute for European and Environmental Policy, London (IEEP).

Data were provided by the Statistical Office of the European Communities (Eurostat), the World Bank, United Nations Economic Commission for Europe (UNECE), International Institute for Applied Systems Analysis (IIASA), UNECE Coordination Center for Effects at RIVM and the European Commission (DG XI).

The whole project was managed and coordinated throughout by Keimpe Wieringa. The report was reviewed by the Scientific Committee of the Agency and technical comments were received from the Commission. I wish to express my appreciation and thanks to all these organisations for their cooperation.

The result of the process is now before you in the form of this report. The findings are important. They show that while indeed some progress is noteworthy, improvements in the environment are difficult to relate to specific actions and are often not apparent even after signific-ant reduction of pressures. Time lags, the non-linear nature of environmental processes and the still limited scale of effort are often the reason for this, but it is equally due to not having control of all significant factors and of new developments changing future expectations. What is clear, however, is that continued vigilance is required and that current targets and approaches need broadening and strengthing if progress across the breadth of environmental issues is to be made.

The report shows how far the European Commission has gone in fulfilling its commitments, in particular in the presentation and implementation of required EC initiatives. But still the core of the 5EAP is the principle of shared but differentiated responsibility of all actors. This is difficult to realise through a programme which is only formally adopted by the EC.

For the Agency, preparing this report has been the first broader exercise towards a more operational environmental reporting system, where not only the assessment of the elements of the pressures-state-impact chain and related indicators are necessary, but also the progressive intro-duction of performance indicators to assess both the progress and prospects in environmental quality and sustainability. This is the challenge for the Agency: to progressively improve the environmental reporting system to make it timely and action-orientated.

Domingo Jiménez-Beltrán
Executive Director

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1. EXECUTIVE SUMMARY

1.1 Main conclusions

Progress towards sustainability

The European Union is making progress in reducing certain pressures on the environment, though this is not enough to improve the general quality of the environment and even less to progress towards sustainability. Without accelerated policies, pressures on the environment will continue to exceed human health standards and the often limited carrying capacity of the environment. Actions taken to date will not lead to full integration of environmental considerations into economic sectors or to sustainable development.

These are the main conclusions of an assessment of the trends, state and outlook of the environment in the European Union (EU) by the European Environment Agency (EEA), as requested by the European Commission. This report forms part of the review process of the 1992 EC *Programme of Policy and Action in Relation to the Environment and Sustainable Development "Towards Sustainability"*, the so-called Fifth Environmental Action Programme (5EAP).

The 5EAP has marked an important change of direction for the EU's environmental policy. Its key principles are: to integrate environmental considerations into the various target economic sectors, to achieve policy objectives (including timing), to broaden the range of instruments and to establish shared responsibility. At more or less the same time as the 5EAP, new concepts like 'sustainable development' and 'environmental space' were developed, which also refer to continuity of ecosystems, public health and economic functions required for the development of future generations.

Enlargement of the EU

Since the publication of the 5EAP and the accompanying state-of-the-environment report, the European Union has enlarged with the accession of Austria, Finland and Sweden from 1995. This implies that new issues will arise, or that existing issues will be altered. For example: the total forest area in the EU has drastically increased; in the Alpine region, pressures from road transport and tourism with their associated risks to human health and the local ecology have become truly EU issues. Many of the new issues connected to the new Member States are a consequence of the sensitivity of the environment in these countries (eg, to water and soil acidification). Also, the extension of the EU to include Finland and Sweden means, in particular, that the productive but sensitive (and heavily polluted) Baltic Sea has become part of the EU.

Although this report focuses primarily on the original EU12 (by evaluating and updating the assessment of 1992), the conclusions are also applicable to the EU15.

Environmental trends

Some of the pressures on the environment have shown a decreasing trend over the past years (mainly due to pre-5EAP policies). Successes can be noted in the reduction of ozone depleting substances, emissions of heavy metals and sulphur dioxide (SO_2) and improvement of surface water quality. Full implementation of environmental policies is likely to lead to further reductions in environmental pressures despite further growth in production and consumption. However, the following issues require further attention at the European level: climate change and acidification, waste management, (urban) air quality, groundwater quality, habitat destruction and fragmentation. Another emerging issue, which has not

been comprehensively tackled at the European level, is the degradation of soil quality, which is an important natural resource.

The time factor obviously plays a part in the development of environmental problems and of pro-active policy making. It takes time before environmental problems become manifest due to chemical and biological time-lags. Once they are manifest, most problems show an irreversible character or, when actions are undertaken, a long recovery time. Furthermore, there are the societal time-lags inherent in, for example: raising public awareness, developing policy actions, fully implementing these measures (taking into account the fleet turnover of capital goods) and changing behaviour of firms and citizens.A diagnosis of only the current state of the environment is therefore inadequate. Early warning information systems and the monitoring of environmental progress and environmental outlooks are crucial for supporting the policy process and for providing sufficient feedback for policy-makers and society on the environmental effects of their present and intended actions.

Societal trends and target sectors

Successes to date have mainly been achieved in the industry sector. Point sources of pollution have been well targeted by regulations. Diffuse sources, such as products, consumers and mobile sources have been targeted far less effectively.

A review of the current state of action and of the information gathered so far leads to the conclusion that at this stage, it is difficult to asses the effectiveness of 5EAP policies in changing future trends. Most production and consumption trends remain unchanged compared with those from three years ago when the 5EAP was published.

Current policies focus on the effectiveness of measures ('how can the target be reached'), while at present, the efficiency issue (ie, maximising the environmental benefits and minimising the economic costs) is hardly addressed. This issue should be one of the key areas for the future. Focusing on the efficiency of measures might be a driving instrument for further integration of environmental considerations into economic sectors. Moreover, in this decade the most cost-effective measures will probably have been exhausted. However, if, as expected, economic growth and the size of the population continue to increase, then in the future the measures necessary to maintain the emission levels that have been achieved, or to further reduce them to the ultimate target, will (without new technical breakthroughs) become more and more expensive and administratively and politically complicated.

Accelerated EU environmental policy needed for reaching targets

If the European Union wants to achieve its environmental targets (ie, to avoid adverse effects on human health and ecosystems), an accelerated environmental policy is needed. This is a major challenge to the European Union in the coming years, since most societal trends show that further pressures on the environment are likely to occur. Population and economic growth show upward trends, translating into more energy and material use, transport and tourism. If these trends cannot be combined with sufficient (and cost-effective) abatement measures, (further) decoupling of economic growth from these trends is essential to secure sustainable development.

1.2 Environmental trends

Progress towards 5EAP Targets

The analysis of current status and trends and their relationship to targets set for each of the key environmental themes leads to the following conclusions:

1. The 5EAP environmental targets for 1994/95 are expected to be reached for chlorofluorocarbons (CFCs) and halons, nitrogen oxides (NO_x), volatile organic compounds (VOCs) and heavy metals.

2. The European Union is set to meet 5EAP targets for the year 2000 in the following key areas (see *Table 1.2.1*):

   - sulphur dioxide (SO_2) emissions;
   - production of Ozone Depleting Substances; and
   - carbon dioxide (CO_2) emissions, where – despite considerable uncertainties – the achievements for 2000 can be seen as a first step towards further reductions.

3. In a number of other areas, the EU is heading in the right direction, but meeting targets in the following areas is far from assured:

   - acidification, where widespread exceedance of critical loads will continue;
   - VOCs, emissions of which are clearly reduced, but due to time lags in the implementation of directives, meeting targets by 2000 is not assured;
   - nitrates, where standards for drinking water will be exceeded less often due to substantial reductions in the use of nitrogen in agriculture, but due to the longevity of nitrates in groundwater, the targets will not be met without denitrification of groundwater;
   - waste management, where (despite current prevention policies) waste generation shows a steady increase and further improvements in recycling will be constrained by recycling costs and the lack of markets of secondary materials;
   - urban environment, where environmental pressures, particularly those related to traffic continue to worsen in most cities;
   - conservation and protection of biodiversity, though an increasing number of areas are protected fornature conservation objectives and impacts from agriculture will be reduced as a result of changes in CAP and due to the agri-environment measures, impacts from transport and tourism will worsen.

Table 1.2.1: Assessment of environmental progress in achieving the 5EAP 2000 targets using nine performance indicators

(Index 1985 = 100)	1985	1990	2000 target	Achievability target
Global scale				
CO_2 emissions	100[a]	102	102	+/–
CFC production	100[b]	64	0[c]	+
European scale				
SO_2 emissions	100[a]	88	65	+
NO_x emissions	100[a]	107	70	–
VOC emissions	100	101	70[d]	–
Regional scale				
Municipal waste per capita	100	115	100	–
Noise above 65 dB(A)	100	>100	100	+/–
Pesticides in groundwater	100	>100	0[e]	–
Nitrate in groundwater	100	>100	0	–

Legend + likely that target will be achieved
+/– uncertain
– unlikely

[a] Including former eastern Germany
[b] In 1986
[c] By 1995
[d] By 1999
[e] By 2005

4. Current policies are not sufficient to tackle a few key issues. These include:

   - CO_2 emissions after 2000;
   - traffic related issues eg, NO_x emissions and noise;
   - water abstraction and the quality of marine water and groundwater (the latter particularly in respect of pesticides);
   - Chemicals in the environment
   - coastal zone management; and
   - erosion and desertification.

Elaboration of the findings for each environmental theme

Global scale

The continuing and rapid increase in the atmospheric concentration of greenhouse gases can cause *climate change*. There is a considerable time delay between a reduction of the emissions of these gases and stabilisation of atmospheric concentrations. After a period of steady increase, total emissions of CO_2 (the most important greenhouse gas) fell between 1990 and 1993, partly due to the economic recession during these years. Although CO_2 emissions from industry have decreased, emissions from the transport sector show an increase.

Achieving the target of stabilisation of EU CO_2 emissions at 1990 levels by 2000 seems to be the cornerstone of EU environmental policy. There is, however, great uncertainty about whether the EU will meet this target. The main causes of uncertainty are: continuous transport growth, continuing low energy prices, the slow improvement of energy efficiency and the fact that many of the measures in national programmes will not be completed before 2000. Current measures are insufficient to prevent a further increase in CO_2 emissions after 2000 as a result of the expected growth of production, consumption and transport. To achieve the global quality objective, reductions in emissions by 1-2% per year are necessary, to which the industrialised countries are expected to make a reasonable contribution.

The *ozone layer* has been considerably depleted worldwide, caused by emissions of halogenated hydrocarbons, such as chlorofluorocarbons (CFCs) and halons. At present, the problem is universally recognised and international negotiations on the tightening of limitations (eg, of CFC production as proposed in the Montreal protocol) have accelerated. In this regard, the European Union is playing a pioneering role. Since the publication of the 5EAP, the targets have been tightened.

The production and consumption of CFCs show a decreasing trend: an 80% reduction between 1986 and 1994. The 1994 target for halons has been reached. It is uncertain whether the production of CFCs will be stopped in 1995 as planned. The production of HCFCs (targeted for complete phase out by 2015) has increased during the period 1986-1994 as a result of the substitution for previous uses of CFCs. Despite current policy measures to phase out CFCs and other ozone depleting substances, the ozone layer will continue to be depleted until late into the 21st Century due to the long lifetime of chlorine compounds in the atmosphere.

European and transboundary scale

Acidification, combined with other forms of environmental stress, increase the chances of damage to ecosystems by devitalising forests and undermining the quality of water resources. This process will continue due to deposition of sulphur and nitrogen compounds. Sulphur emissions have been reduced considerably. Meanwhile, NO_x and ammonia (NH_3) emissions have stabilised.

The European Union has undertaken considerable action to reduce emissions from various sources (eg, large combustion plants, vehicles, etc). The effectiveness of these actions can be observed, although full implementation is still underway. It is expected that SO_2 emissions will continue to decrease and that the 5EAP target will be achieved. This is also true for the more stringent target agreed in the revised UNECE Sulphur Protocol. Due to the introduction of the catalytic converter for vehicles, NO_x emissions will start to decline. However, it is uncertain if the 2000 target will be met. Current reduction plans of EU Member States will lead to a 20% reduction by 2000 (compared to 1985 levels) instead of the 30% target mentioned in the 5EAP. The positive effects of end-of-pipe techniques will be partially offset by traffic growth (passenger and freight).

Even though overall acid deposition levels have decreased (and this will continue in the future, mainly due to sulphur reduction), critical loads will still be exceeded in the more sensitive regions. In 1993, deposition exceeded the 'critical acid loads' for ecosystems in 34% of the total European area (for the EU this proportion is even higher). Based on the current reduction plans of Member States, this will decrease to 25% in 2000.

The two main *air quality* problems - which occur throughout the EU - are summertime and wintertime smog. Considerable improvements in recent decades have been achieved. However, the current concentrations of pollutants still significantly exceed health standards. Due to the concentration of population and economic activity, major urban areas experience the highest levels of pollution and exposure to health risks. For example, it is estimated that in nearly three quarters of major EU cities, WHO Air Quality Guidelines for SO_2 and particulate matter (PM) were exceeded at least once in a typical year, giving rise to

winter smog episodes. PM pollution, as emitted by vehicles, has been identified as one of the key environment-health issues.

Although overall emissions of air pollutants are declining, the increase in emissions from road transport - which is a key sector for air quality - will partially offset improvements. Despite the implementation of policy measures, it is unlikely that the EU will meet the VOC target for 2000.

Due to a lack of information, it is difficult to assess progress towards two other air pollution problems, *dioxins* and *heavy metals*. Meeting the dioxin target is heavily dependent on progress in the implementation of adequate abatement measures at a time when waste incineration capacity (a key source of dioxins) is growing significantly. There is considerable progress in the reduction of heavy metals by the so-called North Sea countries. The reduction target for 1995 will be achieved by most countries, although copper, zinc and chromium still require attention.

Regional scale

Waste management is important for several reasons. Sustainable use of raw materials involves increased recycling of secondary materials. Effective management, especially of hazardous wastes, prevents soil pollution and reduces risks to human health. Energy recovery from waste contributes to primary energy conservation. Waste prevention proved to be difficult to tackle. Municipal waste generation per capita - one of the key 5EAP target indicators - has shown a steady increase of about 20% between 1985-1993. However, considerable success has been achieved in recycling of paper and glass - current recycling rates are almost 50%. The majority of municipal waste is disposed by landfill, although this is declining and is being replaced by incineration (current disposal rates are 57% and 23% respectively). Lack of data prevents a full assessment of the hazardous waste situation, although this waste category has higher risks for the environment.

Due to further economic growth and a lack of effective prevention measures, municipal waste per capita will continue to grow. It will increase by 30% by 2000 compared with the 1985 level (the 5EAP target is to maintain the 1985 level in 2000). Despite the Packaging Directive, further improvements in recycling will be constrained by recycling costs and the lack of markets for secondary materials. It is expected that disposal by landfill will continue to decrease and incineration will increase. This may have positive impacts on soil and water pollution, but to prevent knock-on effects in terms of air emissions, adequate legislation for emission control is a prerequisite.

Urban environment problems do not have a Transboundary character, but are ubiquitous throughout Europe. Many regional and global environmental problems originate in cities. More than two-thirds of the EU's population now live in urban areas. Environmental problems in concentration areas tend to increase. Apart from traffic congestion and air pollution - which are discussed above - the major urban environmental stress is noise. A lack of open and green space, a lack of infrastructure (eg, sewage treatment), disintegration of infrastructure and housing stock, crime and other social problems are also associated with large, poorly planned cities.

In large cities, the proportion of the population exposed to unacceptable levels of noise is two to three times higher than the national average. Transport, the main source of noise disturbance, is currently exposing some 17% of the population in most EU countries to noise levels higher than 65 dB(A). Due to accelerated traffic growth, it is expected that this will increase, while policies aim to stabilise present levels. Only with concerted local action, can the target be reached.

The main threats to ground and surface *water resources* are deterioration of the water quality and overexploitation of water reserves. On average, 17% of renewable water resources in the EU are abstracted each year. Water abstraction rates increased by 35% between 1970 and 1985 and are predicted to continue to increase, in particular within the agricultural sector in southern regions of Europe.

The majority of Europeans (65%) rely on groundwater for drinking water purposes. This leads in many places to over exploitation of aquifers, which results in the lowering of the watertable and associated effects such as: salt water intrusion in coastal aquifers, decreasing river flow and drying out of wetlands. The use of groundwater for drinking water is threatened by the leaching of pesticides and nitrates from agriculture. Nitrate and pesticide concentrations in groundwater are increasing and are estimated to exceed the target in more than 85% (of all Europe) and 75% (of EU) of agricultural land respectively.

Due to significant investments in sewage treatment, most large European rivers have shown signs of improved conditions over the last decade. Emissions of oxygen-depleting substances and phosphorus have decreased markedly, leading to improved oxygen

levels and better conditions for aquatic animals; the improvement has been greatest in north-western regions of the EU. Despite a reduction in phosphorus emissions to surface waters, eutrophication remains an issue of concern. As for groundwater, the great majority of EU rivers (75%) show continuing increases in nitrate concentrations due to intensification of agriculture. This raises the potential for eutrophication in receiving seas.

Many current policy initiatives will require a significant investment by Member States, but are expected to result in a significant payback in terms of environmental quality by the year 2000. Up to that time, it is likely that the quality of surface waters will either remain at the present level or show a gradual improvement. With regard to groundwaters, the impact of the Nitrates Directive and the expected reduction in the use of pesticides may take longer to become vis-ible.

The degradation of *coastal zones* is caused by the accumulation of pollutants from river catchment areas, direct pollution to seas, oil spills, atmospheric deposition and coastal erosion and stress due to tourism and fishing. The main pollutants affecting coastal zones include: nutrients, heavy metals, chemicals, oil and hazardous waste (Baltic and Mediterranean). Coastal zones also face eutrophication caused by discharges of nutrients via rivers (Baltic and North Sea). Most North Sea States have reduced phosphorus and heavy metals by about 50% between 1985 and 1995.

Environmental risks predominantly arise from industrial and nuclear accidents, chemicals and natural hazards. Environmental damages from accidents and natural disasters have risen consistently over the last thirty years. The overall aims of policy in all fields of risk is to reduce exposure to risk based on the precautionary principle. This has been addressed through, for example: the reduction of the amount of toxic substances in the environment, the prevention of major industrial accidents ('Seveso' Directive), risk management of genetically modified organisms (GMOs) and the implementation of safety standards to reduce the risk of nuclear accidents. Concerns also arise from the number of existing chemicals already in use (approximately 100,000 chemicals are marketed in the EU), about which little is so far known about their environmental impact and synergistic effects.

The main *soil quality* problems in Europe are erosion and pollution. Soil as a natural resource has degraded and is causing concern in many parts of the EU. Degradation might continue in the future, in spite of Member States' programmes. Environmental policy targets and measures concerning soil are limited, as is the available information on which to develop policy. Apart from measures, EU policies are absent due to subsidiarity considerations.

Soil erosion - especially in the Mediterranean zone - is caused by deforestation and inadequate agricultural practices. Soil pollution can have different origins: airborne acidification, excessive utilisation of fertilisers and pesticides in agriculture, storage and disposal of materials in industrial sites, disposal of domestic and industrial wastes and mining operations.

Impacts on nature and biodiversity

Conservation of *nature and biodiversity* is traditionally pursued by protecting areas and species. The Habitat Directive, through the creation of a coherent European network of natural and semi-natural sites (the NATURA 2000 network), provides a potential mechanism for increasing the total area of protected sites in the Union, as well as for improving management and monitoring systems for these designated areas. The current challenge for the Union and Member States is to designate sites reflecting the variety of Europe's natural habitats, and to show a willingness to contribute significantly to facilitating the process.

Biodiversity in Europe is under stress from human impacts from all target sectors. The change of biodiversity leads to: a depletion of natural genetic sources, disappearance of species, an increasing vulnerability of ecosystems. A decrease in biodiversity also imposes the possibility of long-term risks to food security. Natural habitats such as hedgerows, open, natural and semi-natural grasslands and wetlands are specifically under pressure and change continually. Many plant and animal species are currently declining and threatened with extinction. Although Europe's area under forest is increasing, this does not mean that forest as an ecosystem is not to be considered as vulnerable. Patches of old forest are under pressure from the forestry industry. Air pollution (which influences all habitats) is also seriously damag-ing forests. In the southern part of Europe, forest fires are a major problem. The composition of habitats, especially forests, has changed due to the introduction of non-indigenous species. In many areas, forests are no longer natural ecosystems due to afforestation practices.

Land use and habitat fragmentation are the major factors directly affecting nature and biodiversity; however, pollution and other human activities also

give rise to multiple stresses (eg, acidification, chemicals in the environment, disturbances in water availability and nutrient cycles and introduction of new species). In spite of the reductions in pressure that have been achieved, exceedances are still above critical levels of ecosystems.

Environmental expenditures

Total environmental expenditure in the EU12 was about 63 billion ECU in 1992. Expenditure on environmental protection has been increasing steadily since 1985 at a rate of about 4% per annum, although since 1990 growth has been slower at 1% per annum. Expenditure on wastewater treatment measures accounts for the largest share of total environmental expenditure (about 50%). Waste management is the next most significant area of environmental spending (33%). Environmental expenditure is expected to increase by about 50% between 1992 and 2000 as a result of stricter environmental policies, but also due to general economic growth.

The overall impact of environmental policies on economic development can be considered as minimal. OECD concluded that the current costs of pollution control are only a small part of total costs in most sectors and that nearly all Member States have introduced similar environmental measures at roughly the same time. Environmental measures are not a source of significant cost differentials among major competitors and have marginal effects on overall trade between countries.

The potential effect of environmental regulation on the environment industry (the provision of goods and services for environmental protection activities) and on job creation is significant and shows an upward trend. The implementation of clean (process-integrated) technologies and energy and resource conservation measures (due to climate change and waste recycling programmes respectively), can also lead to financial savings.

1.3 Societal trends and target sectors

Trends

The key strategy of the 5EAP is to integrate environmental considerations into other policy areas, focusing on five target sectors, therefore aiming to initiate changes in current trends and practices. Despite this strategy, the driving forces behind the pressures on the environment have not changed or lessened. Apart from agriculture and material use, all sectors show upward trends, resulting in more energy use and transport mobility (see *Figure 1.3.1*).

Compared with the assumptions made at the time the 5EAP was compiled, the following trends have not changed, or have resulted in increased pressure on the environment:

- a larger population increase than predicted;
- a faster expected growth in transport (road and air);
- continuous growth in tourism; and
- continuous increase in energy consumption (improvements in energy efficiency in industry and the domestic sector are counterbalanced by the increased consumption in the transport sector).

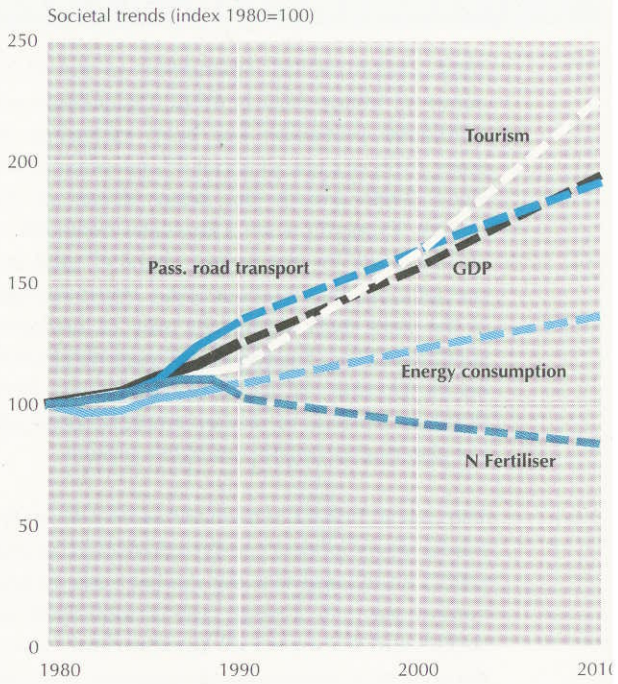
Some other trends have resulted in (relatively) less pressure on the environment (compared with 5EAP assumptions):

- relative reduction in economic and industrial growth (despite the completion of the Internal Market); and
- absolute reduction in use of fertilisers and pesticides in agriculture (mainly due to the CAP reform).

Target sectors

Despite a steady increase in activities, the *industry* and *energy supply* sectors have achieved some successes in reducing their environmental loads. Point-source-oriented policies (initiated before the 5EAP), mainly focusing on end-of-pipe technology, have been quite successful. Although small to medium sized enterprises (SMEs) still require attention. By the year 2000, the industry and energy sector will probably have achieved the majority of the no-cost/low-cost measures including: energy efficiency, input and waste minimisation, and low-cost changes to process technology. However, pollution prevention and conservation of energy, materials and other resources (eg, water) have not been significantly integrated into sectoral policies and behaviour.

Figure 1.3.1: Societal trends in the European Union (GDP, passenger road transport, energy consumption, nitrogen fertiliser use and tourism) and current scenarios
Sources: Eurostat; World Bank, 1995; DRI et al., 1994.



Note: Future growth rate for tourism is in terms of arrivals, while past trends are in terms of overnight stays

Since the early 70s, *energy* intensity has decreased mainly due to energy efficiency improvements and changes in overall structure of the economy. However, total final energy consump- tion increased steadily between 1974 and 1992 by about 0.6% per year on average. Implementing the current 5EAP measures (at EU and national level) will hardly lead to any change in these figures; in fact, energy intensity will show less reduction. Major underlying factors are the remaining low prices of energy (which discourage energy conservation measures) and the increased use of energy in the transport sector (which counterbalances the lower energy use in industry).

In the last decade, the breakdown in energy supply has shown some changes. The share of solid fuels has fallen, the share of natural gas and nuclear has

increased. It is expected that fuel supply by gas will further increase in place of solid fuels. The present share of renewable energy accounts for some 5%, this will increase to 7.5% in 2010.

Agriculture occupies the major proportion of the land area and is largely responsible for the maintaining rural landscapes and the rural economy. However, intensive farming adds pressure on the aquatic environment and has reduced and altered natural habitats and biodiversity. Trends in agriculture are reducing pressures on the environment, mainly due to the reform of the EU's Common Agricultural Policy. Full implementation of the Nitrate Directive will lead to further improvements. Due to time lags and accumulation in the soil, the effects of policies to reduce impacts on the environment will only be noticeable in the long term. In the meantime, problems such as the demand for sufficient drinking water resources and the further deterioration of water quality will increase.

Transport appears the key sector on which to focus future policy. Environmental pressure from this sector shows a steady increase. Forecasts suggest a near doubling of freight road transport and about a 50% increase of passenger road transport between 1990 and 2010. Emissions from transport are crucial for (urban) air quality and contribute significantly to climate change. This contribution is increasing and counter-balancing gains from other sectors. To date, the EU has played a key role in establishing environmental requirements for the transport sector (technical and fuel standards). Apart from introducing further technology-forcing product requirements, the challenge is to design new transport systems including the re-engineering of infrastructure to satisfy mobility demands in a more sustainable way than road transport. Efforts to encourage a decrease in the overall demand for mobility (facilitated, for example, by the 'information society') will also be necessary.

The *tourism* sector has experienced significant growth in recent years, which is expected to continue into the future. Due to patchy or missing information, it is impossible to fully assess the environmental impact of this sector. Excessive or poorly managed tourism may have complex and wide ranging negative impacts, such as those associated with road and air traffic, water pollution, unsafe (due to lack of sewage treatment) bathing waters and loss of habitats associated with tourism infrastructure and disturbance. A clear strategy for sustainable tourism at regional level is still lacking, while the EU is not competent in this sector.

2. INTRODUCTION

2.1 Objective and structure of the report

Scope

In the Fifth Environmental Action Programme (5 EAP) the European Commission states that "a comprehensive reappraisal of the situation will be undertaken and an up-dated report on the state of the environment and a review of the policy-cum-strategy set out in this Programme will be published before the end of 1995" (EC, 1992). The European Commission (DG XI: Directorate General for Environment, Nuclear Safety and Civil Protection) has asked the European Environment Agency (EEA) to produce the above-mentioned state-of-the-environment report, requesting that besides producing an update, the EEA should also carry out a quality assessment as to whether the measures taken to date will lead to achievement of the 5EAP targets. Data and time at this stage were insufficient to allow for quantitative assessment based on modelling.

This report will be the fifth EU state-of-the-environment report (the first four were published by the European Commission in 1977, 1979, 1986 and 1992 respectively). The scope of the report is both a description of the state of EU's environment and an integrated environmental assessment based on:

- diagnosis of the state of the environment and its mutual dependencies (to identify knock-on effects and multi-stress impacts);
- integration over time (to assess past and future environmental trends identifying time-delays in the environment and ecosystem);
- diagnosis of driving forces (societal trends) and pressures (emissions); and
- an assessment of the costs of implementation of environmental measures.

The limitations listed below should be noted.

- *Effectiveness* in delivering environmental results of current policies has been assessed on a qualitative basis in terms of the likelihood of achieving 5EAP targets. While the European Commission has undertaken a stock-taking exercise of current action by Member States, the data provided by Member States does not allow for a complete or consistent basis for modelling. (The information gathered by the Commission is used to diagnose some specific developments in Member States.) Furthermore, full appraisal of past policies and specific measures has not been possible for similar reasons. The environmental assessment of the progress and prospects of the 5EAP is further hampered by the absence of a complete overview of the 5EAP measures and the assumptions made in relation to the achievability of the 5EAP targets.

- *Efficiency* of current policies is not within the scope of this report, since this would require the establishment of a baseline case - the state of the EU environment in the absence of 5EAP - and comparison with alternative policy options, neither of which have been possible *ex post*.

In addition to the state of the environment, this report includes an *ex ante* environmental assessment of the progress and prospects of the 5EAP (see also *Box 2.1.1* for a further elaboration on this issue). The following issues are addressed:

- changes in the initial state of the environment (new insights);
- changes in social developments (eg, population growth, energy use);
- progress in implementation of 5EAP actions (since 1992) for which the EU is taking the lead;
- qualitative assessment of the effectiveness of policy measures and actions; and
- distance to targets (expert judgement on the achievability of selected 5EAP targets for main environmental themes based on the existing state of action and policies in the pipeline).

The focus of this report is on the trends and the state of the environment at the *EU level*. Although the 5EAP calls for action at the Member State and local levels, and by target groups, evaluation of the progress to date is the subject of the Commissions Progress Report on the 5EAP; the analysis of this report is limited to discussion of progress in the implementation of those actions mentioned in the 5EAP at the Community level.

The assessment of state of environment at EU level is an aggregation of data provided by Member States for EU12 and EU15 (including the three new Member States: Austria, Finland and Sweden). However, the focus has been primarily on EU12 in order to:

- provide some continuity with the previous state-of-the-environment report, which was restricted to EU12; and
- assess the assumptions and the achievements of the 5EAP targets addressing the EU12 Member States.

Additional information is provided on individual Member States in *Appendix 2* and in maps and discussions in the main body of the report. Data on the three new Member States is also provided. However, no desegregated appraisal of the state of the environment or action has been attempted since 5EAP did not set targets throughout each individual Member State separately.

Selection of indicators and data sources

The work in this report has focused on a set of *indicators*, which have been selected on the basis of the following criteria:

- they provide an indication of key pressures/stresses or environmental quality in relation to the key 5EAP themes (ie, it should monitor progress of environmental policies, preferably towards a 5EAP target);
- they reflect recent work carried out on indicators by , for example, OECD; and
- the information should be available (in the short term) on a comparable basis for EU12 and EU15 using Eurostat and other official sources, or *Europe's Environment: the Dobříš Assessment* (EEA, 1995), wherever possible.

Map 2.1.1: The countries of the European Union. Source: EC/Eurostat

Box 2.1.1: Towards a new way of reporting

The time factor obviously plays a part in the development of environmental problems and of pro-active policy making. Three time-lags can be distinguised.

- *Chemical time-lag.* A continuous loading in time influences the storage capacity of reservoirs. Once such storage capacity has been exceeded, the environmental problem becomes manifest (often referred to as the 'time-bomb' effect). It can also take a long time before the original situation is recovered, once actions are undertaken. Some striking examples of environmental problems that show a rather 'irreversible' character (or a long recovering time) are climate change, ozone depletion, (persistent) chemicals in the environment and loss of habitats. In relation to reservoirs, 'time' also means that despite the reduction of environmental pressures, this process might not suffice. The total stress remains too high because the pressure is still exceeding critical levels and is well above the carrying capacity of ecosystems. For improving the quality of nature, further improvement of environmental conditions and land management are crucial.

- *Biological time-lag.* There is a time dealy between the chemical (or physical) exposure and the effect, ie, the frequency of human diseases such as cancer. A typical example is the time-delay between the exposure of UV-B radiation (due to ozone depletion) and the increased prevalence of skin cancer decades later.

- *Societal time-lag.* Apart from the time it takes for raising public awareness and development of policy trategies, the regulation period also needs time. Direc-tives that have not yet been approved will take at least 4-5 years to come into effect and, where derogations are offered to specific Member States or sectors, may not be fully implemented for a further 10 years. This implementation period also depends on the speed of 'fleet turnover' (eg, it will take 10-15 years to fully implement the new catalytic converter in all passenger cars). This fleet turnover is even longer in some other sectors (eg, power plants, transport infrastructure, housing).

Therefore, a diagnosis of only the current state of the environment is inadequate. Early warning information systems, monitoring of environmental progress and environmental outlooks are crucial for supporting the policy process and providing sufficient feedbacks for policy-makers and society on the environmental effects of their present and intended actions.

It should be noted that in order for information to be an indicator, trend data are required, otherwise only a stop frame image of the environmental situation is presented. The indicators selected can be divided into two groups based on societal and environmental trends. The first group reflects the driving forces behind the environmental pressure and is linked with the 5EAP external integration policies. The second group contains the more traditional environmental indicators, which describe the 'cause-effect' chain (or environmental pressure, state and impact). The emphasis in this report is on pressure indicators (eg, emissions) for the two main reasons given below.

- Most EU measures are source-oriented, aiming to reduce environmental pressures. Pressure indicators are thus more suitable for monitoring policy progress. State and impact indicators are 'suffering' from chemical time-lags, ie, only after a certain period can successes (or failures) of policies can be noted.

- Pressure indicators are more developed, partly due to the interest these indicators hold for selecting policy targets. The quality of the environmental state and impact indicators is not overwhelming. Trend data are mostly absent. Assessing the state of the environment requires a full description of all parameters that affect the state. For a full description of all parameters, please refer to the report *Europe's Environment: The Dobříš Assessment* (EEA, 1995).

In addition to the above mentioned indicators, a shorter list of 9 'target' indicators have been selected; these help to indicate where the EU stands in relation to key 5EAP targets and how much more needs to be achieved ('distance to target'). These 'target' indicators include:

- CO_2 Emissions (tpa);
- Consumption of Ozone Depleting Substances (ODPs) (tpa);
- SO_2 Emissions (tpa);
- NO_x Emissions (tpa);
- VOCs Emissions (tpa);
- Municipal Solid Waste (MSW) arisings per capita requiring disposal (kg pa);
- Area of EU12 where Nitrates targets are exceeded (% of land area);
- Area of EU12 where Pesticides targets are exceeded (% of land area); and
- Percentage of EU12 population exposed to more than 65 dB(A) noise.

The quality of this report depends heavily on *data quality, availability and consistency*. Two types of information were required:

- Societal information (economy, population and sectorial trends); and
- Environmental information (pressures, state, impact and trends).

The main source of data for past and present situation trends in society is Eurostat. Information about future trends on societal developments, which underlie changes in the environment (eg, population, transport patterns, and energy consumption), has mainly been drawn from the report *Potential Benefits of Integration of Environmental and Economic Policies; An Incentive-based Approach to Policy Integration*, commissioned by the EC (DRI et al., 1994) - hereafter referred to as the *DRI Integration study*. Although in some cases more up to date information is available from national, trade association or other resources, the DRI study has been used extensively in order to ensure consistency.

From the DRI Integration study two scenarios have been referred to: Reference (REF) and 'Policy-in-the-Pipeline' (PIP) scenario. The first is a baseline or 'business as usual' scenario based on projections assuming that all policy measures and actions agreed by the end of 1992 will take effect. The PIP scenario is based on an assessment of the likely evolution of EU environmental policy making, including policies still at the proposal stage and in some cases policies which have subsequently been abandoned (such as the introduction of a carbon/energy tax). This PIP scenario does not reflect the situation of the state of action at mid 1995, but can serve as a 'best case'. Although the DRI Integra-tion study only considers 6 Member States of the EU15 (Germany, Spain, France, Italy, The Netherlands, and the United Kingdom), it reflects about 85% of the total GDP and CO_2 emissions, and 80% of the total municipal waste production.

The environmental data provided in this report updates and improves upon trends reported on by the European Commission in 1992 and the 5EAP, which is mostly based on 1989 data (EC, 1992). Much of the relevant data has been updated in the pan European state-of-the-environment report *Europe's Environment; the Dobříš Assessment* (EEA, 1995) (hereafter referred to as Dobris), which has been drawn on and updated wherever possible. The main sources for new data relating to emissions were the 1995 Eurostat/OECD questionnaire and data collected by UNECE within the framework of the Convention on Long-Range Transboundary Air Pollution (LRTAP) and the Climate Change monitoring mechanism. In some cases 'state' and 'impact' information is also updated (eg, atmospheric CO and ozone concentrations, exceedance of acid critical loads, nitrate concentration in ground water and compliance with bathing water directives).

Structure of the report

The 5EAP sets out an integrated strategy for both environmental themes and causes of environmental degradation by target sectors. Although the relation between themes and sectors is complex (see also *table 2.1.1*), an attempt has been made to separate these two topics in this report.

The report is structured along similar lines to the 5EAP itself and is divided into three mainchapters.

- *Chapter 3* describes the past and future trends in society, the activities within each of the 5EAP target sectors and the policy measures influencing the level of activity within each sector.

- *Chapter 4* is the main body of the report and covers 11 environmental themes (including the soils issue, which was not covered in the 5EAP) and for each describes the environmental issues (including human health)*[1], EU policy measures, the state of the environment and underlying factors and the outlook and progress towards achieving 5EAP targets. The themes are categorised according to their spatial scale of impact (see also RIVM, 1989); there are three categories: global (*Sections 4.1* and *4.2*); transboundary (*Sections 4.3* and *4.4*) and regional (*Sections 4.5-4.10*). *Section 4.11* covers the impacts of each of the other themes on nature and biodiversity.

- *Chapter 5* summarises the contributions of 5EAP sectors (including the households sector, which is not covered in the 5EAP) to each of the environmental themes (focusing on environmental quality and sensitivity) and provides an overview of the estimated costs of actions to achieve 5EAP environmental targets.

Tables within the report provide an overview of developments on a similar basis to tables within the 5EAP itself (with the exception of the table on the international dimension), showing the objectives and measures set out in the 5EAP and progress at EU level in the period 1992 until 1995. *Chapter 3* contains the target sector tables (including a table on industry, which was not provided in the 5EAP) and *Chapter 4* includes the tables on environmental themes. The table on horizontal measures is presented in *Section 3.1*. *Section 2.2* gives an overview of the state of action and implementation of the 5EAP, in order to draw a base-line for evaluating current environmental trends and to assess whether the measures taken to date will lead to achieve the 5EAP targets.

Table 2.1.1: Indication of the Impacts of 5EAP Target Sectors on Key Environmental Themes

	Energy	Transport	Industry	Agriculture and forestry	Tourism
Global scale					
Climate change	◆◆◆	◆◆◆	◆◆◆	◆	◇
Ozone depletion	◇	◇	◆◆◆	◇	◇
Transboundary scale					
Acidification	◆◆◆	◆◆◆	◆◆◆	◆◆◆	◇
Other air pollution	◆	◆◆◆	◆◆◆	◇	◇
Regional scale					
Waste management	◆◆◆	◆	◆◆◆	◇	◆
Inland water quality	◆	◇	◆◆◆	◆◆◆	◆
Urban environment	◆	◆◆◆	◆	◇	◆
Risk	◆◆◆	◆	◆◆◆	◆	◇
Coastal zones and marine	◆	◆◆◆	◆	◆◆◆	◆◆◆
Impact					
Nature and biodiversity	◆	◆	◆	◆◆◆	◆

Legend:

◇ Nil or insignificant
◆ Some impact
◆◆◆ Substantial impact

*[1] A recent review of human health and the environment in Europe can be found in the Monograph on Environment and Health (EEA/WHO, 1995).

2.2 EU state of action

The Fifth Environmental Action Programme Towards Sustainability

When it was proposed in 1992, the European Commission's Fifth Environmental Action Programme, *Towards Sustainability* (5EAP), marked an important change of direction for the Community's environmental policy. Previous action programmes had generally taken the form of lists of proposed legislation often selected in response to events, whereas the 5EAP attempts to address the fundamental causes of environmental degradation as a means of creating a more sustainable economy and society. The 1992 Earth Summit of the UN Conference on Environment and Development and its main result, Agenda 21, gave (further) political guidance to sustainable development.

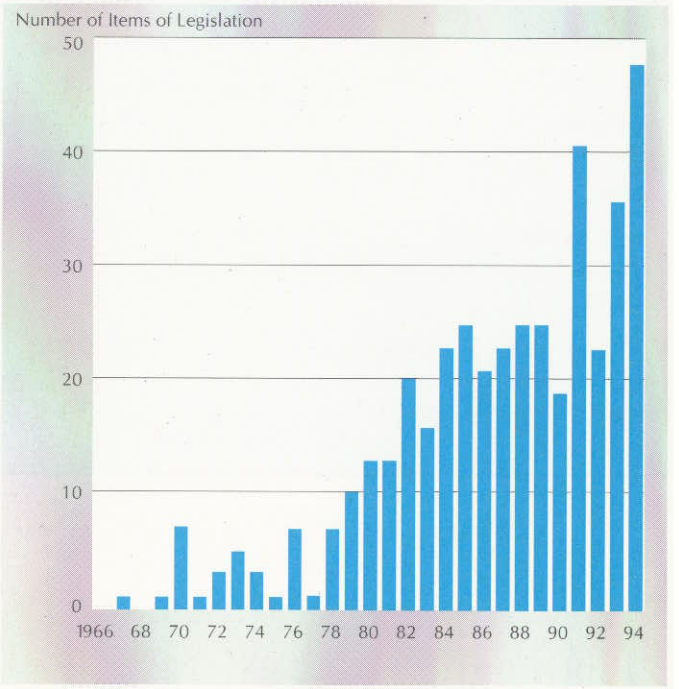
The 5EAP focuses on ten major environmental problems or themes, and five economic sectors, which make a significant contribution both to their creation, and by the same token, their solution. For most of the themes and target sectors, the Programme presents tables setting out policy objectives, indicative targets up to the year 2000, the instruments and timetables for achieving the targets, and the key actors from whom action is required.

Running through the 5EAP is the principle that the environment needs to be integrated from the outset into all the policies and actions of industry and government, especially in the target sectors. Other important features of the Programme include a recognition that changes in society's patterns of behaviour must be achieved in a spirit of shared responsibility among all key actors, including central and local government, public and private enterprise, and the general public (as both individual citizens and consumers). It also emphasises that the range of policy instruments applied to the solution of environmental problems should be broadened beyond traditional 'command and control' legislation; instruments should include: voluntary agreements, economic instruments, and better information and education to enable the public to make more informed choices.

Currently, legislation has traditionally been the principal instrument of the Community's environmental policy, and the number of items of legislation agreed each year has continued to grow.

Figure 2.2.1 shows that there has been a steady increase in the number of items of EU environmental legislation over the past 3 decades. Legislation now covers air and water pollution, waste, hazardous substances, wildlife and countryside protection, noise, impact assessment and information, climate change, and financial instruments for the environment.

Figure 2.2.1: Total EU environmental legislation adopted each year
Source: IEEP, 1995



Note: the figure includes energy labelling, the Cohesion Fund, authorisation of pesticides, etc, but excludes legislation on the control of radioactivity.

The earliest measures were mainly concerned with the harmonisation of product standards to remove internal barriers to trade. In the 1980s there was a rapid expansion of the corpus of environmental legislation. This resulted in part from the revision and amendment of the earlier measures as well as the development of policy in areas such as water and air quality. The 1987 Single European Act provided a further impetus to legislation in new areas. In the early 1990s the continued expansion of legislative activity partly reflected the identification of new policy areas such as climate change, and the development of new 'horizontal' measures such as the Eco-Management and Audit (EMAS) and Ecolabel schemes.

However, following the 5EAP approach and the entry into force in 1993 of the Maastricht Treaty, with its commitment to the principle of subsidiarity, the number of legislative proposals put forward by the Commission has declined, and the graph of legislative activity is likely to reflect a downward trend in the future. On the other hand, the commitment to review existing legislation in the light of the subsidiarity principle, made at the Edinburgh European Council in December 1992, will lead to some further amendments to existing legislation.

The 5EAP recognises that alternative policy instruments which affect the behaviour of firms and individuals directly, such as eco-taxes or improved environmental information and education, can have an advantage over traditional command and control' legislation. Unfortunately, and despite the emphasis given to them in the 5EAP, few such instruments have so far been deployed at Community level, but as discussed in the following chapters, such measures are becoming an important element of environmental policy in individual Member States.

Evaluating the impact of the programme

The extent to which the 5EAP can eventually contribute to a more sustainable use of Europe's resources depends on the actions of a number of different actors at various levels, and (where the EU takes the lead) on a decision-making chain made up of several vital steps. Where measures have been identified in the programme for action at Community level, the first key step in the decision-chain is for the Commission to develop formal proposals for consideration and subsequent agreement by the Council and European Parliament. This report seeks to describe in tabular form, for each theme and target sector, how far the Community has acted to fulfil the commitments that should have been achieved by now on the basis of targets set out in the 5EAP.

This is not a straightforward exercise, since commitments have not always been clearly defined in the Programme, nor deadlines set. However, overall it appears that, where the 5EAP assigns the leading role to the EU, the Community has taken considerable action - in the sense that the required action has been taken and, for instance, new legislation is close to adoption. This includes examples where there may indeed have been some activity, but not of the type envisaged in the 5EAP. Alternatively, the Commission may have produced draft proposals, but progress has since slowed down or come to a standstill as a result of opposition by one or more Member States - the most obvious and relevant example here being the proposal for an EU carbon/energy tax.

The principle of 'shared responsibility' is rightly emphasised in the Programme, and accordingly actors other than the EU (for example, the governments of the Member States or local authorities) are allocated the lead role for very many of indicative actions of the 5EAP. The extent to which they have taken the appropriate action varies considerably between and even within Member States. However, the Programme is a non-binding framework document and, as such, includes no legal obligation for the Member States to report on its implementation. As a result, information on the implementation of the Programme has either not been made available by some Member States, or has been provided in incomplete form.

Implementation and enforcement of legislation

Even where the Community is allocated the lead role, it is still the Member States that ultimately determine whether Community measures will be effective or not, since it is national governments who are responsible for implementation and enforcement on the ground. This is one of the most crucial links in the decision-chain, and means that even the best designed Community legislation can be rendered completely ineffective if it is not implemented properly. Implementation failures by Member States may take the form either of complete or partial failure to transpose EU legislation into national law, or of inadequate practical application and enforcement of that national law. The latter may result from inadequate administrative machinery and/or procedures; poor permitting, monitoring or inspection regimes; or insufficient public expenditure.

3. SOCIETAL DEVELOPMENTS AND DRIVING FORCES

3.1 Introduction

In the following sections a description and analysis is made of societal developments, based on indicators that 'explain' environmental pressure and quality in the EU. The sectoral pressures themselves will be discussed in *Section 5.1*. The sectors covered (which are the same as the 5EAP target sectors) are: industry; transport; energy; agriculture and forestry; and tourism. The issues which are addressed in each sector are:

- identification and contribution of relevant EU policy measures;
- societal trends in the past years (1980-1993/1994);
- assessment of these trends ('driving forces'); and
- future expectations in the societal trends under two scenarios.

The first scenario is based on projections at the time the 5EAP and 1992 State of the Environment Report was compiled (to be further referred to as '5EAP92 scenario'). The second scenario reflects more recent expectations (consistent as possible) to be used as a basis for the review of the 5EAP (to be further referred to as '5EAP95 scenario'). The 5EAP95 scenario is derived from conclusions and findings of various studies. In particular the DRI Integration Study was the main source for societal outlooks. In the evaluation of the societal trends, these two scenarios will be compared; societal developments that substantially diverge from those assumed in the 5EAP will be identified. There are two main causes of the divergency: new insights on societal, economic and technological trends; and impacts of (implemented) environmental policies on those trends. The difference between these two causes is difficult to assess, although the latter cause is expected to be only marginal, due to the current state of action.

To assess the societal trends identified in each sector, it is important to take into account the different levels of pressure acting on the environment in each of the Member States. For example, a 40% increase of transport in a country with a low activity level has a different environmental impact compared to a country where there is already a high activity level of transport. The spatial distribution of production and consumption and of housing and work determines the distances travelled, the energy consumed and the space demanded by traffic and transport in society. Due to differences in population density, pressures on the environment exhibit a marked spatial variation. *Figure 3.1.1* lists the indicators per surface area.

The human activities putting pressure on the environment vary considerably between Member States. In general, highest pressure is in North-western European countries, while lower pressure is exerted in the Southern Member States (excluding Italy) and in the three new Members States. A main cause for the differences is the load factor per capita, which reflects the lower level of economic activity in Southern Member States.

A short discussion is provided in this section of the European Commission's role in the implementation of the 5EAP, the main trends in the integration of environmental policies and the use of horizontal measures.

Main trends in European integration of environmental policy

One of the messages of the 5EAP is that implementation of a strategy for sustainable development will require a drastic change in almost all major policy areas of the Community. Ways towards integration of environmental concerns in sectoral policies have been clearly depicted. However, policies and measures

Figure 3.1.1: Environmental load indicators in the beginning of the 1990s
Sources: Eurostat; OECD, 1993

AT	Austria	IE	Ireland
BE	Belgium	IT	Italy
DE	Germany	LU	Luxembourg
DK	Denmark	NL	Netherlands
ES	Spain	PT	Portugal
FI	Finland	SE	Sweden
FR	France	UK	United Kingdom
GR	Greece		

Note: Livestock Unit (LU) includes cattle, pigs, sheep and goats, and is based on fodder requirements (one cow equals one LU).

in these areas have gained their own momentum over the last 30 years. Also, the introduction of new instruments, based on the legal and policy foundation provided by the Treaty on European Union and the 5EAP, can only be assessed in terms of their effectiveness after the societal actors have adapted their behaviour. From the findings and conclusions on the societal and environmental trends, it will become clear that effective mechanisms to assess the potential effects of policies aimed at stimulating economic growth and, consequently, increases in industrial production, households consumption, mobility and energy consumption, still need to be developed.

With the introduction of the White Book in 1987 on the *Completion of the Internal Market* in 1992, the European Commission committed itself and the Member States to a closer economic and monetary cooperation. One of the driving notions behind this was the assumption that a greater internal market, not hindered by non-harmonized technical, fiscal and monetary rules, would trigger additional economic growth in the Member States. According to the *White Paper on Growth, Competitiveness and Employment* (EC, 1993), this has happened; in the period 1986-1992 an additional 0.4% growth can be attributed to the Internal Market.

In spite of technical progress and structural changes in industry, there is still a strong relationship between GNP and the use of resources (raw materials and energy). Hence, this additional growth in itself is expected to give rise to an increased environmental load. This is reflected through such explanatory indicators as: industrial production; passenger and freight kilometres; energy use; agricultural inputs (fertiliser, pesticides) and outputs (livestock); and tourist stays. These indicators are described in the following sections.

Liberalization of energy and transport markets is another important priority area. The abolition of market monopolies, particularly in the areas of energy production and transport, is believed to stimulate competition and is therefore considered an important objective. In some instances, this may lead to price reductions that would be beneficial to users and end-users. No attempts have been made to assess the environmental consequences of this policy.

In addition to the integration of economic policies, *Structural Funds* have been created to assist development in the least favoured regions. In financial terms, resources have increased from about 7 billion ECU in 1988 to 14 billion in 1993. Greece, Ireland, Portugal and important parts of Spain and Italy are designated as main receptors of these funds.

Based on more extensive environmental requirements, screening procedures for regional plans and programmes have been reinforced, emphasizing the need for comprehensive monitoring at the Community level.

Article 130d of the Maastricht Treaty established a *Cohesion Fund,* which contributes to projects in the fields of environment and to trans-European networks in the area of transport infrastructure. Member States with a per capita GNP less than 90% of the Community average benefit from this.

The Cohesion Fund has demonstrated less concern for environmental impact of the projects and programmes it funds than the revised Structural Fund Regulations (which do not apply to the Cohesion Fund). Past allocations, such as those in 1993, were particularly directed at transport projects, mainly motorway construction.

Furthermore, Articles 130r to 130t on the protection of the environment call for measures in the field of physical planning and land uses, as it is clear that these play a key role in the sustainability of economic development. In the Commission report *Europe 2000 +*, the essential facts and strategic elements for integrated land planning all over Europe are stated, lightening the link between the management and monitoring of natural resources and the territorial impacts of sectoral policies.

In the *White Paper on Growth, Competitiveness and Employment* (EC, 1993), the Commission launched a strategy for economic recovery and a discussion about a model for sustainable development. Key to achieving this could well be the systematic internalization of external environmental costs through efficient policy instruments, such as economic instruments. Benefits of this strategy include the possibility to reap a double 'dividend' improved environmental protection and increased employment) by financing a fiscal reform (eg, lowering charges on labour) through environmental taxes.

Horizontal measures

One of the key objectives of the 5EAP is to broaden the range of policy instruments in order to bring about substantial changes in current trends and practices and to involve all sectors of society. In *Box 3.1.1* the proposed so-called horizontal measures are discussed and the actions taken by the EU so far are listed.

It is difficult to fully appraise the effectiveness of these horizontal measures. Most of them are viewed as essential to improve the policy process, to support other policy instruments and to gain social acceptance of new environmental measures still to be implemented. Optimal feedback on the environmental consequences of individual behaviour to citizens and companies is vital to encourage more environment-friendly products and production methods.

Box 3.1.1: EU state of action. Horizontal measures since 1992.

5EAP objectives for EU (1992-1995)	Selection of actions undertaken
Improvement of data	● Establishment and start-up of European Environment Agency ● Publication of the report: *Europe's Environment: The Dobris Assessment* and various Eurostat publications ● Development of the European Environment Information and Observation Network (EIONET) ● Decision 94/808 on a programme strengthening the environment component of Community statistics 1994-1997
Getting the prices right: ● evaluation and accounting	● Commission communication on environmental indicators and green national accounting (COM(94)670) - proposes establishing a work programme for developing harmonised instruments for integrating environmental and economic indicators and national accounts. Use European System of Integrated Economic and Environmental Indices with eventual target of creating satellite national environ mental accounts.
● Other economic and market-related instruments: - Environmental audit of major enterprises	● Regulation 1836/93 eco-management and audit, formal compliance April 1995
- Integrated liability and joint responsibility	● Green Paper (COM(93)47) on environmental liability ● (Directive on civil liability for future damage – proposal foreseen in 1996 Commission work programme)
Public information and education	● Information exchange network on energy efficiency (SAVE), new ALTENER information exchange being established, ● Second round under way of general measures to educate and increase awareness in the field of environment, aimed at economic operators including trades unions, regional and local authorities, environmental protection organisations and consumer-protection organisations. ● Preparations under way for measures to promote environmental education at all levels. ● Regulation 880/92 on Community Ecolabel award scheme. 5 related decisions on criteria of products.
Professional education and training	● Study guides on university environmental courses ● Commenius Programme
Financial support mechanisms	● 1992 McSharry reforms of the Common Agricultural Policy marked the start of the move toward increasing direct payment compensation, gradually replacing market support. ● Regulation 1973/92 establishing a financial instrument for the environment (LIFE) ● Life 2 proposed April 1995, COM(95)135. ● New cohesion Fund – Regulation 1164/94 – 923 million allocated to environment in 1993-1994 ● Programme (COM(94)207) providing assistance to SMEs ● Community guidelines on state aid for environmental protection C72,10.3.94

3.2 Spatial distribution and population

The issue

Spatial distribution and population issues are not addressed in a structured way in the 5EAP (forecasts are not included), although the key role that they play in a number of environmental problems is addressed. Two themes in which spatial distribution and population issues are particularly important, in terms of environmental stress, are the urban environment and coastal zones. Strategies and specific actions focus on noise abatement standards for urban environment, and the integrated planning and management needs of coastal zones.

Changes in land use patterns (which are influenced largely by underlying factors such as economic growth and changing consumption and production patterns) are particularly evident in energy and transport developments. Population growth and composition also have an impact on societal developments.

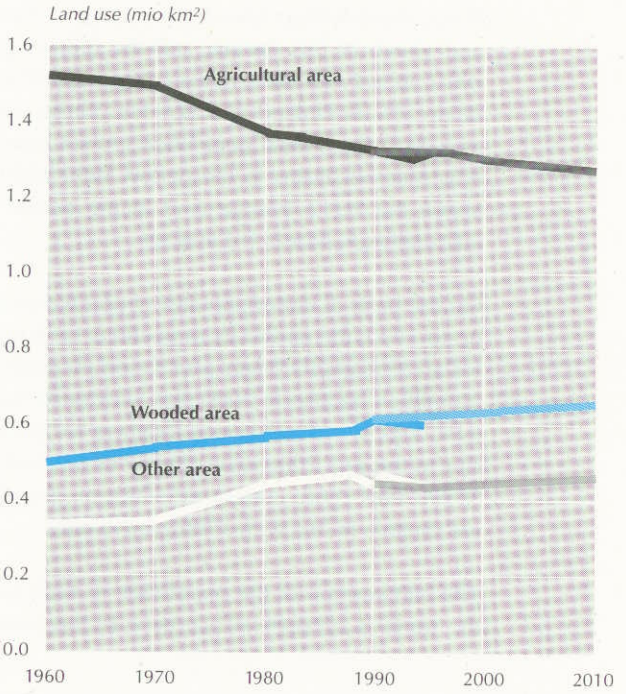
Past trends and outlook

Spatial distribution

Trends in land use within the EU12 are shown in *Figure 3.2.1*. This shows a general tendency towards a strong reduction in the extent of agricultural area since 1960. Exceptions to this are Germany, Greece, Ireland and Portugal. A recent forecast (DRI et al., 1994) predicts a further decrease in agricultural area of 0.15% per annum over the period 1990 to 2000 and 0.3% per annum from 2000 to 2010.

Trends also indicate that the extent of forest areas is expanding rapidly. Increases over the period 1960 - 1990 vary from 1-3% in Germany, Belgium and Luxembourg to 90% in Ireland and 40% in the UK. The wooded land area of the EU12 over the last thirty years has increased about 10%, mainly as a result of reforestation policies and spontaneous forest growth in marginal areas (EEA, 1995). The new Member States Finland and Sweden, and to a lesser extent, Austria have large areas that have remained forested for many centuries. In recent years, a great deal of unprofitable, redundant arable land has been planted with trees, which are predominantly of a rapidly growing type rather than of high quality.

Figure 3.2.1 Development of land use changes in EU12, past trends and outlook.
Source: Eurostat; EEA, 1995; DRI et al., 1994



Other land uses (urbanisation, infrastructure, tourism) have often replaced land that was previously in a natural state or used for agriculture. In recent decades, urbanisation processes and increased mobility requirements for work and leisure have led to a built-up-area increase of about 2% per decade in the more densely populated countries. Total length of motorways increased in EU12 by an average of more than 4% per annum between 1970 to 1990; however, it is forecast (ERECO, 1994) that growth will diminish to an average annual rate of 1.9% in EU12 for the period 1990 to 2000. According to an estimate by the EC (EC, 1992), the road network consumes about 1.3% of the total EU land area, as compared with only about 0.03% for the railway network.

Population

In the period 1960-1985, the EU12 population increased from around 300 million people to around 340 million people, implying an average growth rate of about 1%. In the period 1980-1985, population growth rate in EU12 declined to around 0.1% (*Figure 3.2.2*). Increased international migration towards Western and Northern European countries pushed the growth rate up to 0.5% in 1985-1990. This increased growth rate is likely to continue as the low reproduction

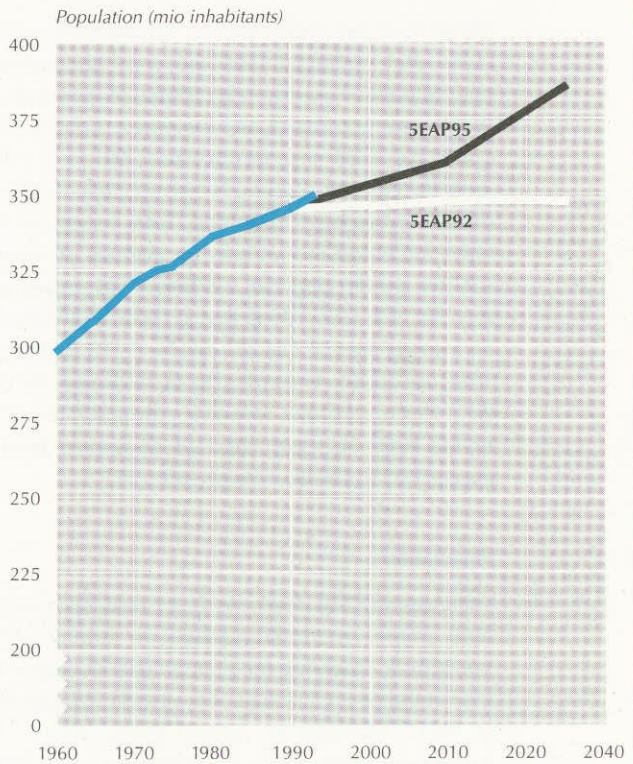
rate (about 1.5%) of the past 10-25 years is expected to be replaced by a reproduction rate rising above 2%. Some indications of this trend have been noted recently. In each of the new Member States, reproduction rates are predicted to rise to 2% and above in this decade and the following. After 2010, recent estimates indicate that they will decline below 2% in Finland and Sweden. These estimates also show the annual population growth rates of the new Member States in the period 1990-2000 rising above the EU12 average and in the period 2000-2025 falling below EU12 average.

On the basis of underestimates of population growth up to 1990, the latest UN projections for Europe are for a considerably larger population increase (about 12 million people) in 2000 than previously expected (UN, 1995)[*2]. The previous forecasts for population size in the year 2000 were already largely realized in 1990. After 2000, current estimates on growth rates are roughly in line with 1988 growth rates.

The composition of the population is also changing; the trend is towards an increase in the population over 65, with a greater share of those in the over 85 age group. Population ageing has become accepted as 'a matter of fact'. There are already clear indications that the levels of disposable income and leisure time in the over 65 age group give rise to an increased mobility demand.

In addition, over the period 1980-1990, there are continuous trends apparent in most of the EU12 countries towards smaller household sizes and a gre ater household numbers. This suggests that an increase in demand for mobility and an increase in the consumption of energy, drinking water, and industrial products may be expected.

Figure 3.2.2: Population in EU12
Source: Eurostat; UN, 1989: UN, 1995



*2 A 'high' Eurostat scenario projects a still higher total population in 2010: 382 million (Eurostat, 1992).

3.3 Economy and industry

The issue

The 5EAP places particular emphasis on the need to change consumption and production patterns. It makes explicit reference to the additional exploitation of natural resources, consumption of energy and increase of pollution and wastes, which have resulted from increased economic growth and industrial development.

New instruments and measures are presented in the 5EAP to create a 'self-perpetuating' movement towards the integration of economic and environmental policies. The Programme therefore adopts a coordinated approach of high environmental standards (set in relation to most pollutant emissions and discharges and recycling of packaging materials) combined with positive incentives for industry to improve performance even further.

In the 1993 *White Paper on Growth, Competitiveness and Employment*, a new model for sustainable development is outlined, which offers "society a better quality of life with a lower consumption intensity and reduced stress on environmental resources." A key to achieving this is the systematic internalisation of environmental costs through proposed means, such as fiscal reform and the wider use of cleaner technologies and techniques.

Developments in environmental management and audit schemes demonstrate progress towards changing attitudes in the corporate sector; this progress is promising in that the developments are designed to promote efficient resource use and to stimulate pro-active behaviour. However, it is still too early

Box 3.3.1: EU state of action in the industry sector since 1992.

5EAP objectives for EU (1992-1995)	Actions achieved
Sustainable production	
• Energy efficiency programme	• *See Box 3.5.1* on energy.
• Environmental auditing	• Eco-Management and Audit Scheme (EMAS) –Regulation 1836/93; scope is limited to certain industrial sectors and is voluntary. • CEN guidelines for standardisation.
• Deposit/return systems	• Packaging Directive 94/62 sets targets for the recycling and recovery of packaging waste and requires Member States to establish return, collection and recovery systems. However, there is no mandatory requirement within the Directive for reuse nor are other waste types addressed.
• Civil liability	• Proposal on civil liability for damage caused by waste – COM(91)219 – amended. Doubtful whether proposal will be adopted in the future.
Higher product standards	
• EU-wide ecolabelling scheme	• Regulation 880/92 establishes a voluntary scheme for the award of Ecolabels to products with reduced environmental impact. Progress in finalising ecological criteria for product groups has, however, been very slow. The 4th RTD Programme includes funding provisions for the development of life cycle analysis.
Pollution control	
• System of integrated pollution control	• Proposal for a directive on integrated pollution prevention and control (IPC) – common position reached at June 1995 Environment Council Meeting – proposed IPC scheme applies only to some industrial processes.
• Reduction of emissions, waste, risk	• See *Section 5.1.*

to assess the added value of more integrated (although so far voluntary) measures in comparison with the 'conventional' approach of issuing specific environmental legislation, either generic or detailed.

The 5EAP does not set any quantitative targets for the manufacturing sector as such; progress has to be assessed in a qualitative way. *Box 3.3.1* summarises progress at EU level since 1992.

Past trends

National economies in the EU have different economic cycles, and the industrial sector, by its very nature, is extremely diverse. This section describes and analyses some main trends in the EU for economic and industrial development.

In the period 1980-1994 annual economic growth averaged 1.9% in the EU12 and was largely influenced by the recessions of the early 1980s and 1990s (see *Figure 3.3.1*). GDP in the EU12 grew by about 30% over the period 1980 – 1993. Growth in each of the Member States was closely aligned to the EU average with the exceptions of Ireland which experienced rapid growth of about 70% over the same period, and Greece which had a slower growth rate (20%).

From 1980 to 1992, average industrial growth was around 1% whereas between 1986 and 1992 it was about 2.8% pa (see *Figure 3.3.2*). Ireland and, to a lesser extent, Portugal experienced growth greater than most of the other Member States of the EU12 while Greece lagged behind the EU average.

Since the early 1970s, production process efficiency has improved substantially. This is reflected in both energy intensity decreases and material intensity decreases, both of which have been substantial in the past 20 years: respectively about 20% and 50% (*see Figure 3.3.3*). Structural changes in Europe's economy have resulted in a shift away from heavy industry with a high energy consumption (such as iron and steel and the metals industry), to light consumer industries with a much lower rate of energy consumption (such as assembly and service industries). In the period 1980-1992, production output of the chemical industry and the pulp and paper industry increased by about 50% (with the exception

Figure 3.3.1: Development in GDP EU12
Source: Eurostat; EC, 1990; DRI et al., 1994

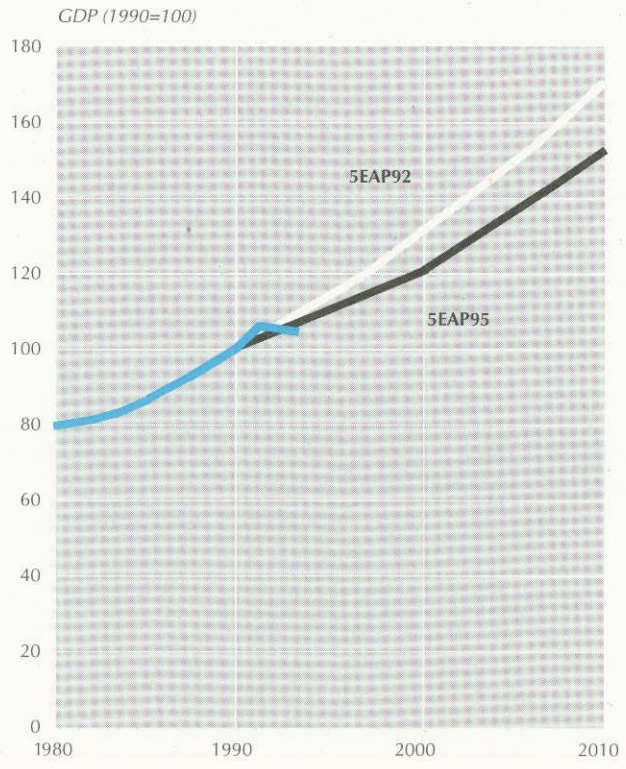
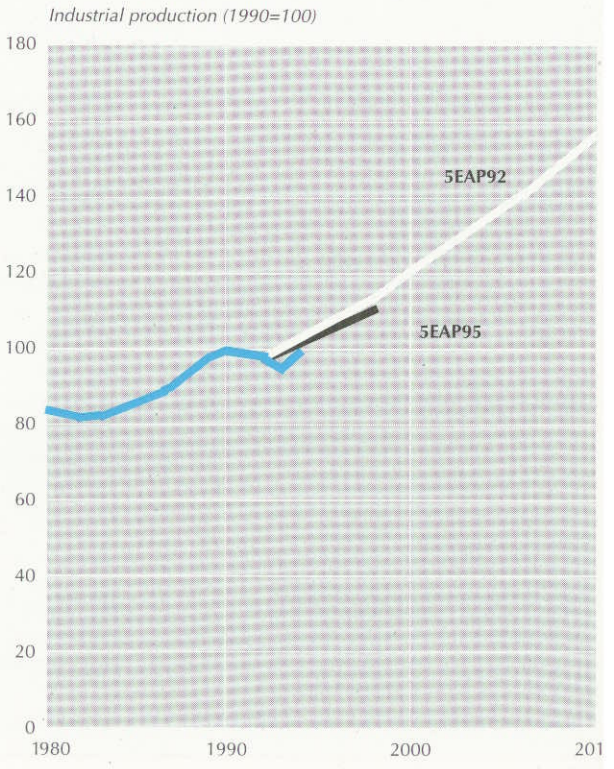


Figure 3.3.2: Development of industrial production EU12
Source: Eurostat; EC, 1990; ERECO, 1994



of the former industry lagging behind in Italy and the latter industry in Spain).

As in most other Member States, manufacturing activities in Sweden, Finland and Austria have shifted to a smaller number of large plants. In general, this process of modernisation has resulted in lower emissions of pollutants and a more efficient use of raw materials, despite higher output. Manufacturing, particularly in Sweden and Finland, is primarily based on forest products (timber, pulp, paper). All three countries have extensive mechanical and electrical engineering industries, which add more value to resources than basic mining or smelting activities. Also, a number of chemical and pharmaceutical industries are present in Sweden.

The report of the World Commission on Environment and Development (Brundtland) addresses the issue of preserving the overall balance between natural resources and the equitable distribution and use of resources between nations and regions over the world as a whole (WCED, 1987). In the 1960s, the EU12 accounted for 10% of the world population (see *Figure 3.3.4*). In the 1990s, this percentage declined to 6%. In the same time period, the EU was responsible for about 25% and 15% respectively of the world consumption of resources (metals and materials). This means that the balance has remained unchanged the last thirty years.

Outlook

In the 5EAP, GDP and the total manufacturing industry was expected to grow by an average rate of 2.7% and 2.6% pa to 2000 respectively (see *Figure 3.3.1*). More recent forecasts (5EAP95) are lower and estimate for both issues a growth of 2% pa in the period up to 1998 (ERECO, 1994; DRI et al., 1994). Above average growth is still expected in the recent forecast for the chemical industry and paper and board industry.

According to the same forecast, a below average growth is expected for the non-metallic minerals sector (cement and glass). Below average growth is also forcast for the steel industry, partly as a result of European restructuring efforts.

Figure 3.3.3: Development of the metals and minerals, and the energy intensity in the EU12 (consumption per unit GDP)
Source: Eurostat; Worldbank, 1995

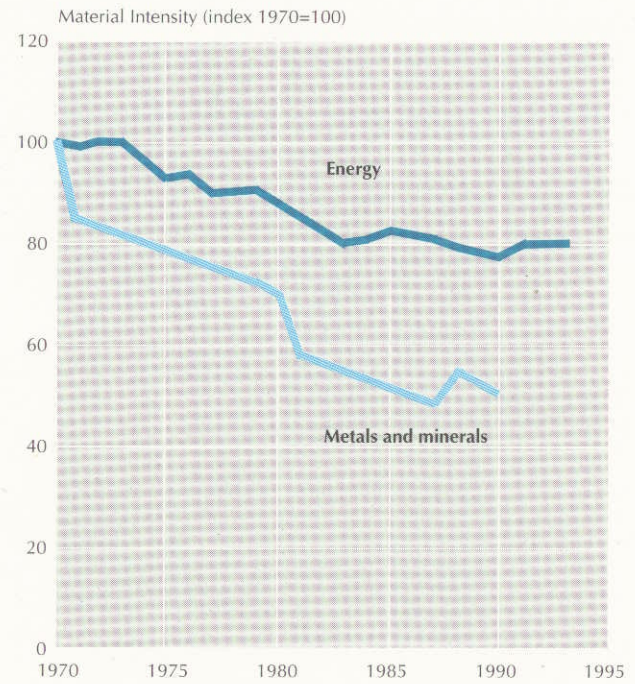
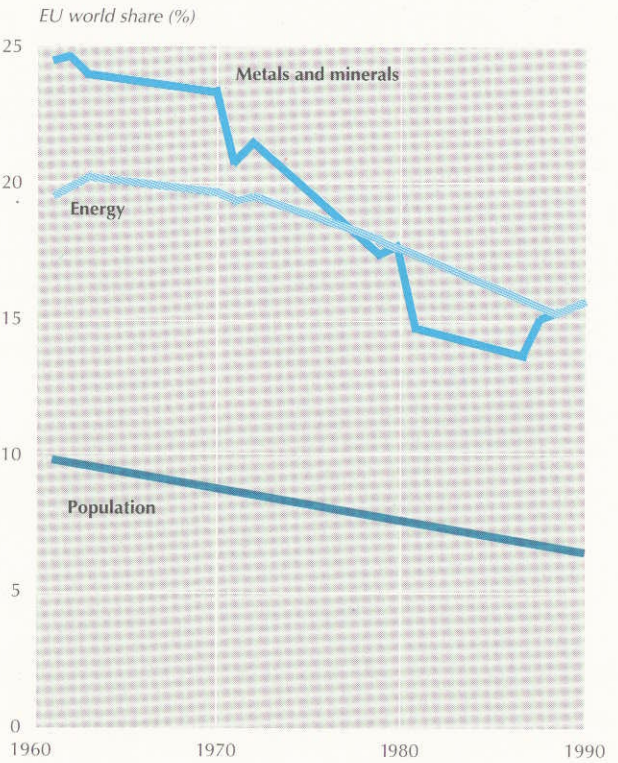


Figure 3.3.4 Development of the share of population and resource use in EU12
Source: Eurostat; Worldbank, 1995



The international position of a great number of manufacturing sectors has been suffering from increased international competition. Although rationalisation and automation are leading to efficiency improvements, they may still be insufficient to compensate for overall cost differences. New, more environmentally efficient products based on advanced technologies are expected to lead to limited opportunities within the EU in terms of increased production. Some factors which drive the adoption of clean technologies include: demonstrated reduced costs and improved efficiency compared to old technologies, relative financial pay back, and the level of environmental legislation.

3.4 Transport

The issue

The 5EAP identifies traffic as a key target sector, and makes explicit the importance of trade and transport within the context of EC environmental policies. To date, approaches and existing measures are not geared to deal with the expected growth in international trade and the subsequent upward trends in transport activity. Congestion problems are now being experienced regularly on about 10% of the 54.000 kilometres of major roads within the EU.

In response to the recognised problem of increased transport activity, the Green Paper on sustainable mobility (EC, 1992) was published following the Commission's commitment to sustainable development at the Dublin Summit of 1990. The stated purpose of the Green Paper is to "initiate a public debate on the issue of transport and the environment and the proposed strategy for 'sustainable mobility'" (EC, 1992). It also recommends that greater account be taken of costs, including external costs, in order to restore balance amongst the different modes of transport.

The White Paper (EC, 1992), which followed, draws heavily on the Green Paper for its environmental dimension. Given present trends in the growth of transport movements, the tension between the role of the transport industry as "essential for the integration of the Community, its economic performance and the mobility of citizens" and its environmental impact is evident. While recognising the need for "complementary measures addressing the demand for transport, particularly that, currently satisfied by the private car" to accompany technical and fiscal measures aimed at improving energy efficiency, the White Paper does not refer specifically to measures to reduce the demand for transport; these are also not included in the Annex of priority measures envisaged for 1993-1994. These measures are addressed in the recent *Common Transport Policy Action Programme 1995-2000* (EC, 1995).

The contribution of the above initiatives, particularly their short term impact, is difficult to observe at present. An important indication of a change in the policy direction in this area is the decision to allocate investment for 14 priority projects (cost of 91 billion ECU; Community funding will be a small proportion of the total cost and will be financed through the TENS fund) as follows: 80% for railway connections; 9% for combined rail-road transport; and 11% for road networks (Kinnock, 1995). The actual impact of EU legislation is still very much related to technical improvements of vehicles (reduction of emissions and noise), although other developments such as

Box 3.4.1: EU state of action in the transport sector since 1992.

5EAP objectives for EU (1992-1995)	Actions achieved
Fuels and vehicles - composition & consumption of fuels: complete move to unleaded petrol by 2000	
• Regulation	• Duty on unleaded petrol - Regulation 92/82 sets a reduced rate of duty. No proposal, so far, for measures to instigate a complete move to unleaded petrol
User behaviour - development of inter-active communication infrastructures	
• Locking and tracking systems, electronic home, video conferences	• R&D efforts through a range of programmes covering vehicle-based telematics, telecommunication and telecommuting. Some funds from the Drive 2 Programme in particular are being diverted into environmental assessment of advanced telematics. (Commissioner Kinnock's support of Citizens Network concept may add impetus to transport informatics developments.)
Pollution control vehicles	• Emission reductions, noise, waste (see Section 5.1)

research into telematics and electronic traffic control seem to be promising in terms of their potential to reduce pressure on transport infrastructure. *Box 3.4.1* shows progress at EU level since 1992.

Past trends

Passenger transport

Over the period 1980-1990 passenger transport (in kilometres) by road increased by almost 40% *(see Figure 3.4.1)*. According to national estimates, much of this increase in kilometres (about 50%) was realised over a distance of less than 5 km (EEA, 1995; EC, 1995). From 1980-1990, car ownership rose by 37%; this had a significant impact on mobility growth.

The number of cars per capita increased at a much faster rate in the southern EU countries (about 60% in Spain and over 100% in Greece and Portugal), where car ownership per inhabitant was relatively lower (20-30 cars per 100 inhabitants in 1990) than in northern countries (40 cars per 100 inhabitants in 1990). Significant increases in car ownership appear to be fairly recent.

A number of underlying factors that have contributed to the growth in road transport from both the demand- and supply-side are listed below.

Demand-side:
- income levels;
- demographic and employment trends; and
- physical planning (distance from home to office).

Supply-side:
- higher rate of car ownership;
- transport times, public transport tariffs; and
- availability of parking space.

The rapid growth over the past 15 years of road transport passenger kilometres has not brought about a substantial change in its share of total passenger kilometres. This is due to the fact that public transport kilometres by rail has also increased, although at a much lower growth rate, and air traffic passenger kms increased at a greater rate, from about 200 million in 1980 to almost 400 million in 1990 (see *Figure 3.4.2*). In 1990, 84.3% of the total passenger kilometres were realised by road transport (including cars and buses) and 6.5% were realised by rail (in 1970 this figure was 9.5%).

Figure 3.4.1 Passenger road transport in the EU12
Source: Eurostat; EC, 1990; DRI, 1994

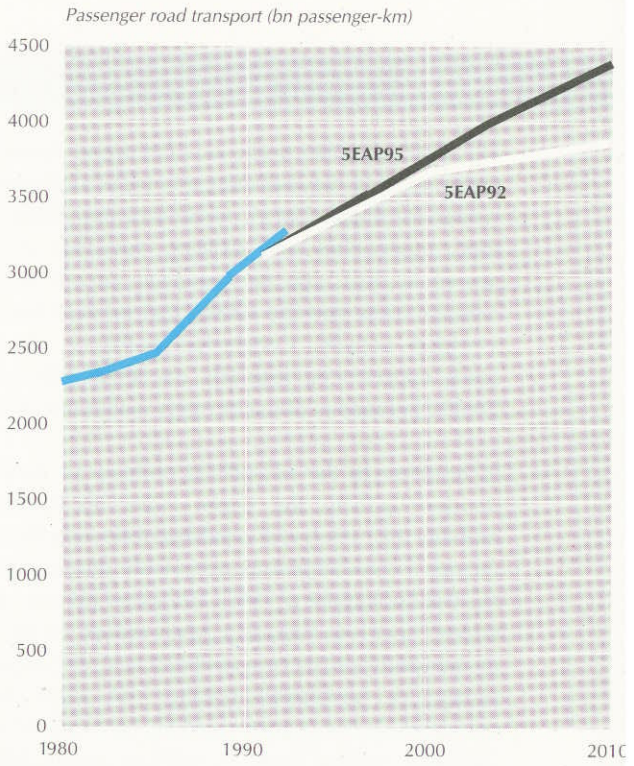
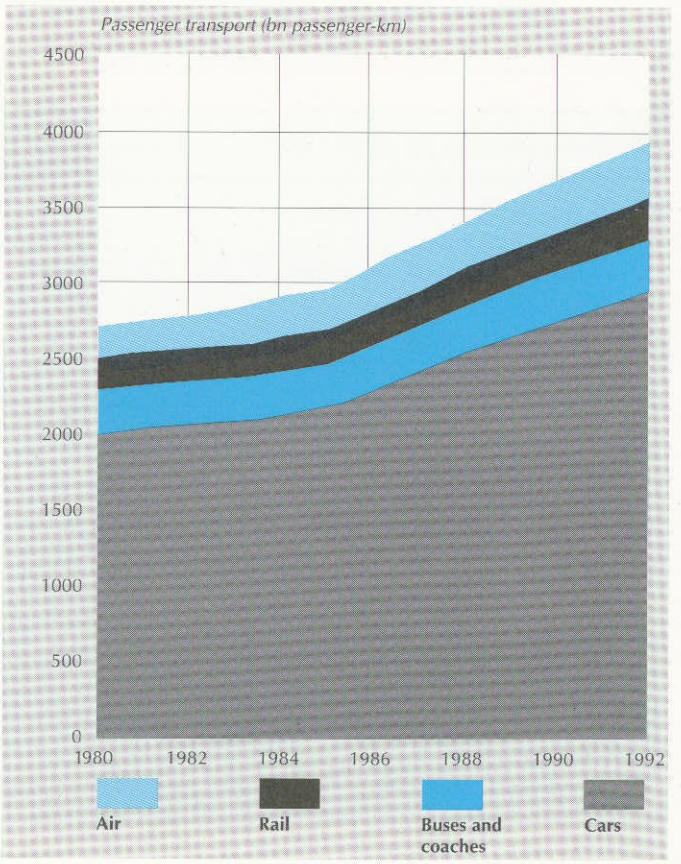


Figure 3.4.2 Passenger transport modal split in the EU12
Source: Eurostat



Freight transport

The trend in freight road transport over the last few decades has been for strong growth (*Figure 3.4.3*). The period 1984 –1989 was also characterised by a high GDP growth rate and an average increase in both domestic and international freight of about 6% per annum. The annual average growth rate for the EU15 over the period 1980-1990 was 3.3%. This fell to 2.5% from 1990-1992 and shows a reduction of 0.5% for 1993 (EC, 1995).

Geographical circumstances such as the location of main ports can account for large national differences in freight transport (in tonne kilometres). Some countries, such as Belgium and The Netherlands, have a relatively high share (over 55%) of international road transport, whereas the UK has about 8%. As a result of increasing trade within the expanding EU, road capacity for transit traffic does not appear to be sufficiently meeting demand, particularly in the Alpine countries (France, Germany, Austria). There is also increased local opposition across Europe to new road infrastructure.

A number of underlying factors which contribute to the growth in freight transport are:

Demand-side:
- volume of economic activities;
- opening up of national economies (Internal Market 1992, East-West relations);
- transport needs and logistics ('just-in-time' delivery practices); and
- small batches of freight with high value-added.

Supply-side:
- low variable costs;
- free choice of modes;
- relative absence of congestion or road use restrictions; and
- technological improvements (eg, combined use road/rail/ship).

Figure 3.4.4 shows developments in the *modal split* for freight transport. This shows increased demand for freight transport from 1980-1992 almost completely met by additional road transport, while the share of the other modes remained virtually constant or declined slightly (as for rail transport)*3. This implies that existing spare capacity in other transport modes is often not utilised, such as extensive railway networks (France, Germany) or inland waterways (The Netherlands).

*3 The percentage breakdown in freight transport in 1993 for EU15 is as follows: road 71%; rail 15%; inland waterways 8%; pipelines 6% (EC, 1995).

Figure 3.4.3 Freight road transport in the EU12
Source: Eurostat; DRI et al., 1994; EC, 1990

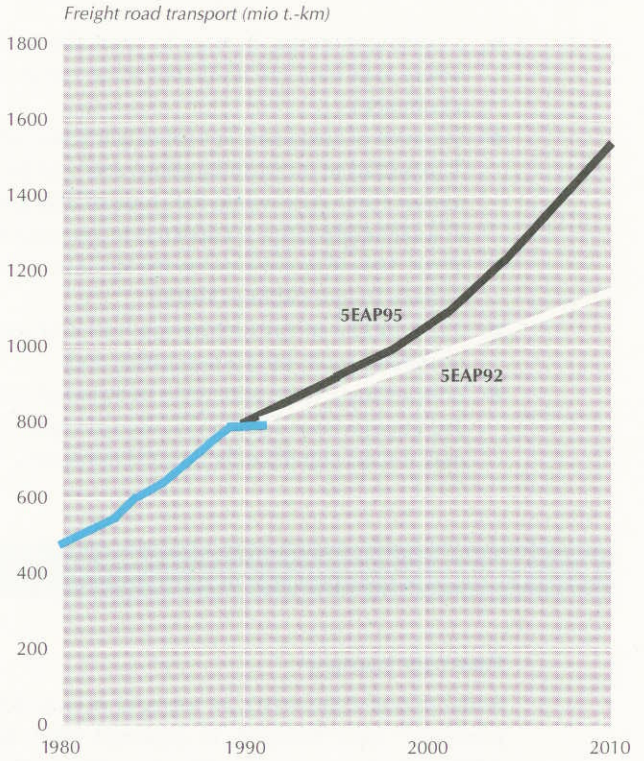
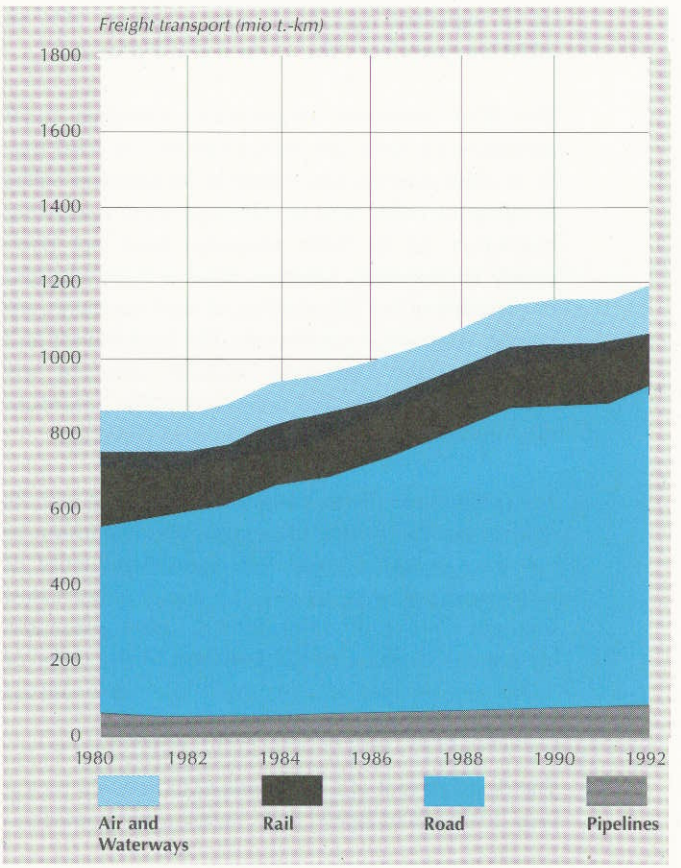


Figure 3.4.4 Modal split freight transport in the EU12.
Source: Eurostat



Changes in the modal split for freight transport may be influenced by a number of factors including:

- a continued strong increase in international traffic where long haul rail traffic has some comparative advantages;
- the share of containers in total freight flows, which is expected to increase by about 250% in the period 1990-2015 while the share of bulk goods in total freight flows is expected to decrease by about 50% (Commission on the Review of the Betuwe freight rail line, 1995);
- multi-modal infrastructure (eg, rail and road terminals, multi-modal terminals); and
- policies towards re-allocation of transport costs (eg, through internalisation of external costs, which may impact significantly on road transport).

Outlook

Passenger transport

In the period 1990-2010, an increase of over 40% in passenger road transport is expected (DRI et al., 1994), which, in annual terms, is a 2% increase to 2000 and a 1.6% increase to 2010. The 5EAP (EC, 1990) forecasts were substantially lower (1.8% pa in 1990-2000 and 0.5% pa in 2000-2010), and resulted in an expected overall increase of about 25% in 2010 compared to 1990, as shown in *Figure 3.4.1*.

The 5EAP mentions infrastructure charging, fiscal incentives on fuels and discouragement of road traffic in cities as some key measures for Member States to influence traffic growth. Although there is growing consensus, so far these measures have not been widely implemented. Member States actively engaged in considering the introduction of such measures are France, Germany, Luxembourg, The Netherlands and the UK. Other measures include reducing the demand for mobility and improving traffic control to raise the efficiency of the existing road capacity.

The position of railway transport is improving with its relative environmental advantages, the expansion of networks in urban areas, and the development of high-speed rail links between European cities. Latest forecasts (DRI et al., 1994; ERECO, 1994) estimated an average increase in rail transport in the order of 1.7% over the period 1990-2010 with an expected increase of 2% between 1992-1998.

The development of a high-speed rail network by the year 2010 would significantly increase rail passenger-kilometres in the order of 50%. Half of this increase would be attracted away from the roads and over a quarter from air transport (INTRA-PLAN/INRETS, 1993) for long distance journeys). However, growth in road traffic by the year 2010 (passenger-km for trips over 80 km) will only be 5% lower than it would have been without construction of the high-speed train network.

Aviation traffic is expected to grow by 182% in the period 1990-2010, reflecting a more rapidly increasing demand for business and leisure travel (both short and long haul) than estimated in 1992. Within Europe, on journeys between 400-600 kilometres, European airlines will become increasingly subject to competition from railways, in particular by the high-speed European rail network.

Freight transport

A comparison of forecasts made at the time of the 5EAP (EC, 1990), (increase in road freight transport of 1.9% pa 1990-2000 and 1.6% pa 2000-2010 and for rail 1.2% and 1.3% respectively over the same periods), and later estimates of future growth based on the DRI Integration Study (increase in road freight of 2.7% pa 1990-2000 and 3.8% pa 2000-2010 and for rail at 1.5% and 2.9% respectively) indicates that tonne-kilometres by both modes are now expected to increase faster than previously forecast (see *Figure 3.4.3*). For road freight transport, this implies an almost doubling in size by the year 2010. The accession of the new Member States means vital transit routes (Austria) and relatively isolated geographical positions (Sweden, Finland).

Common policies directed at curbing this growth through a mix of demand and supply influencing measures are in an early phase of development. Meanwhile some Member States (eg, Germany, Austria) have introduced various 'supply-side' restrictions and are considering further measures to 'discourage' international road transport in particular.

3.5 Energy

The issue

The 5EAP emphasizes the importance of long-term energy strategies to ensure that environmental stress from energy supply and consumption is reduced to sustainable levels. Greater efforts are required to achieve this, particularly taking into account the considerable growth forecast in the transport sector.

The response to this within the energy sector is largely influenced by the debate on the role the Community can play in shaping the energy dimension of the future. No specific energy title was included in the Maastricht Treaty. New guidelines have been drawn up and are presented in a Green Paper *For a European Union Energy Policy* (EC, 1994). This paper defines the Community's approach to future policy, stressing that within a deregulated energy market a clear energy policy framework offers better possibilities for the development of integrated resource or least-cost planning. It also includes a section on environmental

Box: 3.5.1: EU state of action in the energy sector (consumption and supply) since 1992.

5EAP objectives for EU (1992-1995)	Actions achieved
Awareness building	
• Economic and fiscal instruments	• New proposal for Directive on CO_2/energy tax (COM(95)172) - would establish a harmonised framework for Member States wishing to apply a carbon/energy tax • Amended proposal (COM(94)147) on excise duties applicable to fuels of agricultural origin
Energy Efficiency	
Implementation of PACE, SAVE and national efficiency programmes:	• SAVE - has supported 25 pilot projects in least cost planning and demand side management
• energy efficiency standards for appliances, products and vehicles	• Three energy efficiency Directives have been adopted: hot water boilers, labelling of household appliances & omnibus Directive 93/76
• efficiency standards for energy technology	• Directive proposed on efficiency of fridges and freezers and draft proposals on least-cost planning and limiting CO_2 from cars
Technology Programmes	
Implementation of THERMIE and JOULE programmes including:	• 3rd and 4th Framework Research Programmes (230 million ECU for energy)
• R&D of new energy technologies and promotion and use thereof	
• R&D on renewables (ie biomass)	
Promotional Programmes	
• ALTENER: promotion of renewable energy	• Programme adopted by Decision 93/500 - promotion of renewable energy sources (ALTENER). Standards for biodiesel have been formulated and support given to pilot projects. Effects not expected until year 2000.
Nuclear Safety Programmes	
Study on safety and waste aspects of nuclear energy	• See *Box 4.9.2* on Nuclear Safety
Pollution control	
• Reduction of emissions	• See *Section 5.1*

objectives, which emphasises clean technologies, improving the efficiency of supply and internalising the external costs of energy use.

In 1990 the EC report *Energy for a New Century: the European Perspective* identified three major themes: the changing geopolitical framework, the internal market and the environment. Subsequent studies in 1992 and 1995 present several scenarios identifying the range of influences at work that could affect the direction of energy demand and supply in the longer term (2005/2050). In the 1992 study, called *A View to the Future* (EC, 1992), the observation is made that "without a substantial change in policy objectives we are presently set on a course which, ... will not bring us in the direction of what is considered a 'sustainable' future". *Box 3.5.1* summarises progress at EU level since 1992.

Past trends

Energy consumption and prices

Since the early 1970s energy intensity (gross inland energy consumption per GDP) has decreased mainly due to energy efficiency improvements and changes in the economic structure (eg, less heavy industry, less reliance on production of intermediate goods) (see also *Figure 3.3.3*). This implies a weakening of the links between GDP, growth in population, and energy consumption. However, total final energy consumption in the EU increased steadily between 1974 and 1992 by about 0.6% per year on average (*Figure 3.5.1*). The rate of increase differs across Member States and is considerably higher in the more peripheral economies of the EU such as Finland, Ireland, Italy, Portugal and Spain. The two factors which largely explain the relatively high energy consumption in Finland and Sweden are: the presence of an energy-intensive industry, and the cold climate.

A number of driving forces influence energy consumption including:

- economic growth;
- increased demand for transport services;
- low energy prices; and
- growing concern about the environmental issues.

Oil prices increased sharply during the 1970s, peaked in the early 1980s and have been falling gradually since (*Figure 3.5.2*). The current price of energy is now at the same level as the early 1970s. The price has not been significantly influenced by energy-taxes. The consumer price of other energy sources was generally made dependent on the oil price.

Figure 3.5.1: Development of energy consumption in the EU12
Source: Eurostat; EC, 1990; DRI et al., 1994

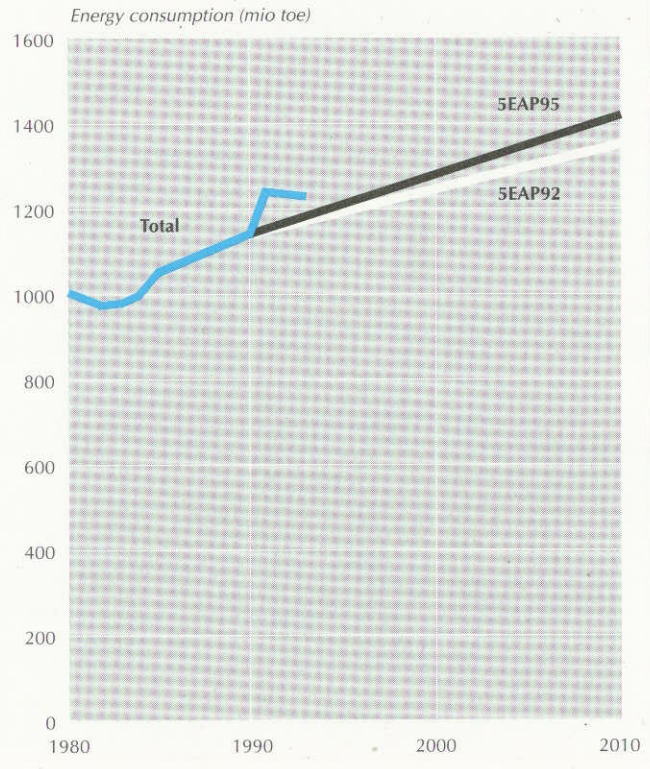
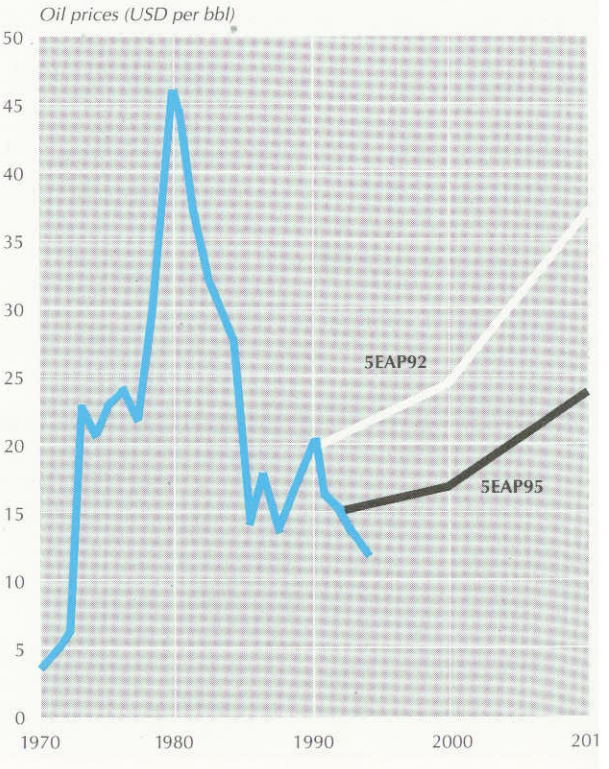


Figure 3.5.2: World market oil prices
Source: DEA, 1995



Energy consumption within each sector has its own characteristic; the pattern in industry, transport, the domestic sector and the electricity sector are described briefly below (see *Figure 3.5.3*).

- Energy consumption in *industry* in the EU shows a steadily decreasing trend from 1980 to 1995. This evolution corresponds to significant improvements in the energy intensity of the sector, especially given that overall industrial capacity increased steadily until 1990. Energy consumption in energy-intensive steel, chemicals, and non-metallic minerals, was also significantly lower in 1992 compared to 1980. Sweden is one of the very few countries where energy consumption by industry increased in the period 1980-1992.

- In the *transport* sector, energy consumption grew steadily from 1980 to 1991. In this sector, energy demand has grown faster than overall economic activity. Therefore, energy intensity in the transport sector increased by 0.7% pa in the period 1980-1990 (EC, 1994). Also, real prices for transport fuel dropped significantly from 1985 to 1987, helping demand to push up fuel consumption. Significant improvements in energy consumption of vehicles were counteracted by an increasing number of cars, a higher share of larger, more powerful cars and an increase in kilometres travelled per capita. These developments are reflected in road transport's share of total energy consumption in the transport sector, which increased from 79% in 1974 to 83% in 1992.

- In the *domestic* and *tertiary* sector, energy consumption grew slightly from 1980 to 1992, although consumption in this sector varies with climatic conditions and fluctuations. Other important factors are population size, number of households, private income and evolution of the services sector. It is not possible to give a full split between both subsectors, but indications are that there has been growth in energy demand in commerce (supermarkets, shopping centres, etc) and in the domestic sector as a consequence of widespread penetration of household appliances. This increase has largely made up for technological and other efficiency improvements made since 1980. In most Member States, there has been a tendency for demand to stabilise or decrease over this period; exceptions to this include east Germany, Greece and Portugal.

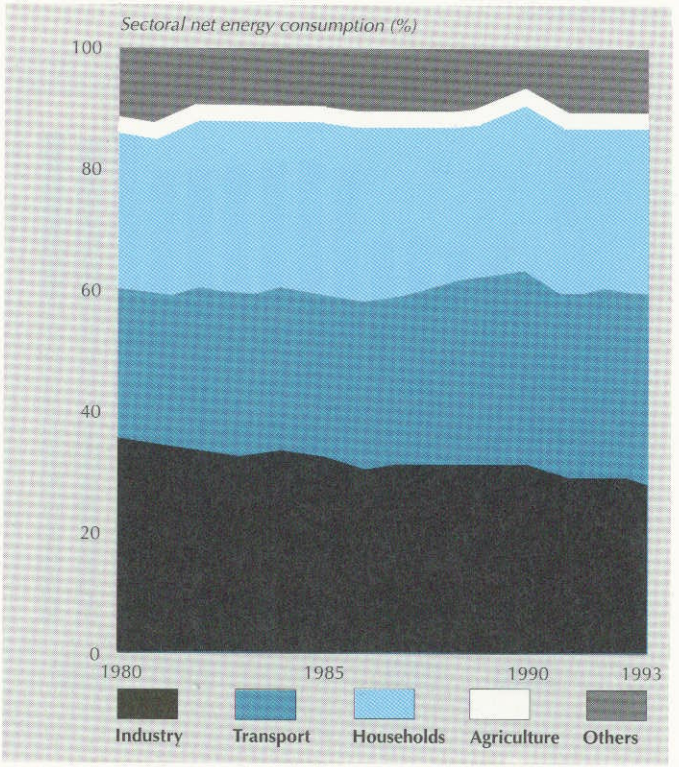
- In the *electricity* sector, there has been an almost continuous increase in electricity consumption between 1974 and 1992 by an average of 2.7% pa. In 1992 electricity demand decreased to 1.3% growth as a result of economic slow down. In 1993 there was, for the first time, a drop in consumption by about 1%, reflecting economic recession.

Energy supply

The mix of fuels in the total primary energy supply of the EU12 during the period 1980 to 1993 is shown in *Figure 3.5.4*. Nuclear power accounts for the largest share of total supply (27% in 1993); actual supply from this source has remained relatively stable since the late 1980s. The trend in the share of energy supply by oil and coal (19% and 23% in 1993 respectively) has been falling over the period, while the share by natural gas (24% in 1993) is increasing.

National factors (own energy sources, direct access to harbours, climate, economic structure, political preferences, etc) explain the large differences in the type of energy used across the EU. The new Member States very much reflect the varying energy source structure for electricity generation in the EU: Austria has an almost equal shares of solids, oil and gas, and a relatively substantial share of hydro in 1990; Finland is largely dependent on nuclear (45%) as is Sweden (70%).

Figure 3.5.3 Sectoral energy consumption
Source: Eurostat



Outlook

Energy consumption and prices

According to the current estimates, oil prices would increase by about 20% between 1990 and 2010 (see *Figure 3.5.2*). The 5EAP92 forecast contains a significantly higher price increase of about 90% in 2010 compared to 1990 prices. It is expected that energy prices will tend to increase smoothly, with coal prices lessening relative to the price of oil and gas after 2010.*4

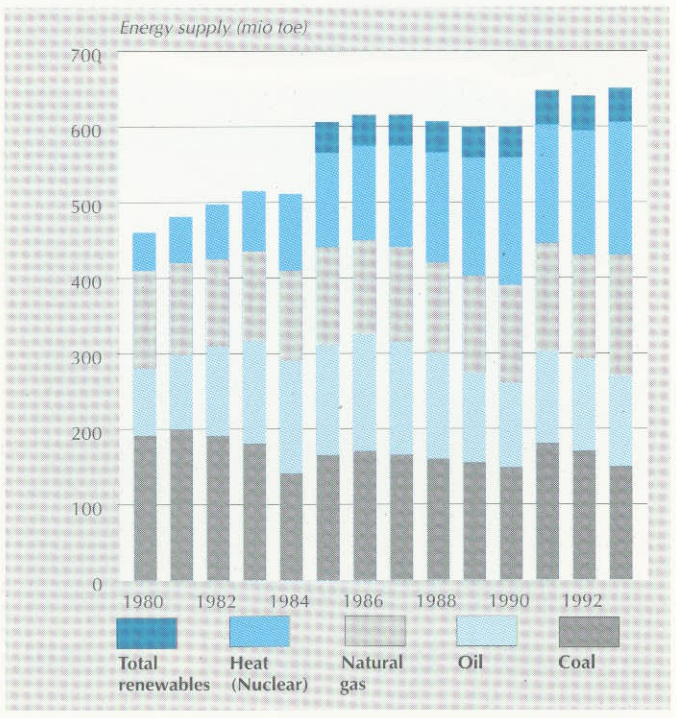
In the period 1990-2010 an average growth in primary energy consumption*5 of around 1.1% pa is expected (DRI et al., 1994). At the time of the 5EAP, the average growth pa was estimated at slightly less than 1% for the same period. Final energy consumption growth is estimated at 1.25% pa mainly reflect-ing an increase in efficiency of electricity production (see *Figure 3.5.1*).

Thus, despite promotion and co-financing of energy conservation initiatives at the EU and national level, current energy consumption forecasts are virtually unchanged in comparison with 5EAP92 projections. Lower energy use in industry and stable use in the domestic and commercial sector were counterbalanced by increased use in the transport sector.

Unsurprisingly, due to the lack of economic incentives, reductions in energy intensity are modest. In industry, energy intensity gains must be considered together with a continuing change in industrial processing structures. Intensities in the domestic sector are also expected to decline. In 1992, final energy intensity was estimated to decrease by 1.5% to 2000 and decrease by 2.2% between 2000 and 2010. Due to lower economy growth and unchanged energy consumption, the current forecast is lower (5EAP95).

One of the EU policy initiatives with a potential short term impact on the demand side is the SAVE Programme. This Programme was renewed in 1995 and aims to attain a 20% energy efficiency improvement by 1995. Estimates indicate that only about 10% of the improvement will be achieved. Recently adopted directives on efficiency for freezers and refrigerators may yield some results in the immediate future. An energy/CO_2 tax has been suggested by the EC as a cost-effective instrument for substantial, short-term, improvements in energy efficiency, taking into account the responsiveness of energy demand to an increase in prices which would follow from the imposition of a tax. While an EU wide tax would be creating 'a level playing field' within the EU, some Member States (Denmark, Finland, Sweden) have already introduced an energy/CO_2 tax or plan to do so (The Netherlands). Those countries which already have such a tax allow exemptions to industry subject to international competitiveness.

Figure 3.5.4: Primary energy supply (1980-1993), renewable energy included from 1985, the former GDR included from 1991.
Source: Eurostat



Energy supply

The forecasts in 1992 for energy supply in the period 1990-2010 are still reasonable based on current forecasts, although import dependency is expected to increase (DRI et al., 1994). The share of total fuel supply accounted for by natural gas might increase faster than estimated in 1992, resulting in a growth of, at least, around 3% pa. On the other hand, the share of solid fuels is expected to decline due to their environmental drawbacks (SO_2, NO_x, CO_2) and rapid substitution by natural gas in power generation, in spite of their competitive pricing.

*4 The most recent, provisional outlook described in Energy Futures to 2020 (EC, 1995) reaches conclusions very much in line with the above.

*5 Primary energy consumption (TPE) corresponds to gross inland energy consumption, excluding quantities delivered to marine bunkers. Final energy consumption is always lower since it does not include energy losses in conversion (electricity) and distribution.

The demand for natural gas is expected to increase rapidly mainly due to its importance in power generation. The efficiency, convenience and cleanliness of natural gas has been widely recognized by residential and commercial consumers. The prevailing trend in the electricity sector is the penetration of natural gas combined cycle plants, also built for cogeneration of heat and power (CHP). The industrial market for hard coal and residual oil is also threatened by competition from natural gas. The projected further expansion of distribution, particularly in Denmark, Spain, Portugal, Ireland and Greece, will favour gas penetration in industry. Nevertheless, price relations between gas and its competitors are considered decisive. Oil products remain important for end-use, although they are expected to lose their share in the market.

In the 5EAP95 scenario, nuclear power is held virtually constant to 2010 (EC, 1994). Although the present share of renewable energy sources accounts for some 5% of gross inland consumption, this source has the highest future growth rate forecast compared to other energy sources and is expected to account for 7.5% in 2010. Hydropower in electricity generation (about 16%) was not included in the forecast, but its possibility for extension is very limited.

3.6 Agriculture and forestry

The issue

Since the creation of the European Community, a Common Agricultural Policy (CAP) has existed with the following objectives: availability of food supplies at reasonable prices; stabilisation of markets; and fair standard of living for farmers. Over a period of some 30 years, the trend towards intensification of agricultural practices (in which farmers have tended to concentrate their efforts on producing a greater output of fewer products, and to do so by using more inputs (fertilisers, pesticides and purchased animal feeds) developed in response to the promptings of farm advisors and the economic signals sent by national governments and the CAP at the time.

This was recognised in the CAP reform of 1992, which gave consideration to the role of farmers in providing environmental services and promoted less intensive methods of agricultural production. The key elements of the CAP reform are as follows:

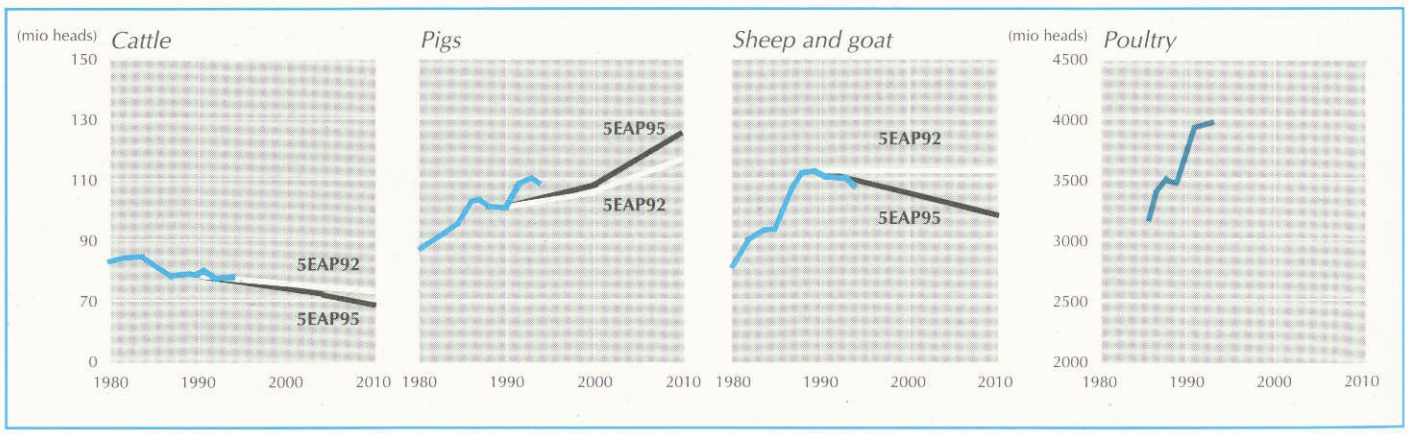
- reduction of market intervention and gradual introduction of lower prices for agricultural products;
- direct payments to farmers, unrelated to the level of production, to compensate for lower prices;
- compulsory set-aside scheme for arable farmers;
- encouragement of extensification in the beef and sheep sectors;
- maintenance of certain quotas, including for milk and sugar; and
- accompanying measures, including a new agri-'environment' package (Regulation 2078/92), further encouragement to tree planting (Regulation 2080/92), organic farming and general extensification and additional incentives to farmers for early retirement and release of their lands from intensive production.

The 5EAP described policy measures in the area of agriculture and forestry with the aim of promoting structural changes in those activities that would lead to sustainable practices and lower environmental impacts. *Box 3.6.1* shows progress at EU level since 1992. The key environmental measures are: the Nitrate Directive (676/91), which is aimed at reducing the use of nitrogen fertilisers; measures aimed at reducing pesticide input; and the above-mentioned forestry measures and agri-environment package.

Member States have made progress in the application of the Nitrate Directive and in limiting the use of manure and artificial fertilisers; codes of good agricultural practices or action programmes to tackle the nutrient problem have been developed in Austria, Germany (Fertilisers Act), Finland, Ireland, The Netherlands, and the UK; targets have been defined in France.

Similarly, Member States are making progress in limiting pesticides use by passing the following measures: an action plan for sustainable development in agriculture in Denmark; incentive programmes for bio-farming in Austria, The Netherlands and UK; methods of integrated crop protection in Germany and Finland; and other promotion of environmentally friendly farming in Ireland, Luxembourg, and Portugal.

Figure 3.6.1: Development of livestock: (a) cattle, (b) pigs, (c) sheep and goats, and (d) poultry
Source: Eurostat; FAO, 1995; DRI et al., 1994



Box 3.6.1: EU state of action in the agriculture and forestry sector since 1992.

5EAP objectives for EU (1992-1995)	Actions achieved
Reduction in pollution	
● Reduced incidence of surface waters with a nitrate content exceeding 50 mg/l or giving rise to eutrophication of lakes and seas	● Directive 91/676 (on nitrates from agricultural sources); its implementation is still at a relatively early stage. ● Regulation 1765/92 replacing price support partly by direct income payments and introducing obligatory set-aside. ● Regulation 2078/92 including incentive schemes for extensive farm practices, reduction of livestock density, promotion of integrated farm management and organic farming.
● Reduction programme for phosphate use	● Proposal for a Directive on ecological quality of surface waters encourages lower phosphate levels in water.
Significant reduction of pesticide use	
● Registration of sales and use of pesticides	
● Control on sale and use of pesticides	
● Promotion of integrated 'control' (in particular training activities) and promotion of bio-agriculture	
Management plans for all rural areas	
● Training farmers, promotion of exchange visits between regions with comparable environment management situations	● Substantial increase in number of management plans as a result of Regulation 2078/92 implementation. ● Funding made available for two separate farm schemes.
Increase forest plantation, including on agricultural land	
● New afforestation and regeneration of existing forest taking into account of environmental needs (species adapted to site conditions, multi-functional forests)	● Regulation 2080/92 supports afforestation of farm land with Member States able to initiate afforestation programmes. In Objective 1 areas up to 75% funding is provided by FEOGA. Actual incentives are set by Member States. ● Funding is also available under the Cohesion Fund for reafforestation of land at risk of erosion. ● Environmental set-aside and afforestation to count towards farmers annual set-aside obligation.
Improved protection of forests (health and forest fires)	
● Further action against forest fires	● Regulation 2158/92 on the protection against forest fires promotes identification of risk areas and approval of action plans. Action under Community initiatives. Spain amongst others also gets funds from the Commission under Regulation 2078/92 for fire prevention schemes.

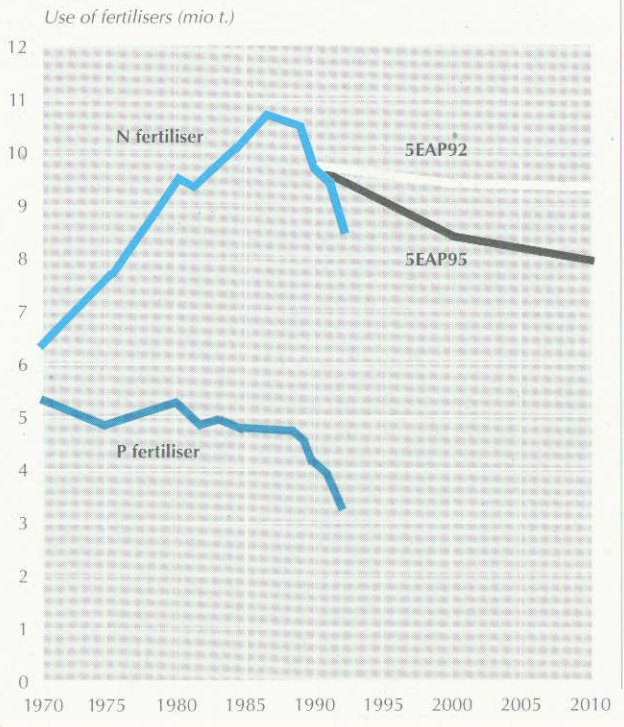
Past trends

Historic trends in *livestock* populations present a mixed picture. The overall population increased considerably in the period 1980 - 1993, especially pigs and poultry; cattle decreased; sheep and goat populations increased at first, but declined gradually in the second half of the 1980s (see *Figure 3.6.1*). This largely reflects changes in consumer preferences. The decrease in cattle is also likely to be due to the first adjustments in the common market organisations introduced in the mid and late 1980s, particularly the milk quotas.

The distribution of livestock (heads per hectare) is very unbalanced across Europe, with the highest concentrations in north-western coastal areas. Although cattle populations decreased overall in the EU12, above average decreases were evident in Denmark and Germany while populations actually increased in a few such as Ireland and Belgium.

The overall use of nitrogen and phosphate artificial *fertilisers* in the period 1980-1992 in the EU15 was initially for stabilisation of phosphate (P) and a slight increase in nitrogen (N) use. Use has been decreasing since the late 1980s (10% in nitrogen for the whole period, 40% in phosphate in the period 1988-1992) (see *Figure 3.6.2*). The increase in use at the beginning of this period was driven by supply-side oriented agricultural policies with over-emphasis on price support mechanisms, which made the over-use of fertilisers more profitable. The more recent decreasing trend is likely to be due to the overly high level of input already reached in some Member States and awareness of environmental consequences. In addition, the decrease in cattle populations meant that there was a reduced need for cattle-feeding crops.

Figure 3.6.2: Development of artificial fertiliser consumption: Nitrogen (N) and phosphate (P).
Source: Eurostat; DRI et al., 1994



In the period 1980-1990, the total consumption of artificial fertilisers containing nitrogen, phosphate and potassium (NPK) declined in those Member States with already high inputs (> 250 kg/ha NPK) such as Germany*[6] (35%), Belgium (10%) and The Netherlands (17,5%). In most other EU countries with lower inputs (< 250 kg/ha NPK) there was still some increase in use. In the new Member States, inputs fell in the same period by around 25% (Austria, Sweden) or stabilised (Finland) (Eurostat, 1995).

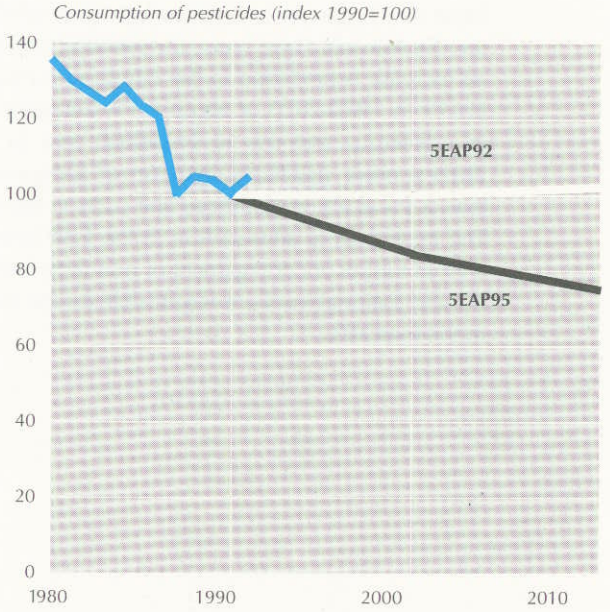
In the period 1980-1992, the total consumption of *pesticides* (in tonnes of active ingredients) tended to stabilise in the EU countries with already high inputs (France, Germany, Italy, The Netherlands, Portugal, Spain) (*Figure 3.6.3*). The historic trend had been to increase pesticide use for the same reasons as in the case of fertilisers. Very recently, significant reductions in pesticide use has been detected in some Member States (eg, The Netherlands).

The average load of pesticide use per hectare is high in viniculture, vegetable and fruit cultures, flower bulbs, potatoes and sugar beets. Newer generations of pesticides are often more biologically active and require relatively lower applications rates. As with the use of fertiliser, there are considerable variations in application rates between and within different countries.

The use of pesticides is highest in those EU12 areas (LEI-DLO, 1994) with intensive horticulture (northern Italy, the south coast of France, the south-east coast of Spain, and The Netherlands). This is because the products are intensively grown in narrow rotations, demanding high yields and directed towards exports liable to phytosanitary regulations. The use of fungicides to grow grapes is highest in regions with relatively

**6 Fertilizer consumption per ha in (former) East and West Germany was on the same level in 1985.*

Figure 3.6.3: Consumption of pesticides (active ingredients)
Source: OECD; DRI et al., 1994



high precipitation levels (northern parts of Italy and Spain) where the climatic conditions favour fungi growth. Differences are large in the use of pesticides to grow arable crops, ranging from 3 kg (Germany) to 22 kg of active substance per hectare (The Netherlands).

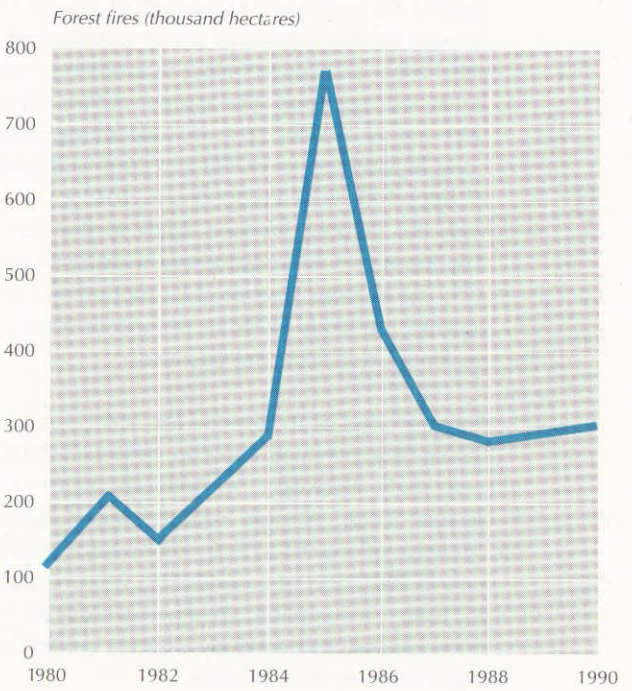
Promotion of *bio-agriculture*, as one of the objectives of the 5EAP, is difficult to assess in depth. Nevertheless, available estimated data show a growth in number of bio-farmers, from 7500 in 1987 to 15,000 in 1992 (from which 60 % are in Germany and France) (EC, 1994). At the same time, the part of bio-agriculture land area has expanded to 400,000 ha in EU12 (100,000 ha in 1987). Since the implementation of Regulation 2092/91 on biological production mode of farming products, some bio-farmers have given up practising due to their incapacities to meet the standards fixed by the regulation. Concerning bio-products marketing, it concerns 0.5 % of the farming products market in EU (from 0.1 % for Italy to 0.8 % for Germany). Market analyses and forecasts are leading to an estimate of 2.5 % by year 2000.

Forest area has increased in the EU12 by 10% in the last 30 years (1960-1990). All countries have expanded their wooded land, with lowest variations in Portugal, Belgium, Germany and Luxembourg and highest in Ireland and UK. This increase in wooded land over the last thirty years is due to reforestation policies and spontaneous forest growth in marginal areas (EEA, 1995).

Fire is one of the major problems for forest conversation, especially in the southern countries of the EU. During 1980 to 1990, the number of fires in the EU increased, although the area burnt did not increase by the same proportion (see *Figure 3.6.4*). An average of 500,000 ha. of wooded land were burnt per year. Assessing forest fires should be done with caution, given the year to year variations in the number and importance of forest fires.

Concerning the productivity of forests, the diversity of natural conditions of forests growth, of socio-economic contexts and of changes in rural areas all over the EU is such that it is very difficult to assess the forest resources structures. Furthermore, the division of forestry land into smaller units does not facilitate any homogeneous environmental statement on impacts of quick growing trees plantation. Some effects (which could be of physical, chemical and biological nature) occurred locally but they are still difficult to quantify at EU level. On the other hand, atmospheric pollution, changes in weather conditions, insect attacks and human activity cause damages to forests which could affect timber production, both in terms of quality and quantity. Results on forest condition are now provided by common EU and UNECE transnational and national surveys. The results of the 1994 survey show, among other things, that defoliation affected 17.7 % of sample trees in EU12 (see also *Section 4.11*).

Figure 3.6.4: Forest fires in EU12
Source: Eurostat.



Outlook

The 5EAP92 scenario (DRI et al., 1994) is based on the assumption that the pre-1992 version of the common agricultural policy is maintained, whereas the 5EAP95 scenario*7 reflects more recent forecasts and takes account of the likely effects of the 1992 CAP reform. However, this does not include the new world-wide agreement on international trade, which is likely to reinforce the effect of the CAP reform.

The 5EAP92 scenario assumed a growth in total *livestock* population, especially after 2000. The growth of the pig population (0.5% per year) is expected to be greater than the decline of the cattle population (see *Figure 3.6.1*), mainly due to changes in consumer preferences and the existing market adjustments measures, such as the milk quotas.

Current estimates for livestock point to uniform, EU-wide and gradually declining numbers of cattle, sheep and laying hens, and increasing numbers of pigs (0.7% per year) and poultry. In this case, consumer preferences are reinforced by the cutbacks in CAP price support, measures to encourage extensification in the beef and sheep sectors, maintaining of the milk quotas and the continuing pressures on environmental control. The increase in numbers of pigs and poultry reflects also the falling price of feed.

For *fertilisers*, a decrease was estimated in the use of nitrogen fertiliser of 5% between 1990 and 2000 and around 2% between 2000 and 2010 (*Figure 3.6.2*). It is expected that downward trends in intensively cultivated zones and upward trends in extensively cultivated zones will continue. The current outlook foresees a decrease of around 10% in total nitrogen fertiliser consumption between 1990 and 2000 and a decrease of around 7% between 2000 and 2010. A comparison with the 5EAP92 scenario leads to the conclusion that the new CAP might cause a decrease of about 5%. The reduced level of price support and set-aside policies are likely to make the use of fertilisers less profitable, thus reducing their use.

For *pesticides*, at the time of the 5EAP, a stabilisation in use was estimated between 1990 and 2000 and a very slight increase (1%) between 2000 and 2010 (*Figure 3.6.3*). A more recent forecast estimates a decrease of around 17% in total pesticide consumption in 2000 and of around 27% in 2010 compared to 1990 consumption. Again, the reduced level of price support and set-aside policies would be main contributors to that decrease.

For *forest* area, a 1992 forecast shows an increase in coniferous forest (0.1% annually in 1990-2000 and 0.3% in 2000-2010) and a decrease in broadleaf forest (0.3% for the whole period 1990-2010) (see also *Section 3.2*). Three years after the 5EAP publication, an increase is predicted in the rate of forest cover in EU-12 in 1990-2000 of about 0.1% annually (0.2% in coniferous and 0% in broadleaf) and in 2000-2010 a more significant increase of somewhat less than 0.3% (0.4% in coniferous and 0.2% in broadleaf). The incentives to afforestation in the CAP reform, as well as further encouragement of non-farm forestry at EU and national level are responsible for the increase in the forecasts.

*7 Based on the Policy in the Pipeline' Scenario from DRI et el.,1994

3.7 Tourism

The issue

Tourism is one of the key sectors in the 5EAP. As an economic sector it has experienced significant growth in the recent years which is expected to continue into the future; it makes an important contribution to GDP in most EU countries (Eurostat/EC, 1992). Tourism, though highly dependent on the quality of the environment and protection of natural resources for its continued growth, can also have a negative impact on the environment, if not properly managed.

The 5EAP identified the following actions, which should be implemented (at the regional level and by the tourism sector itself) in order to minimise the negative environmental impacts from tourism activity:

- diversification of activities and better management of mass tourism;
- improved quality of tourist services, including information and awareness building;
- and visitor and facilities management;
- changing tourist behaviour to make tourism more sustainable, including media; and
- campaigns, codes of conduct and a wider choice of transport modes.

The Community Action Plan to assist tourism (Council Decision 95/421/CEE) puts a strong emphasis on the environment, supporting pilot projects, representing innovative moves towards initiating sustainable tourism development in Europe (EC, 1992). The Commission's Green Paper on the role of the Union in the field of tourism (EC, 1995) considers the necessity of coherence and the linkage in the three main issues, namely tourism, the interest of consumers and natural and cultural heritage. *Box 3.7.1* summarises progress at EU level since 1992.

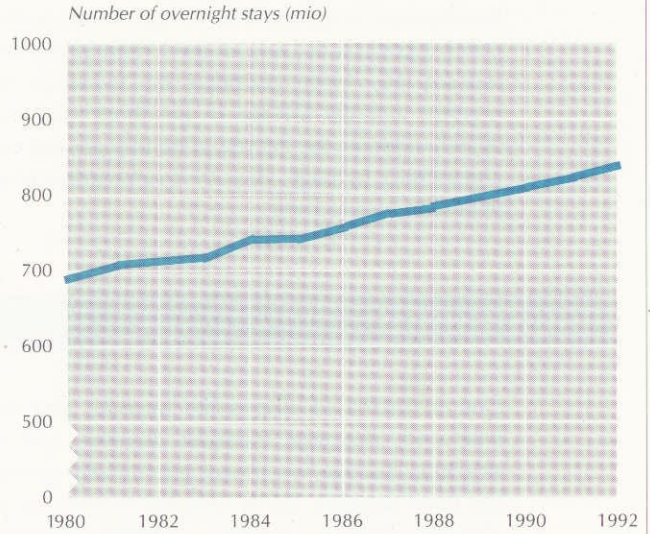
Past trends

Due to increased disposable income, and leisure time and improved transport facilities and infrastructure, tourism has grown enormously during the last three decades; this is reflected in increase in the average distance travelled. Another measure of tourism activity is the number of overnight stays in different locations and countries . *Figure 3.7.1* shows trends in this measure over the period 1980-92. The number of overnight stays in the EU in 1992 was 840 million, an increase of 21.5% on 1980 levels (692 million).

Box 3.7.1: EU state of action in the Tourism Sector since 1992

5EAP objectives for EU (1992-1995)	Actions achieved
Liberalisation of air and coach transport - TGV - network	
• EC transport policy and national transport policies	• 'Third Air Package' in 1992 to increase air transport liberalisation. It gave rise to reduced fares and stimulated air transport for both short and long distance(eg, Atlantic route) trips.
Increase marginal costs of use of private car and of promote alternative transport modes	
• Economic incentives such as CO_2/energy tax and road pricing and encouraged use of public transport	• Directive 93/116 modifies fuel consumption testing procedures to reflect the CO_2 emissions performance of cars (seen as a prerequisite for a measure to tackle CO_2 emissions).
Pollution control	
• Reduction emissions, waste, etc.	• See *Section 5.1*

Figure 3.7.1: Tourism - number of overnight stays (residents and non-residents) in EU15
Source: Eurostat



In 1992, the number of overnight stays of tourists or visitors reached high figures in Italy (199 million), Germany (174 million), France (146 million) and Spain (137 million). In terms of tourist arrivals, France, Italy and Spain exceed 50 million per year. However, the statistics are not homogenous; it is difficult to evaluate the consequences of these arrivals for transport because there is a high proportion of day trippers or visitors who travel short distances, often in frontier areas.

In 1993, the most popular EU countries were France, Spain, Italy, and the UK. In these countries, the growth in the number of tourist arrivals from 1992 to 1993 was 2.9%, 2.4%, 1.6% and 4.7% respectively. Arrivals in Greece are also relatively fast growing due to the lower cost of living.

The increase in overnight stays in the new Member States from 1980 to 1991 has been significant in the case of Austria (from 15 to 80 million) but almost stable in Sweden and Finland.

Tourism has been growing more rapidly than GDP for some time. International tourism in Europe has developed more rapidly than domestic tourism. The number of non-resident overnight stays in the period 1980-1992 increased 26%, compared with 19% for residents.

Outlook

For the tourism sector, the 5EAP92 and 5EAP95 forecasts are similar. – Although the more recent forecast includes some measures aimed at reducing environmental pressure in some instances, these seem not to be enough. This is because policy and tourism initiatives, while aiming to reduce the environmental pressure from tourism activities in sensitive areas, are also trying to encourage new, sustainable types of tourist locations and activities.

Recently a EU12 average annual growth rate of 3.4% to the year 2000 was forecast (in terms of tourist arrivals) (DRI et al., 1994); this growth is to continue after 2000. It was estimated in 1990 that the tourism growth rate over the period 1984-2000 was expected to be 3.6% per annum in the Mediterranean area and 2% in 2000-2025 (World Bank/EIB, 1990). If the trend for1992/1993 is continued, growth in the western Mediterranean region will lag behind these expectations, although it should be noted that the 1992/93 trend was during a recession period.

Factors of major influence on tourism in Europe are political/legal, economical and ecological (Scwaninger, 1984). In the light of increasing stability and wealth in Europe, the following major trends are expected:

- growth in all regions will continue;
- the shift towards the eastern part of the Mediterranean area, central and Eastern Europe will continue;
- more tourists from the south will visit the north;
- tourists will tend to avoid areas having major environmental problems (Alps, Mediterranean coast); and
- airline and automobile travel will become relatively more popular.

Member States are implementing policies with respect to the environmental impact of tourism, including Environmental Impact Assessment, environmental zoning, sanitation, etc. Infrastructure has improved in order to avoid traffic jams in the peak season. Policies have little effect on the number of tourists or the surface area they use. One action of public authorities is to extend tourism beyond its traditional spheres and periods of concentration, in order to reduce pressure on the local environment.

4. ENVIRONMENTAL THEMES AND TOPICS

This chapter covers the environmental themes following the 5EAP structure with some exceptions. In comparison with 5EAP the climate change and the ozone depletion issue are discussed separately. This counts also for 'acidification' and 'air quality'. The marine water issue is discussed in 'coastal zones' *(Section 4.8)*. A special section is dedicated to soil contamination and degradation, an issue which was not covered in the 5EAP. Each section describes the issue, the state of the environment and the outlook and progress towards 5EAP targets. The themes are structured according to their spatial scale of impact: global *(Sections 4.1 and 4.2)*; European/transboundary *(Sections 4.3 and 4.4)* and regional *(Sections 4.5-4.10)*; *Section 4.11* covers the impacts of each of the other themes on nature and biodiversity.

4.1 Climate change

The issue

Climate change, resulting from global warming, is a global environmental issue identified by the EU as one of the key environmental themes to be tackled under the 5EAP. Global warming is expected to take place as a result of increasing amounts of anthropogenic emissions of gases that affect the absorption and emission of radiation in the atmosphere. These gases, in particular carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and chlorofluorocarbons (CFCs) and their substitutes are referred to collectively as greenhouse gases (GHGs). The contribution to the overall global warming effect of these pollutants is shown in *Table 4.1.1*. Tropospheric ozone (O_3) also contributes to global warming. A discussion of CFCs is provided in *Section 4.2*.

Table 4.1.1 Greenhouse Gases - Sources and Contribution to Global Impact
Source: IPCC, 1994

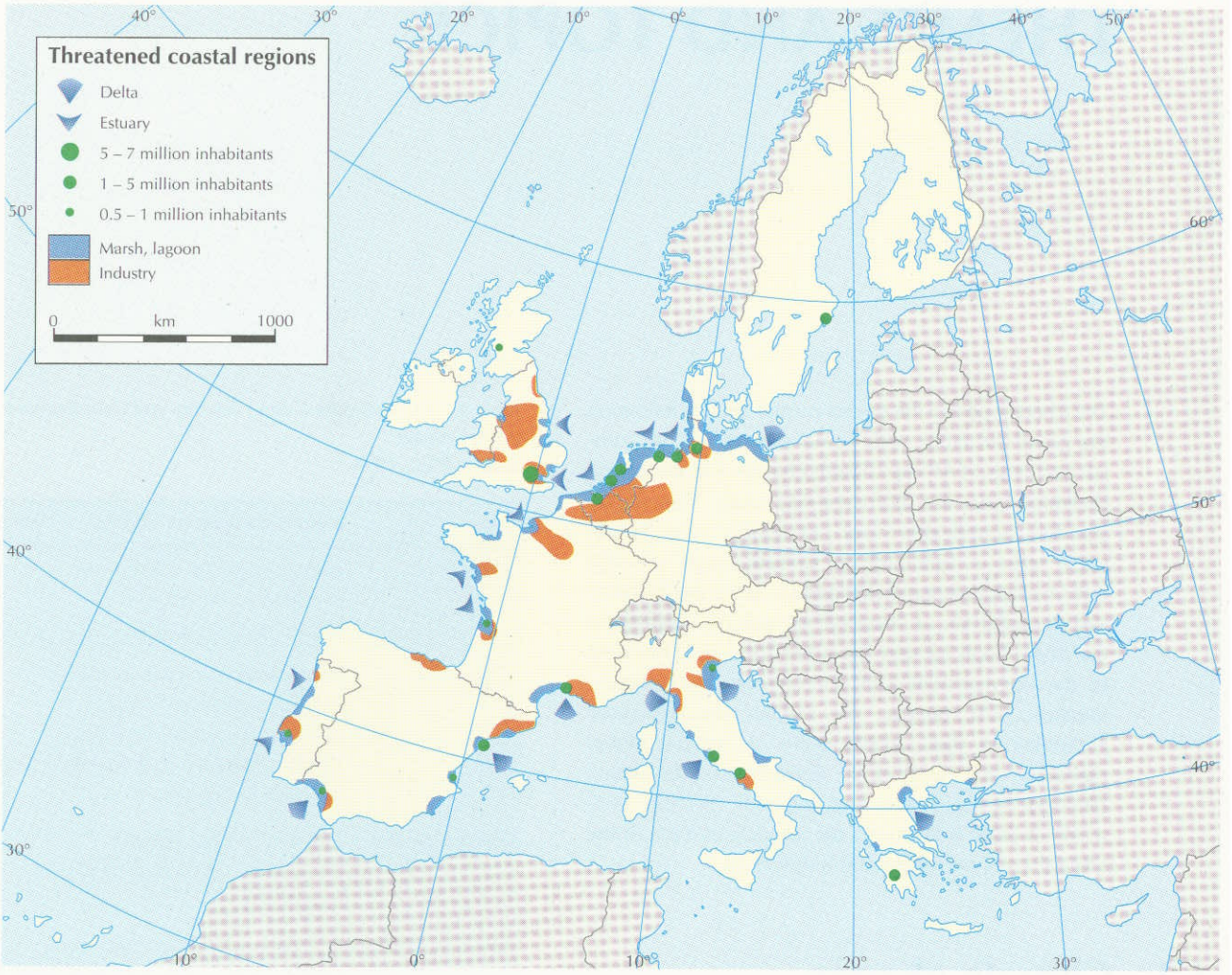
Gas	Main Anthropogenic Sources	Contribution (%)
CO_2	Energy use (80%), deforestation and changing land use (17%), cement production (3%)	51
CH_4	Energy production and use (26%), enteric fermentation (24%), rice paddies (17%), wastes (7%), landfills (11%), biomass burning (8%), domestic sewage (7%)	34
CFCs & HCFCs	Industrial (100%), primarily refrigeration, aerosols, foam blowing, solvents	12
N_2O	Fertilised soils (48%), land clearing (17%), acid production (15%), biomass burning (11%), combustion of fossil fuels (9%)	4

Note: based on 1995 source emission data adjusted using 100 year Global Warming Potentials

The continued emission and accumulation of these gases is expected to result in an enhanced 'greenhouse effect' and an attendant rise in the global mean temperature, which might affect the overall climatic conditions on the planet. This is expected to affect sea level, run-off patterns of transboundary watercourses, frequency of droughts and flooding, agriculture, forests, precipitation levels and biodiversity. The areas most threatened by a rise in sea level, due to their location and elevation, are shown in *Map 4.1.1*.

The severity of these impacts is extremely uncertain, though in recent years the international scientific

Map 4.1.1: EU coastal regions threatened by a rise in sea level and by salt water intrusions into estuaries and ground water
Source: ECGB, 1992



community has made considerable progress in understanding the relationships between, for example: GHG emissions, atmospheric concentration, temperature, and economic costs. While the findings vary (a range of 1-4 degrees C by 2050), the overall conclusions generally support the view that policy action is essential to curb global GHG emissions to control global warming.

The IPCC's next scientific report is due to be published in late 1995.

Environmental policies and EU targets

In an international context, governments responded to the concerns about climate change at the 1992 UN Conference on Environment and Development (Rio de Janeiro). At the conference, the Framework Convention on Climate Change (FCCC) was opened for signatures and individual countries or groups of countries made commitments to control their emissions of CO_2 and other greenhouse gases.

The European Union has set two overall environmental climate change objectives: to not allow the natural absorbing capacity of the Earth to be exceeded, and to follow the activities set out in the Framework Convention on Climate Change. The 5EAP document *Towards Sustainability* mentions a target for the EU, as a whole, to stabilise CO_2 emissions at the 1990 level by the year 2000. The document also identified the need for a monitoring mechanism, which was established under Council Decision 93/389.

Scientists have proposed to use a provisional limit for sustainability of 0.1° C temperature rise per decade (Krause et al., 1990) and a provisional limit of a 2 cm

rise in sea level per decade to prevent damage to coastal zones, wetlands and coral reefs caused by too rapid climatological changes (AGGG, 1990). To remain within these limits it will be necessary to stabilise the concentration of greenhouse gases in the atmosphere at the lowest possible level in the shortest possible time; this has been recognised in the FCCC. According to the IPCC worldwide emissions of greenhouse gases should be reduced immediately by at least 60% (WMO/UNEP, 1990). A stabilisation of emissions of GHGs by the year 2000 at 1990 levels as indicated in the FCCC is therefore considered as a first step.

The first conference of the parties to the Convention was held in March/April 1995. Agreement was reached (the Berlin Mandate) on the establishment of a negotiating process for further commitments under the Convention and the need to adopt a protocol containing further commitments at its third session in 1997.

Box 4.1.1 - EU state of action in the Climate Change theme since 1992

EU Member States have presented their *National Programmes*, as required under the FCCC; the monitoring mechanism, which describe the likely emissions profile for each country up to 2000; and the details of the measures that each country is putting in place in order to achieve a reduction in emissions.

The climate change policy focus has concentrated on the control of CO_2 and its stabilisation at 1990 levels by the year 2000, as CO_2 is the largest contributor to the problem.

No EU policy measures and targets have yet been developed for N_2O and CH_4, although the Commission intends to present a communication on methane during 1995. Some Member States have taken action to reduce these emissions. Actions to achieve these reductions include the introduction of a landfill levy and regulations, agricultural policies to reduce fertiliser use and livestock numbers, measures to reduce leakage from gas pipes.

A summary of EU policy measures aimed at achieving the targets set out in the 5EAP is presented in *Box 4.1.1.*

5EAP objectives for EU (1992-1995)	**Actions achieved**
CO_2 - stabilisation at 1990 levels	See also *Box 3.5.1* on Energy
● Energy conservation measures, such as: - environmentally benign energy use - behavioural changes - economic and fiscal measures	● Decision 93/389 for a monitoring mechanism of Community CO_2 and other greenhouse gas emission (Commission proposal COM(95)172 concerning a carbon/energy tax)
● Improvement of energy, efficiency such as: - R & D - infrastructural changes - change in transport modes - economic and fiscal measures	See also *Box 3.5.1* on Energy
● Fuel substitution towards less or no CO_2 emitting sources (renewables, natural gas, etc), such as: - R & D - infrastructural changes - economic and fiscal measures	See also *Box 3.4.1* on Transport
Methane and nitrous oxide - measures to be identified by 1994 and applied	
● Inventory of data	(Communication on methane emissions in preparation) ● Decision 93/389 for a monitoring mechanism of Community CO_2 and other greenhouse gas emission, includes a requirement for Member States to include data on emissions of other (non-CO_2) greenhouse gases.

State of the environment

Past trends and current status

Given the difficulties in measuring climate change and its environmental effects, the most common indicators used are the stress indicators of emissions of the individual gases. An examination of changes in key stress indicators (CO_2, CH_4, N_2O) over the last 30 years shows a steady increase in emissions.

Recent trends in GHG emissions are now monitored more regularly due to the commitments of the EU and individual Member States under the FCCC. There are a number of different data sources for CO_2 emissions including National Programmes, Corinair, Eurostat and the Convention on Long Range Transboundary Air Pollution (LRTAP). There are difficulties in selecting a data set which meets all the criteria of re-liability, consistency and completeness. Up-to-date data from Eurostat for CO_2 emissions from fossil fuel combustion indicates 3,180 million tonnes in 1993 for the EU12 (2.3% fall on 1990 level). *Figure 4.1.1* shows the trend in total CO_2 emissions in EU12 from 1980 to 1993 (includes final non-energy consumption, excludes bunkers).

Figure 4.1.1: Development of CO_2 emissions in EU12 (includes final non-energy consumption, excludes bunkers) (1980-1993)
Source: Eurostat (data includes emissions from East Germany)

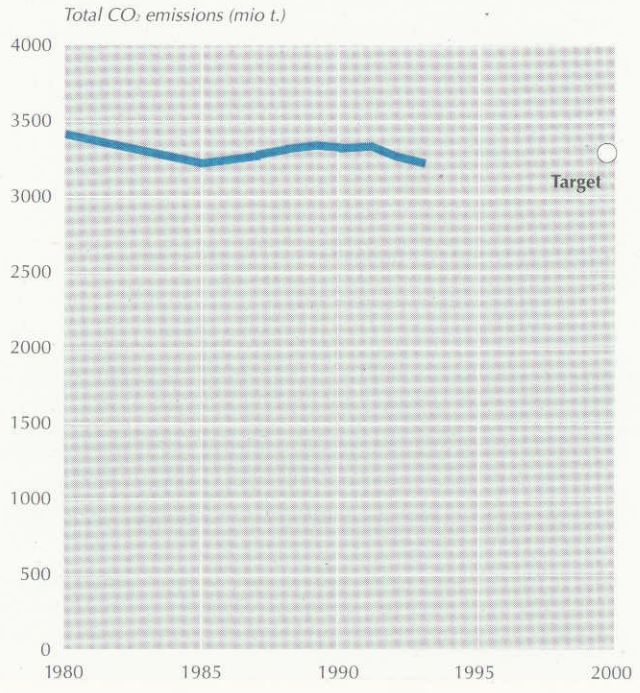


Figure 4.1.2: Source apportionment of CO_2 emissions
Source: Eurostat (data excludes emissions from the former East Germany)

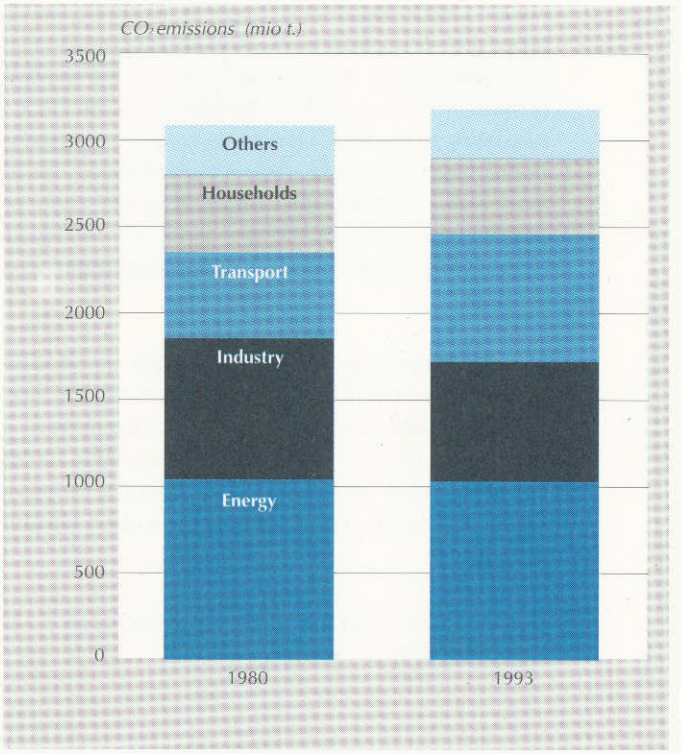


Figure 4.1.3: Development of CO_2 concentration (1950-1994) (at Mauna Loa, Hawaii)
Source: CDIAC, 1994

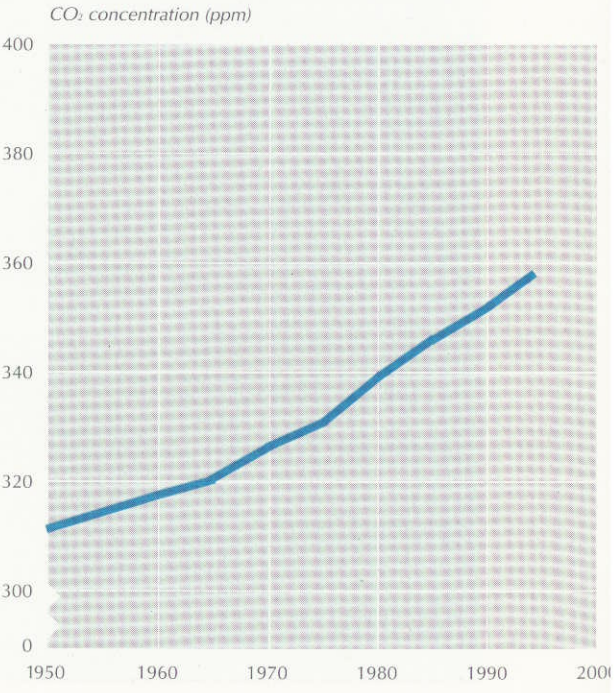


Figure 4.1.4: Source apportionment of N_2O emissions in 1990
Source: ETC/AE, 1995

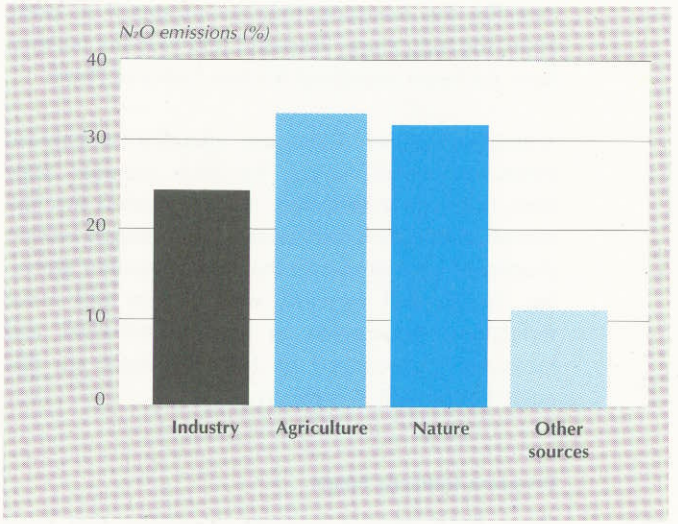
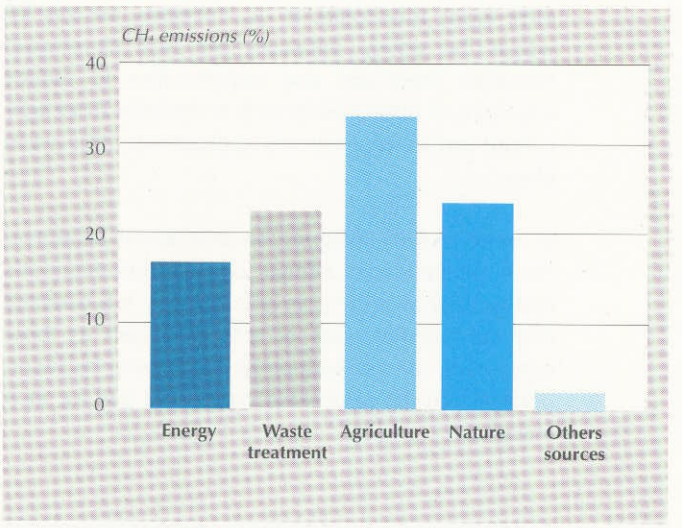


Figure 4.1.5: Source apportionment of CH_4 emissions in 1990
Source: ETC/AE, 1995



Emissions from fossil fuel combustion in the EU12 increased by about 2% overall in the period 1985-90 and 1990-93. Emission reductions were achieved by Germany, Denmark and France (approximately 1%) during 1985-90. Emissions from each of the new entrants were less than the average of emissions for the EU12.

Figure 4.1.2 shows the sectors responsible for CO_2 emissions in 1980 and 1993. Although emissions from industry have reduced, emissions from the transport sector show an increase.

Figure 4.1.3 illustrates the trend towards increasing concentration of CO_2 in the atmosphere since the 1950s as recorded at one of the monitoring stations existing at that time (located in Hawaii).

Figures 4.1.4 and *4.1.5* show emissions of N_2O and CH_4 in the EU12 in 1990 by source. The main sources of N_2O are agriculture and industry and the main sources of CH_4 are agriculture and waste treatment. Natural sources of both these gases are also significant.

Underlying factors and new insights

The main driving factor for GHG emissions is fuel combustion, which is driven by activity in the energy, industry and transport sectors *(see Chapter 3)*. The principal objective of policy instruments is to decouple the link between energy consumption and GHG emissions from growth in these sectors.

In the current context it is important to consider a number of key issues:

- *Penetration of energy efficient technologies.* The rate of penetration of more efficient technologies depends on economic decisions, which are based on the increased capital cost of the technology and the future benefits in terms of energy cost savings. Incentives and information dissemination are required to counteract the expected impact of decreasing energy prices and to encourage the uptake of efficient technologies.

- *Increasing natural gas use could increase CH_4 emissions.* Natural gas is expected to increase its share of primary energy in the EU due to the efficiency of gas technologies and the low emissions (CO_2, SO_2, NO_x and particulates) characteristics of the fuel. It is important to ensure that this increase in use is not accompanied by an increase in emissions of CH_4 resulting from leakage in the distribution system.

- *Member States' economic structure.* The ability of a Member State to stabilise CO_2 emissions depends on its economic and energy structure in the base year (1990) as the scope for improving energy efficiency and reducing emissions is greater in the energy intensive sectors (metals, building materials, paper, etc) than the knowledge intensive sectors (eg, electronics, services).

- *The transport sector is critical.* The transport sector is currently the fastest growing sector in the majority of EU economies and therefore the fastest growing contributor to GHG emissions.

- *CO_2 emissions will remain the largest contributor.* CO_2 contributes around 50% to total GHG emissions, mainly from the use of fossil fuels, which are most easily monitored. It is, therefore, the gas for which the policy initiatives are best developed. However, there are also opportunities to reduce emissions of other GHGs such as methane from agriculture and waste; measures to phase out CFCs are in place.

In order to fully integrate environmental objectives (such as eliminating climate change) into economic and sectoral policies in an efficient way, it is essential that the external costs of activities (such as those concerning the combustion of fossil fuels) be incorporated into the prices that consumers pay for their energy.

Progress and outlook

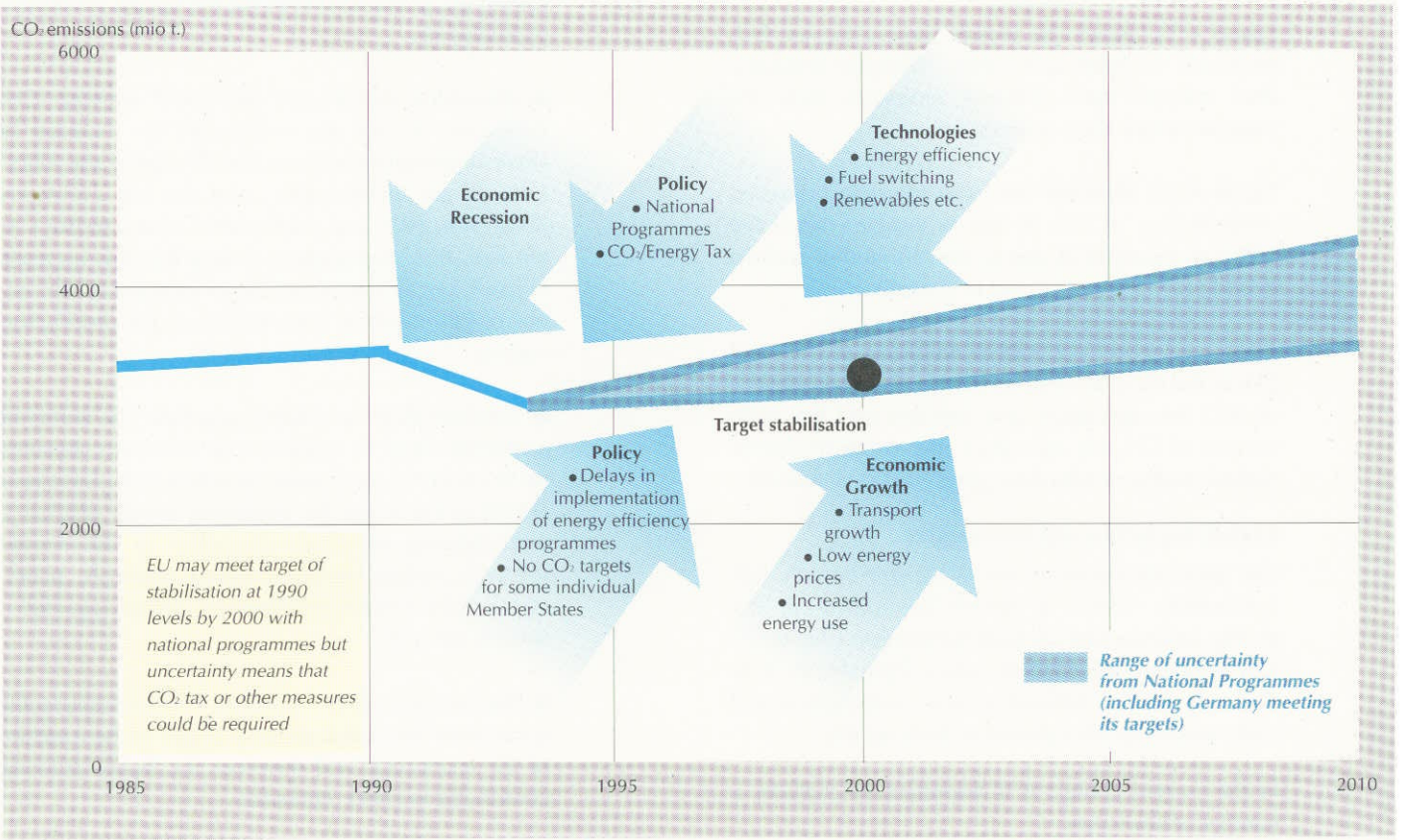
The target of stabilisation of EU CO_2 emissions at 1990 levels by 2000 is being monitored by the European Commission. All Member States have to submit Annual Inventories and National Programmes in which they make projections for the future and describe the measures that are proposed to bring about the reductions. Transport and mobility patterns have not been addressed in most National Plans.

Although Member States are intended to stabilise emissions overall, targets for each Member State have not been established. It is recognised that the overall stabilisation will be achieved through burden sharing of emissions and that some Member States (eg, Spain), will increase, while others will make reductions. Approaches to limiting emissions and measures implemented by Member States are discussed in *Section 3.5: Energy.*

Progress towards target

There have been a number of studies that have attempted to estimate whether the EU will comply with the CO_2 stabilisation target. Studies include DRI (1994), DG XVII and the ERM analysis of the National Programmes for the Commission.

Figure 4.1.6: Progress towards CO_2 stabilisation in the EU12



In summary, there is great uncertainty about whether the EU will meet the target for 2000 and there is a wide range of estimates from an increase of 10% above the stabilisation level (DG XVII) to a 5% reduction by 2000 (DRI et al., 1994), which assumes the introduction of a carbon/energy tax. The outcome is highly dependent on the reduction achieved by Germany, which contributed about 30% of EU15 emissions in 1990 and has not yet set a target for 2000. A preliminary forecast based on the German National Programme predicts that the target for 2000 will be overshot by 1%. These ranges and the key driving factors are illustrated in *Figure 4.1.6.*

In the consideration of the specific measures which have contributed to the reduction of emissions to date and which will affect the likelihood of meeting the targets, a number of key issues are worth highlighting:

- The economic recession in Europe has been a major contributor to reducing emissions between 1990 and 1993.

- The EC programmes, SAVE, THERMIE, ALTENER and JOULE have had some (indeterminate) impact. Full evaluations of these programmes have not yet been carried out, however only partial (50%) achievement of the target (a 20% improvement in energy efficiency) is expected to be achieved under the SAVE programme.

- Only 3 of the 12 intended Directives on household appliance efficiency have been adopted, although there has been a switch in domestic fuel consumption from coal to an increased use of gas.

- In the transport sector there has been limited progress in fuel substitution towards less CO_2 emitting sources, such as non-fossil fuels (bioethanol, electricity from renewables or gas).

- A number of Member States have introduced policies which are likely to have a positive impact; these are mainly fiscal measures *(see Section 3.5).*

After 2000, CO_2 emissions in the EU are likely to rise further by about 1% per year as a result of the continuing growth of production, assuming that no additional policy measures are taken to tackle emissions (DRI et al., 1994; RIVM, 1992).

Methane emissions are also expected to increase from the 1990 level as use of natural gas as a primary energy source increases.

4.2 Ozone depletion

The issue

The ozone layer has been considerably depleted worldwide over the last 20 years. The main cause has been identified as anthropogenic emissions of halogenated hydrocarbons, such as chlorofluorocarbons (CFCs) and hydro chlorofluorocarbons (HCFCs), which are ozone depleting substances. The issues can be summarised as follows.

- The ozone layer of the Earth's atmosphere protects life on earth by absorbing harmful UV-B radiation from the sun.

- The consequences of ozone layer depletion include an increase in UV-B radiation at ground level. This can cause health effects such as increased skin cancer and cataracts in humans. It could also damage marine and terrestrial ecosystems and could alter the biogeochemical cycles of atmospheric gases such as greenhouse gases.

- Observations have confirmed increasing levels of chlorine- and bromine-containing compounds in the atmosphere, caused largely by industrial production of chemicals such as CFCs and halons; a significantly depleted ozone layer has also been observed.

- There is great concern that if emissions of ozone depleting substances continue, there will be a substantial decline in the ozone layer worldwide (including over the densely populated regions of Eurasia and North America).

Environmental policies and EU targets

The aim of current policy is to reduce atmospheric levels of chlorine to less than 2 parts per billion (ppb) by volume, which is the level measured in 1975 just before ozone layer damage was first discovered.

The Montreal Protocol to the Vienna Convention initially stated that production of CFCs should be reduced to 50% of 1986 production levels by 1999. The Protocol was tightened further in London in 1990, while provisions were also made to facilitate the participation of developing countries. This is particularly important as forecast increases in CFC consumption in China and India would otherwise counteract all measures taken in the industrialised countries. Its scope was extended to include other ozone depleting substances including 1,1,1-trichloro-ethane and carbon tetrachloride.

In 1992, signatory countries went further by agreeing in Copenhagen to stop global production of CFCs by 1996. Production of halons was phased out by 1994 and certain other known ozone depleters (1,1,1-trichloroethane, carbon tetrachloride) by 1996. Production of HCFCs (less damaging substitutes for CFCs) will be phased out globally by 2030.

The targets in the Montreal Protocol and Copenhagen Amendment are tightened by EC Regulation 3093/94 on Substances that Deplete the Ozone Layer and supersede the targets established in the 5EAP. The current deadline dates and targets set in relation to ozone depletion (Regulation 3093/94) are as follows:

1994: Phase out production of halons;
1995: Phase out production of CFCs and carbon tetrachloride;
1996: Phase out production of 1,1,1-trichloroethane and limit the use of HCFCs to 2.6% of the consumption of CFCs in 1989 expressed in ODP (ozone depletion potential) equivalents;
1998: 25% reduction in methyl bromide (1991 levels); and
2015: Complete phase out of HCFC (35% reduction by 2004 from 1989 levels).

A summary of policy measures which have been introduced at the EU level in order to limit ozone depletion are given in *Box 4.2.1.*

Box 4.2.1: EU state of action in the Ozone Depletion theme since 1992.

5EAP objectives for EU (1992-1995)	Actions achieved
CFCs + carbon tetrachloride + Halons +1,1,1- trichlorethane - phase out before 1.1.96, except for essential uses	
● Inventory of data	● Regulation 3093/94 halon production/consumption phased out by 1994, CFCs and carbon tetrachloride by 1995, 1,1,1-trichloroethane by 1996; quotas and limits for HCFC and methyl bromide set by Decision 1995
HCFCs, etc - limitation of use to maximum 5% of 1990 CFC use level	
● Inventory of data	● Commission Decision 95/107 allocating production and import quotas for methyl bromide, and setting quotas on use

State of the environment

Figure 4.2.1 shows that, over Europe, the ozone layer has declined by an average of 6-7% between 1979 and 1994; levels of chlorine in the atmosphere have increased sixfold from 0.6 to 3.8 ppb since 1950. There has been a significant reduction in the rate of increase of atmospheric CFC concentrations observed in recent years providing evidence that controls under the Montreal protocol are taking effect. Ozone depletion is subject to large seasonal and latitudinal differences, with greatest decline during winter and early spring in the polar regions (spring ozone levels over Antarctica have fallen by 65% in recent years).

Figures 4.2.1 and *4.2.3* show the sharply decreasing trend in the produc-tion and consumption of CFCs and halons respectively in the EU12 from 1986 to 1994 and the strong likelihood of phasing out production and meeting the targets. Production of total CFCs

Figure 4.2.2: Production and consumption of CFCs in the EU12
Source: EC-DG XI

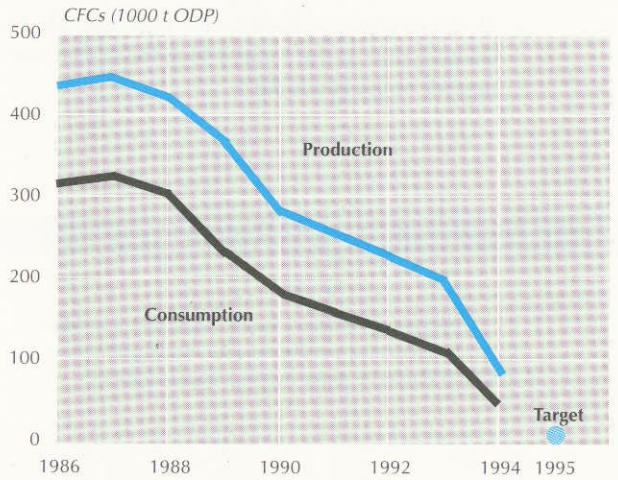


Figure 4.2.3: Production and consumption of halons in the EU12
Source: EC-DG XI

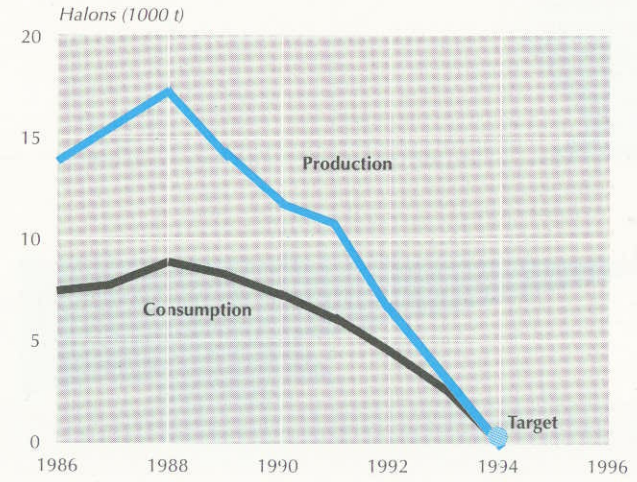


Figure 4.2.1 Changes in ozone concentration above Europe (1979-1994)
Source: CDIAC, 1994

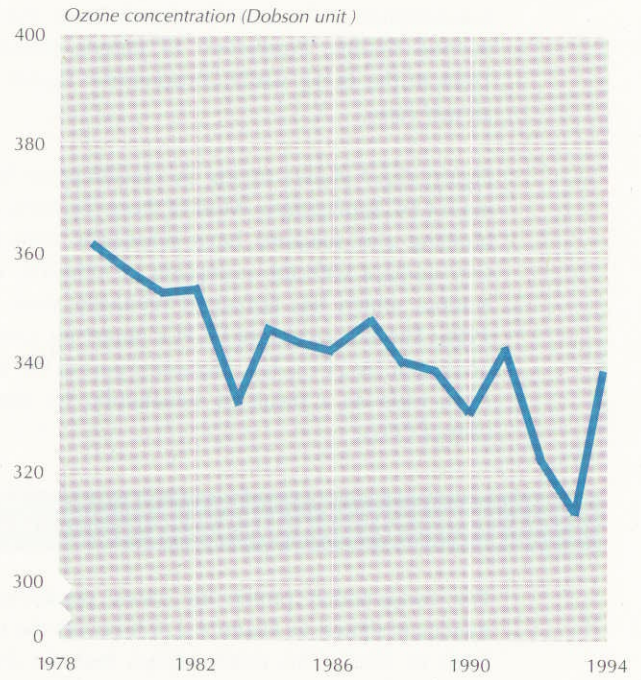
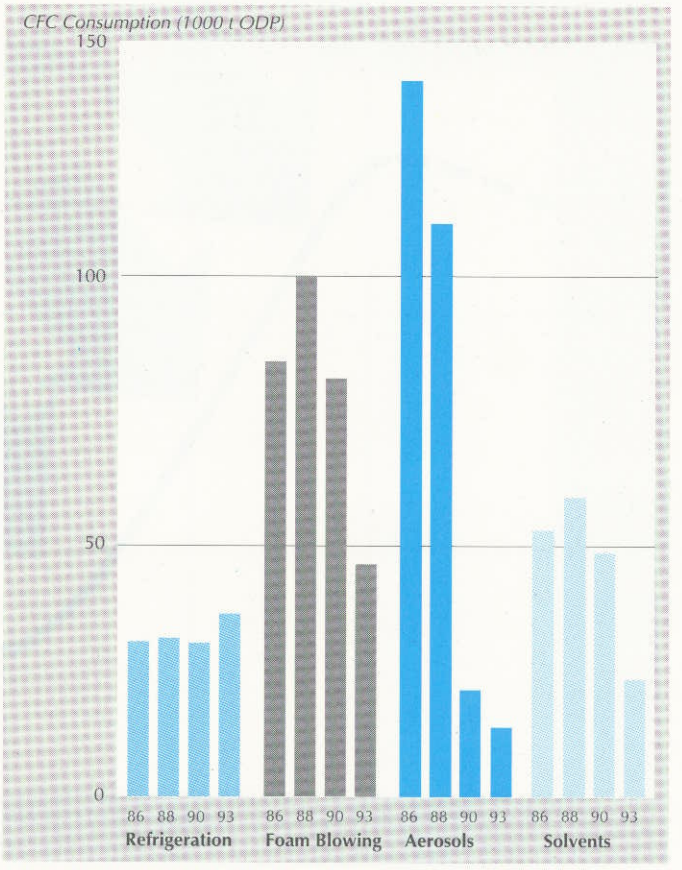


Figure 4.2.4: EU consumption of CFCs in primary areas of application (1986-1993)
Source: CEFIC cited in DoE, 1995



fell by about 70% in the EU12 from 1990 to 1994. Consumption in the EU12 is slightly lower than production figures. Production of halons stopped in 1994 in the EU12 while consumption figures were almost zero.

Figure 4.2.4 shows trends in consumption by the main CFC applications. Most of these (aerosols, foam blowing and solvents) have drastically reduced in CFC content with the exception of industrial refrigeration, which has remained relatively static since 1986. The production of HCFCs (target for complete phase out by 2015) has increased during the period 1986-1994 as a result of substitution for previous uses of CFCs.

Progress and outlook

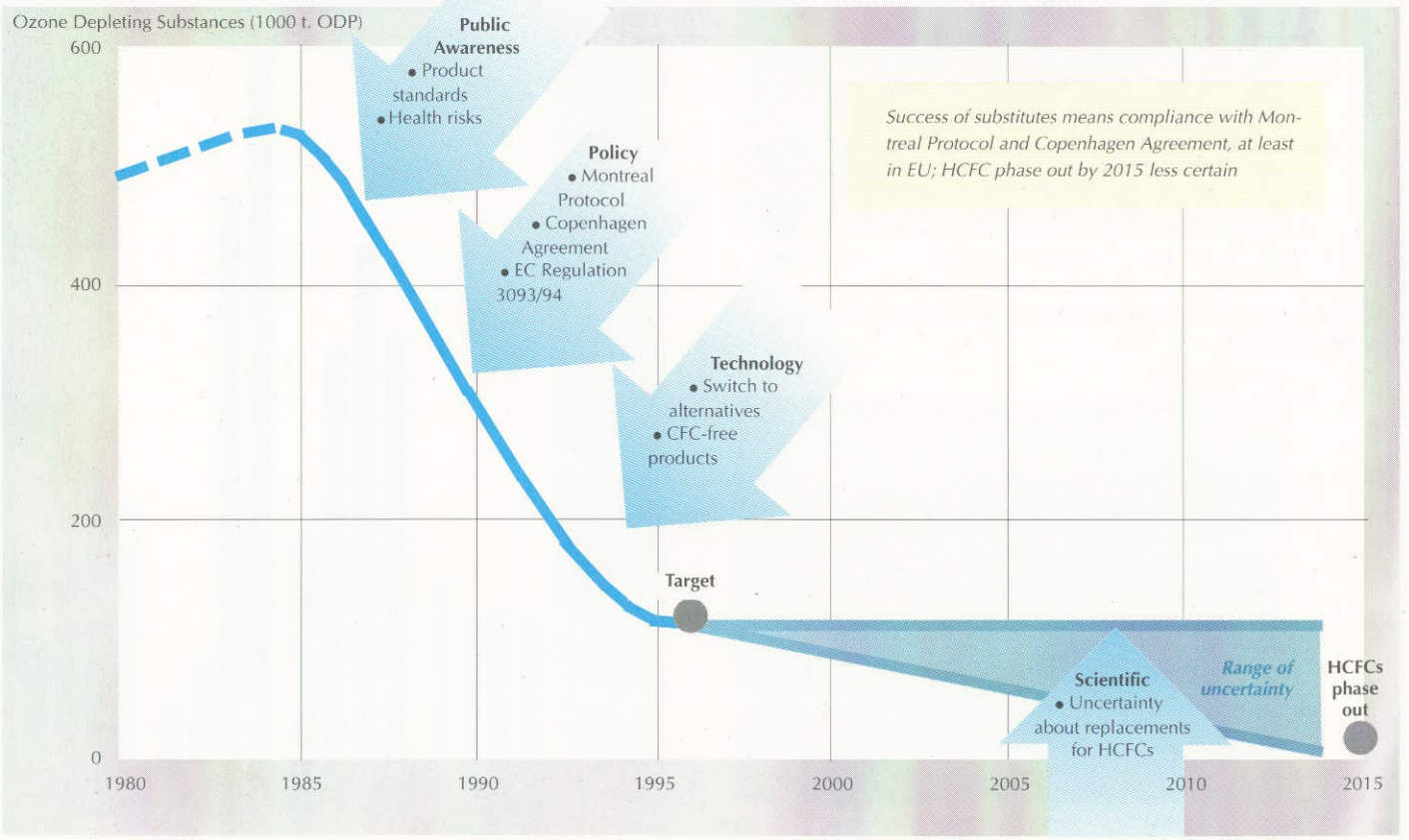
The consumption profile for ozone depleting substances is shown in *Figure 4.2.5*. It covers the period 1980 to 2015. This profile shows that the EU has made significant progress towards its commitment to phase out CFC production by 1995. Success in this area can be attributed to a number of factors including:

- the limited number of industries and applications requiring CFCs;
- technological options for replacing CFCs completely;
- high level of public awareness of the issue; demonstrable links of ozone depletion to health concerns; and
- marketing advantages for producers by switching from CFCs.

The main uncertainty regarding CFC reduction is whether the less-developed countries will be able to reduce consumption. This will only happen when production and sales of ozone depleting substances in the EU and other countries cease and new technologies are made available. The development and adoption of substitutes for HCFCs and restriction of their use as substitutes for CFCs will be needed to meet the commitment for eventual phase out of all ozone depleting substances by 2015.

Despite current policy measures to phase out CFCs and other ozone depleting substances, the ozone layer will continue to be depleted until late into the 21st Century due to the long54 lifetime of chlorine compounds in the atmosphere.

Figure 4.2.5: Progress towards ODP production target



Note: 1996 target is hypothetic

4.3 Acidification

The issue

The main sources of acidifying substances in the atmosphere are sulphur dioxide (SO_2) and nitrogen oxides (NO_x) from the combustion of fossil fuels, and ammonia (NH_3) from agriculture. These compounds undergo chemical conversion in the atmosphere into acid substances which can lead to changes in the chemical composition of soil and water and are seriously threatening to species biodiversity (in both freshwater and terrestrial ecosystems) and ecosystems in general. They also cause material damage and lead to enhanced fluxes of nitrates and heavy metals in groundwater.

The combined deposition of SO_2, NO_x, and NH_3 represents potential acid depositions. The 'critical load' is the maximum input to the ecosystem that is believed not to cause harmful effects.

Despite the implementation of important measures aimed at controlling acidification, there is growing evidence that the problem is as serious as first suggested in the 1970s. Scientific work, instigated by the UNECE Convention on Long Range Transboundary Air Pollution (LRTAP), documents current levels of acid and nitrogen deposition and demonstrates that they are considerably in excess of the critical loads.

SO_2 and NO_x are also major contributors to other air pollution problems which are discussed further in *Section 4.4*.

Environmental policies and EU targets

Cooperative international and bilateral programmes have been implemented since the early 1970s with some important agreements in the 1980s for the control of acidification, such as Convention on Long-Range Transboundary Air Pollution (1979); 1985 Helsinki Protocol on SO_2 reductions; 1988 Sofia Protocol on NO_x reductions; 1991 Geneva Protocol on VOC reductions; and 1994 Oslo Protocol on further reductions of sulphur emissions.

In the 5EAP document Towards Sustainability, the following targets are set regarding emissions of acidifying compounds:

- SO_2: reduction of 35% from 1985 level by 2000;
- NO_x: stabilisation at 1990 level by 1994; 30% reduction by 2000; and
- NH_3: no target for reduction of NH_3 under 'acidification'.

Box 4.3.1 provides details of the main policy measures undertaken at EU level to help meet the targets identified. The main EU Air Directives which will affect the emissions of acidifying substances include:

- the Large Combustion Plant Directive (SO_2 and NO_x);
- Air Quality Directive (NO_x and SO_2);
- Directive on the Sulphur Content of Liquid Fuels (SO_2); and
- Directive setting emission limits for transport vehicles (NO_x).

In March 1995 the Swedish government called for the development of a new EU strategy to combat acidification. The European Commission welcomed this initiative and, as a first step, is preparing a report on acidification which will cover SO_2, NO_x and NH_3, and is expected to be ready by the end of 1995.

Box 4.3.1: EU state of action in the Acidification theme since 1992

5EAP objectives for EU (1992-1995)	**Actions achieved**
SO_x: 35% at EC level reduction of emissions in 2000 (1985 level)	
• Proposals for product standards for coal, fuel oils and residuals	• Directive 93/12 - prohibits marketing of diesel fuels with sulphur content greater than: a) 0.2% by 01.10.94; b) 0.05% by 01.10.96
NO_x : Stabilisation at EC level of emissions in 1994 (1985 level), and 30% reduction in 2000	
• See also *Climate change*	• Proposal on NO_x emissions from new aircrafts under development • Proposed Directive on integrated pollution control • Auto-Oil programme • Various directives to reduce emissions from vehicles *(see Section 5.1)*

State of the environment

Past trends and current status

SO_2 emissions doubled between 1950 and 1970, growth slowed between 1970 and 1980 after the first oil crisis and, since 1980, European SO_2 emissions in particular have been considerably reduced. The emissions profiles for SO_2 and NO_x are shown in *Figure 4.3.1* . The data indicates the following:

- emissions of SO_2 fell by about 12% from 1985 to 1990 in EU12; this was achieved from a reduction in emissions from 5 Member States (Belgium, Denmark, France, Germany, The Netherlands); emissions increased in Ireland, Italy, Portugal, Spain and the UK. Overall EU12 reduction of nearly 35% from 1980 to 1990;

- reduction in SO_2 emissions of about 17% from 1990 to 1992; a reduction of about 10% reduction over the period 1992/93 is indicated by the 6 Member States of the EU12 for which data is available;

- 76% reduction in SO_2 emissions from 1985 to 1990 in new Member States, 39% reduction from 1990 to 1993;

- NO_x increased between 1985 and 1990 by about 7% (reductions achieved by Denmark, France, Germany and The Netherlands) and appear to have decreased slightly (about 1%) from 1990 to 1992; about 1% reduction from 1992-93 is indicated by the 6 Member States of the EU12 for which data is available; and

- reduction of about 8% in NO_x emissions from new Member States in 1993 (largely from reductions in Austria and Finland) compared to 1990.

SO_2 emissions from the energy sector have decreased between 1980 and 1990 mainly due to the installation of flue gas desulphurisation equipment on coal-fired power stations.

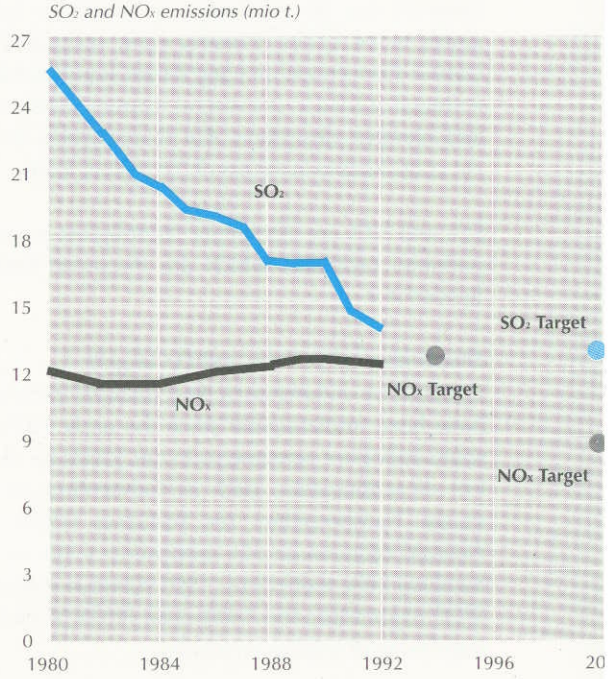
Road transport accounts for 50% (ETC/AE, 1995) of the total emissions of nitrogen oxides to the atmosphere in EU15. The general growth in private car use and road transport of goods indicates that emissions of nitrogen oxides will continue to increase despite increased control of emissions (eg, catalytic conversions, engine improvements, etc) (see *Section 3.4).*

Data on NH_3 shows stabilisation of emissions between 1980 and 1992 largely reflecting livestock effluents and use of fertilisers in the agriculture sector (see *Section 3.6).* (Pers comm. RIVM)

Map 4.3.1 shows exceedance of the critical loads for acidity in 1993 based on depositions of SO_2 and NO_x in ecosystems*8. The proportion of ecosystems*9in Europe (includes Central and Eastern Europe) where deposition is above the critical loads has decreased from 36% in 1990 to 34% in 1993. The percentage of ecosystems in the EU12/15 above critical loads is likely to be higher than this, as a significant proportion of the area below the critical loads is in Eastern Europe. The exclusion of NH_3 from this calculation is likely to underestimate exceedance in some parts of Europe where NH_3 is a large part of the total deposition of acidifying substances.

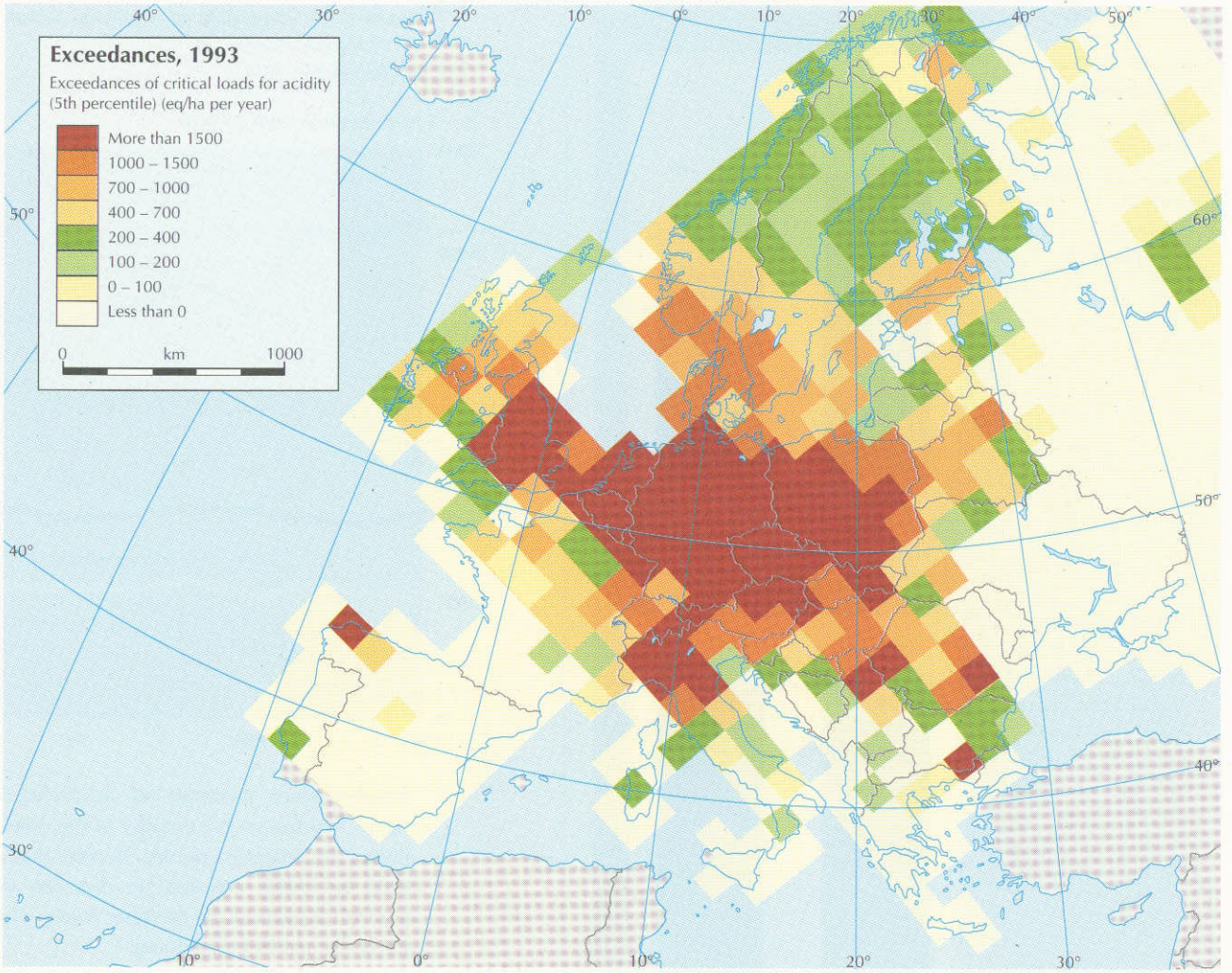
It can be seen from the maps that southern Member States face low exceedances (Greece, Portugal, Spain) while northern Member States (Belgium, Germany, Luxembourg, The Netherlands, Austria, Sweden), despite reductions in their emissions, will be affected by exceedance.

Figure 4.3.1: Development of SO_2 and NO_x emissions in EU12 (1980-1992) (Data includes emissions from GDR)
Source: UNECE/LRTAP, 1995



*8. Derived from RIVM/CCE calculations using critical loads of sulphur-based-acidity. The same data were used for the critical load assessments of the 5EAP and of the UNECE protocol on further reduction of sulphur emissions. Presently, in view of applying the critical load approach based on multiple pollutants and multiple effects, critical loads of sulphur-and-nitrogen-based-acidity as well as critical loads for eutrophication are used for the UNECE/LRTAP framework and the EC preparation).

*9. Previous calculations by RIVM/CCE on acid deposition (eg, 5EAP, Dobris) have been based on proportion of total land area exceeding critical loads; this calculation is based on proportion of ecoreport on a new strategy for acidification (in systems to present a better indication of environmental pressure.



Map 4.3.1 - Exceedances of critical loads for acidity in Europe in 1993

Source: RIVM/CCE, 1995

Underlying factors and new insights

The main factor contributing to emissions of acidifying substances is the combustion of fossil fuels in all sectors. However, each pollutant's principal source contributes at least 50% to its total emissions. The principal sources are:

- SO_2 from power generation;
- NO_x from transport; and
- NH_3 from agriculture.

Power generation accounted for 64% of total *SO_2 emissions* in 1990, 80% of these emissions from coal *(see Figure 4.3.2)*. It is likely that the power sector will make a significant contribution to reducing SO_2 emissions by means of changes in fuel stock and control technologies such as wet limestone, spray dry scrubbing and the use of low sulphur fuel. The share of natural gas which has no SO_2 emissions is anticipated to increase at about 3% per annum up to 2010 *(see Section 3.5)*.

NO_x emissions from road traffic has risen to 62% of total NO_x emissions and growth in this sector has offset gains from other sources *(see Figure 4.3.3)*. Aircraft movements are expected to double by 2000 which will accentuate this trend. The main technical abatement measure implemented in the transport sector is fitting all passenger vehicles with 3 way catalytic convertors.

The main source of *NH_3 emissions* is from agriculture particularly from the application of fertilisers and from animal excrement *(see Figure 4.3.4)*.

Figure 4.3.5 shows total *deposition of acidifying substances* for the EU12 over the period 1985 to 1993 in which SO_2 deposition is falling while NO_x and NH_3 have remained relatively static. The three new Member States have areas sensitive to acidification within their borders and exceedances of the critical load of sulphur.

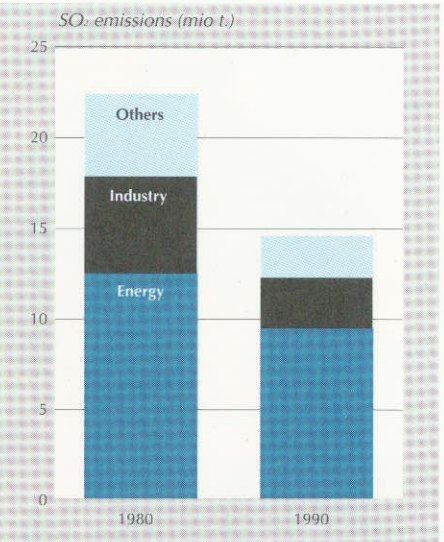


Figure 4.3.2: Source apportionment of SO_2 emissions (only France, Germany, Italy, Spain and UK)
Source: Eurostat/OECD, 1995

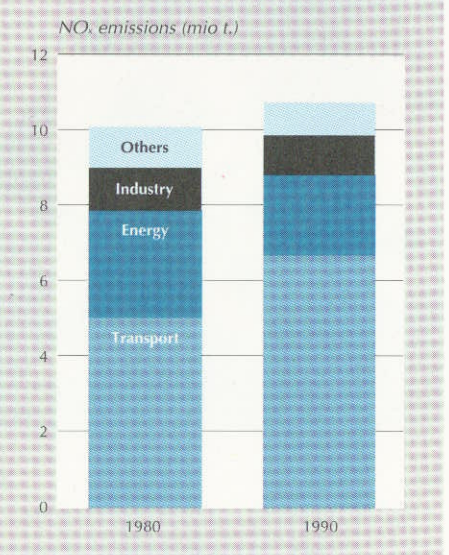


Figure 4.3.3: Source apportionment of NO_x emissions (only France, Germany, Italy, Spain and UK)
Source: Eurostat/OECD, 1995

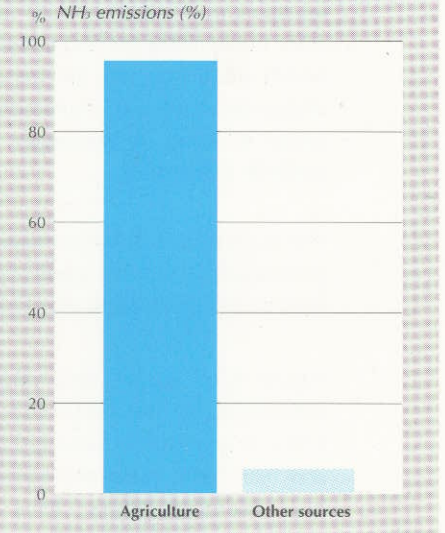
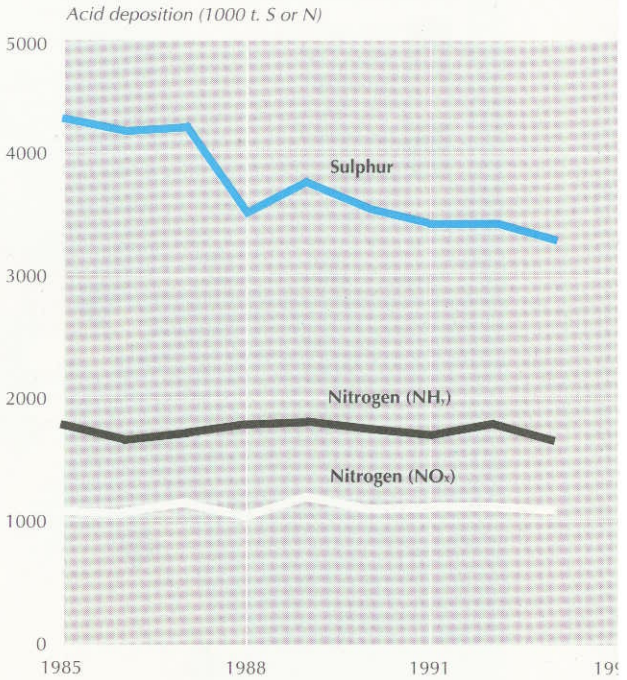


Figure 4.3.4: Source apportionment of NH_3 emissions in EU12
Source: ETC/AE, 1995

Figure 4.3.5: Deposition of acidifying subastances at the EU12 Member States
Source: EMEP, 1994



Transboundary transport of acidifying substances means that the source country of the emissions is not always the receptor country. Transfer matrices, developed by EMEP, are used to describe imports and exports for each of the Member States. The following points are worth highlighting:

- the importance of Germany as the primary or secondary source of deposition for eight of the fifteen Member States;
- the low contribution of Southern European sources to deposition in Northern Europe, where critical load exceedance is the greatest; and
- the significant contribution of Eastern Europe and other non-EU sources to deposition in a few Member States, namely Austria, Finland, Greece and Sweden.

Progress and outlook

The progress towards targets and the outlook for future SO_2 and NO_x emissions is shown in *Figures 4.3.6* and *4.3.7*. These profiles have been developed on the basis of studies by DRI et al. (1994) and IIASA (1995). Both studies suggest consistent results for SO_2 emissions but IIASA forecasts much lower NO_x emissions in 2000. The figures reveal the following:

SO_2: 5EAP target will easily be achievabl and tighter, more ambitious targets agreed under the UNECE now seem more appropriate to reach critical loads across Europe.

NO_x: Based on incomplete data it appears that the 1994 target may have been met or slightly exceeded. However, achieving a 30% reduction by 2000 seems unlikely without tighter control of transport emissions and other physical measures.

Some of the key issues associated with these emissions profiles are summarised below.

Issues relating to the outlook for SO_2 emissions

- Based on the Current Reduction Plans (CRP) of the EU12, a reduction of about 53% in SO_2 emissions by 2000 compared to 1985 levels is likely. Large reductions are expected from Denmark, Germany and The Netherlands while much lower levels of reductions are expected in the southern Member States. The CRPs of Greece and Portugal indicate emissions are likely to increase by 2000. The new Member States reduction in SO_2 emissions by 2000 (on 1985 levels) is in line with the average reduction in EU12.

- *EU average SO_2 targets contained in 5EAP have almost been met.* This should not be considered an unqualified success because the initial target was almost and sulphur has some special characteristics which mean that targets have been achieved relatively easily, namely:

  – a few large point sources of emissions;
  – technical fixes have been possible at reasonable cost;
  – this issue has been a focus of action for more than 20 years; and
  – emissions are easily measured and monitored.

- *Revised sulphur protocol main driver (UNECE).* Based on commitments made by individual countries, an overall fall in emissions of 50% by 2000 is anticipated (to achieve the UNECE target of '60% gap closure' between existing deposition levels and critical loads).

Figure 4.3.6: Progress towards SO_2 target

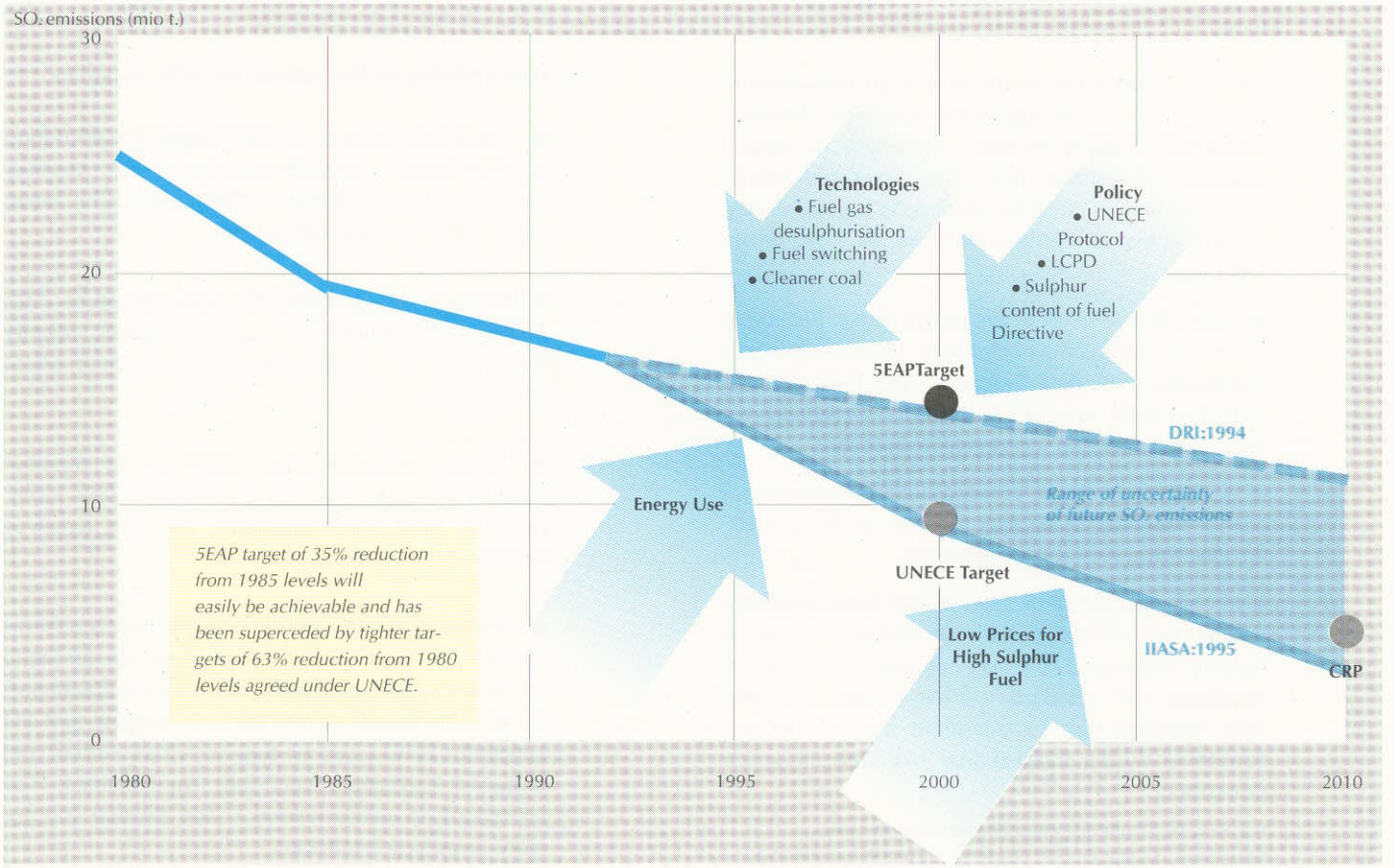
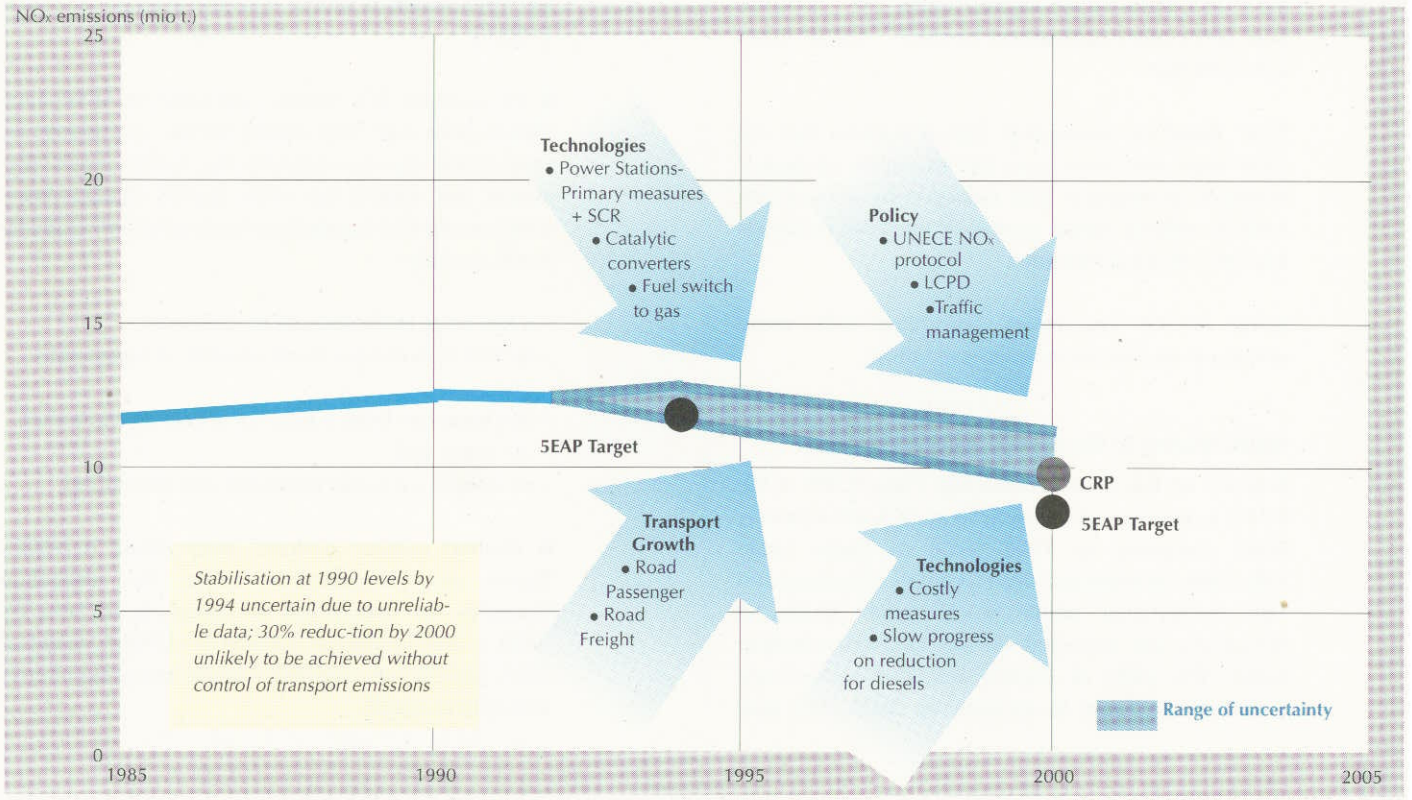


Figure 4.3.7: Progress towards NO_x target



Beyond 2000 some countries will go considerably further*[10] (>70%) although some southern Member States will actually increase emissions or reduce emissions at a slower rate. The expected overall reduction for the EU15 by 2000 is 55%. Austria had already achieved 80% reductions by 1992 (from 1985 levels).

- *Main improvements in the power sector.* Reduction in emissions will come from power sector: shift to gas; low sulphur coal; new German Länder have installed FGD; and fiscal measures such as differential taxes on fuel according to sulphur content as in Finland.

- *EC Initiatives.* These currently include revision of LCPD, reduction of sulphur content in liquid fuels; IPC Directive, Auto-Oil programme.

- *Aircraft fuel standards.* Due to their trans-boundary nature, fuel standards will be addressed internationally. Although DGXI has competence in aircraft emissions, fuel standards are left to the IATA. Similarly, standards set for maritime bunker fuel are controlled by the International Maritime Organisation (IMO).

*10 Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Sweden and UK - based on Current Reduction Plans

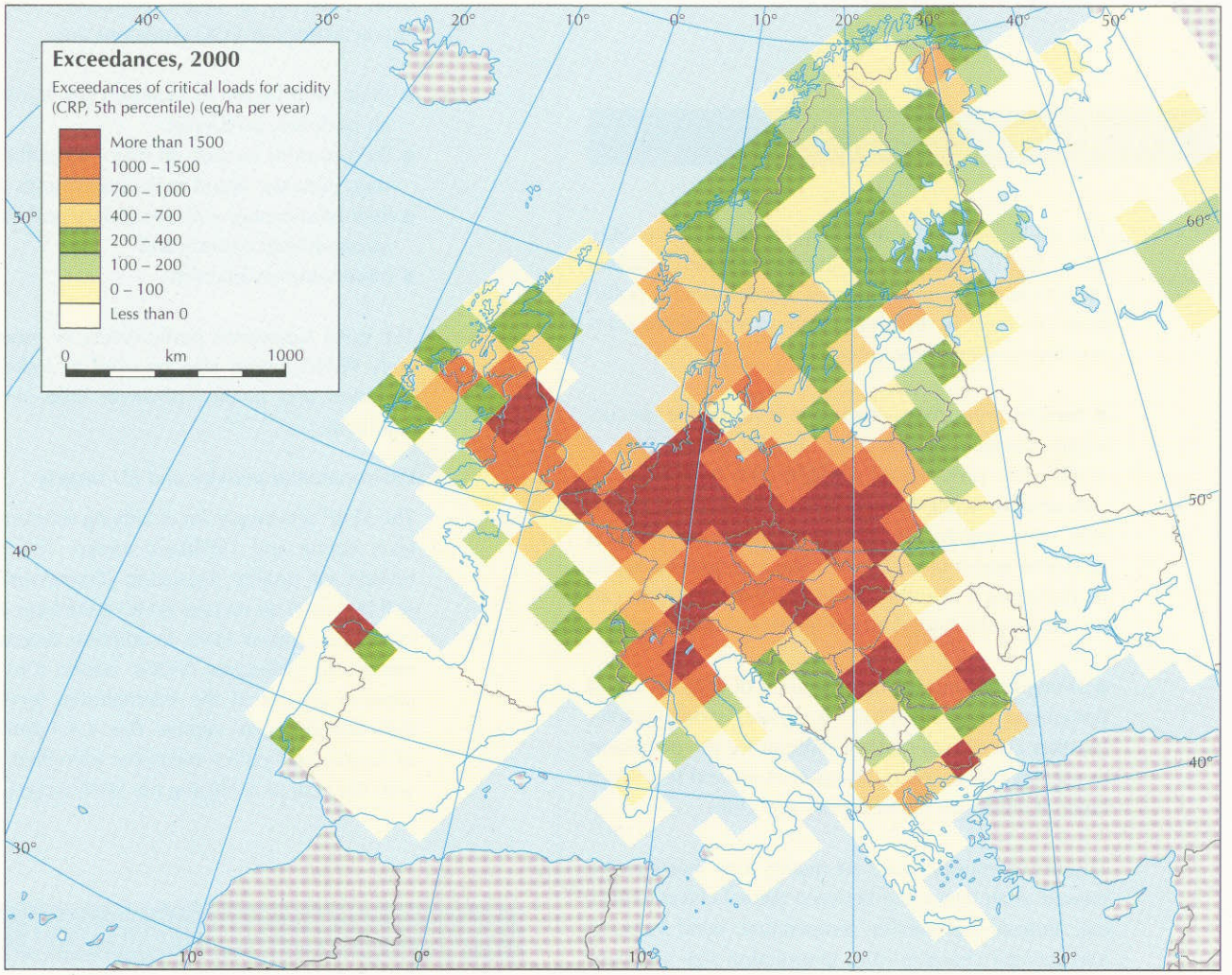
Issues relating to the outlook for NOx emissions

- *Need data to confirm 1994 target* of stabilisation at 1990 levels. Complete data for all EU Member States is not yet available for 1994, although it seems likely that this target will be met.

- *Progress on renegotiation of the Sofia NO_x Protocol.* Recognises NO_x as the highest priority but may also contain multi-pollution/multi-effect approaches.

- *Current reduction plans* (CRP) of EU Member States will lead to a reduction of 20% in 2000 (compared to 1985 level) instead of the 30% target as mentioned in the 5EAP.

- *Not likely to meet the 2000 target.* NO_x emissions are likely to stabilise or decrease slightly in the future according to DRI Integration study. This is due to traffic growthalthough IIASA forecasts suggest that EU targets for 2000 could be fully met if all current and proposed legislation were fully implemented. The limitations to achievements (see *Section 3.4* for more detail) are related to:



Map 4.3.2 - Exceedances of critical loads for acidity in Europe in 2000
Source: RIVM/CCE, 1995

– the slow rate of turnover of the vehicle fleet (maximum of 10% pa);
– problems with the effectiveness of catalytic converters (cold start and city motoring problems); the lack of new technologies in the pipeline; lack of an effective policy initiative for freight transport;
– lack of progress to date in encouraging mode switching from road or from private to public transport on the scale required; and
– the cost of biofuels in comparison to current petroleum prices.

● *EU initiatives.* These include the revision of the LCP Directive; IPPC Directive; Auto-Oil programme. However, the impact of horizontal polices may be more mixed. For instance the effect of Single Market Legislation has been to force Austria to re-duce HGV taxation levels.

Issues relating to acid deposition and exceedance of critical loads

Critical Loads will still be exceeded in 2000

Even meeting the new targets (according to Current Reduction Plans by Member States) will mean that there are still ecosystems in Europe where critical loads are exceeded (25% of ecosystems) (See *Map 4.3.2).* Although overall acid deposition levels are expected to decrease considerably by 2000, critical loads would still be exceeded in the northern Member States, and Central and Eastern Europe due to depositions from EU sources. Only about 60% of the area of the EU is not exposed to deposition in excess of the sulphur critical load. The corresponding figure for nitrogen is less than 50%.

4.4 Air pollution and quality

The issue

The main pollutants affecting air quality are SO_2, NO_x, VOCs, particulates (including lead), carbon monoxide (CO), and benzene. These primary pollutants can react in the atmosphere to form either summertime or wintertime smog.

- *Summertime smog*, or ground-level ozone, occurs when nitrogen oxides and hydrocarbons (VOCs) react in the presence of sunlight. The occurrence of summertime smog in rural areas is high as the pollutants can persist in the atmosphere over long distances and it takes time for the reactions to occur. Its occurrence in urban areas is lower as ozone can be removed by high concentrations of nitric oxide.

- *Wintertime smog* consists mainly of SO_2, NO_x and particulate matter (PM). It arises when winter weather conditions make it difficult for the pollutants to escape and become trapped at ground level by a layer of colder air above towns and cities.

The occurrence of poor air quality can therefore be viewed as an interaction between natural characteristics (eg, atmospheric stability, temperature, wind velocity) and societal characteristics (population size and density, emissions of air pollutants from transport, industry, combustion, etc). The contribution of road transport is of increasing concern *(see Section 3.4)*.

In addition to air pollution problems from the concentration and/or reaction of pollutants in the atmosphere, other emissions to air can lead to deposition related problems mainly from persistent organic pollutants (eg, dioxins) and heavy metals.

The main air pollution sources in Europe are road transport, power generation and industry; due to the concentration of population and economic activity, major urban areas experience the highest levels of pollution and exposure of the population to health risks. According to recent WHO data, air pollution incidents occur in all cities (>50,000) in Europe.

A more detailed analysis of urban air pollution issues is provided in *Section 4.6: Urban Environment*. Emissions of SO_2 and NO_x are already discussed in *Section 4.3: Acidification*. In assessing the trends and outlook of other air pollution problems, VOC emissions have been used as a target indicator. The important characteristics of VOC emissions are:

- their contribution to localised and transboundary air pollution problems;
- their sources include all major air polluting sectors: industry, liquid fuels, households and traffic;
- their relationship with secondary pollutants (ground-level ozone); and
- information availability.

TSP (total suspended particulates), or more appropriately PM10, could also be used as indicators of air pollution and quality, however little information is available.

Environmental policies and EU targets

The 5EAP sets targets for acidifying substances, ground level ozone and TSP/black smoke. The forthcoming revised air quality legislation (Framework Directive) will be based on revised WHO guidelines and is expected by the end of 1995. In addition, targets to combat certain air pollutants (VOCs, ozone (O_3), PCBs and dioxins) are set at the international level, reflecting their transboundary nature. *Box 4.4.1* contains details of targets and policy measures identified since 1992 with the goal of achieving the 5EAP targets.

State of the environment

Past trends and current status

The most recent data on emissions of VOCs, heavy metals, O_3 and particulates is given below for the EU12 and EU15 where available.

VOCs: Non-methane VOC emissions in EU12 stabilised between 1980 and 1990, the latest date for which there is consistent data from UNECE/LRTAP *(see Figure 4.4.1* and *4.4.2)*.

Based on incomplete and inconsistent data submitted by 10 of the 15 Member States, there appears to have been a further reduction of about 5% between 1990 and 1992 (includes Austria and Sweden). Emissions in Germany, the UK and France account for over half of EU12 emissions in 1990. Of those Member States for which data is available in 1985 and 1990, the overall reductions have been achieved through actions in Belgium, Netherlands and Spain. Sweden'sVOC emissions have also decreased over this period.

Box 4.4.1: EU state of action in the air quality theme since 1992.

5EAP objectives for EU (1992-1995)	Actions achieved
Dioxins: 90% reduction of dioxins emissions from identified sources by 2005 (1985 levels)	
• Directive (revision) on standards for municipal waste incineration plants	(No proposal yet; draft under development)
• Proposal for Directive on incineration of hazardous waste	• Directive 94/67 on hazardous waste incineration requires for mal compliance by 31 December 1996
Heavy metals: at least 70% reduction from all pathways of Cd, Hg and Pb emissions in 1995	
• Integrated pollution control and revised BAT	• Proposed Directive on integrated pollution control (COM(93)423) near to adoption
Implementation and enforcement of existing legislation on SO_2, NO_2, lead, particulates and black smoke	
• Identification of existing or potential problems; proposals for amendment of existing legislation	• Proposal for Directive (COM(94)109) on assessment and management of ambient air quality is near to adoption (Proposal (COM(94)345) to continue information exchange among Member States for ambient air quality data) (Proposals exist aiming to amend: Directive 93/59 on light com mercial vehicle emissions Directive 91/542 on gas/particulate emissions from diesel vehicles)
VOCs: 10% reduction of anthropogenic emissions in 1996 (from 1988) and 30% reduction (from 1990 level) in 1999	• Directive 94/63 - VOC Stage I to reduce VOC emissions from storage and distribution of petrol (Draft proposal on Stage II VOC emissions during petrol refuelling under development)
Extension of regulated substances causing pollution or health / environmental risk - ozone:	
• For health protection: current levels if not exceeding mean value over 1 hr. of 175 μ/m^3 and mean value over 8 hrs. of 110 μ/m^3	• Directive 92/72 on air pollution by ozone, formal compliance by March 1994.
• For protection of vegetation: 200 μ/m^3 mean value over 1hr. and 65 μ/m^3 mean value over 24hrs. should not be exceeded	

Table 4.4.1 Atmospheric emissions of heavy metals in Belgium, Germany, The Netherlands, Sweden and UK
Source: Fourth North Sea Conference, 1995

Heavy metal	Will 50% reduction be achieved (1985-95)?	Comment on reduction from point sources
Mercury	All except Belgium and Germany (UK estimates a reduction of between 29% and 56%)	Reductions in chlor-alkali and metallurgical industry, more efficient flue gas abatement at coal fired power plants and waste incineration plants, substitution of mercury in products
Cadmium	All except UK	Reductions in metallurgical industry, more efficient flue gas abatement at coal fired power plants and waste incineration plants, substitution of cadmium in products
Copper	UK, The Netherlands, Belgium and Germany not expected to meet target	Measures in the non-ferrous metal industry and steel industry, more efficient flue gas abatement at coal fired power plants and waste incineration plants
Zinc	UK, The Netherlands and Belgium not expected to meet target	Measures in the metal processing industries, more efficient flue gas abatement at coal fired power plants and waste incineration plants
Lead	All	Increased use of unleaded petrol, measures in the metallurgical industry, more efficient flue gas abatement at coal fired power plants and waste incineration plants
Arsenic	All except UK and The Netherlands	Measures in the metal processing industry, more efficient flue gas abatement at coal fired power plants and waste incineration plants, arsenic no longer used in glassworks
Chromium	Only Sweden and Denmark expected to meet target	As above
Nickel	Only Sweden and Germany expected to meet target	Measures in the metal processing industry, more efficient flue gas abatement at coal fired power plants and waste incineration plants, partial conversion from coal to gas powered plants

Heavy metals: Data on emissions to air from point and diffuse sources are provided by Belgium, Germany, The Netherlands, Sweden and the UK for 8 heavy metals and summarised in *Table 4.4.1*, which is based on the North Sea Conference target of 50% by 1995. This reduction target is expected to be met in all North Sea States for lead and in most of the countries for cadmium, mercury, arsenic and chromium. Emissions of copper, zinc and chromium are not expected to reduce considerably. However, it should be noted that this takes no account of reductions achieved prior to 1985 which were significant in some countries.

TSP: Data for TSP/black smoke in selected countries (which represents 60-70% of total EU12 emissions) are given in *Figures 4.4.3* and *4.4.4*. This shows emissions of particulates falling steadily over theperiod 1980 to 1991. However, emissions from transport have increased over the ten years from 1980, and the reduction in total emissions has come from a significant reduction from stationary sources,

Figure 4.4.1: Development of VOC emissions in EU12
Source: UNECE/LRTAP, 1995

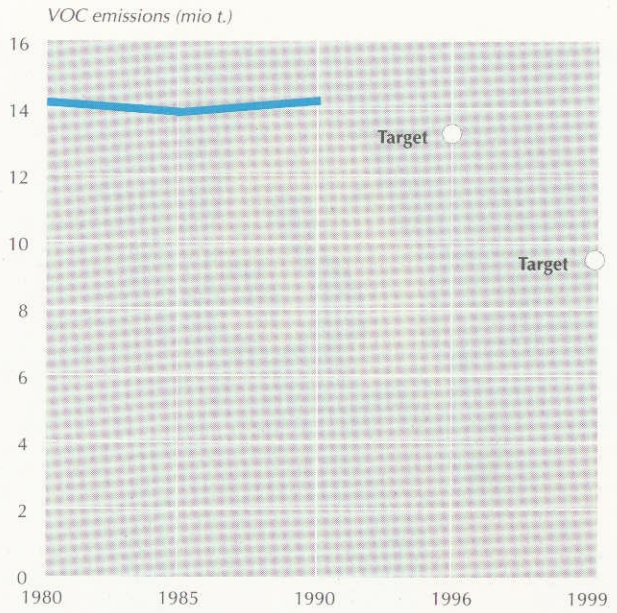
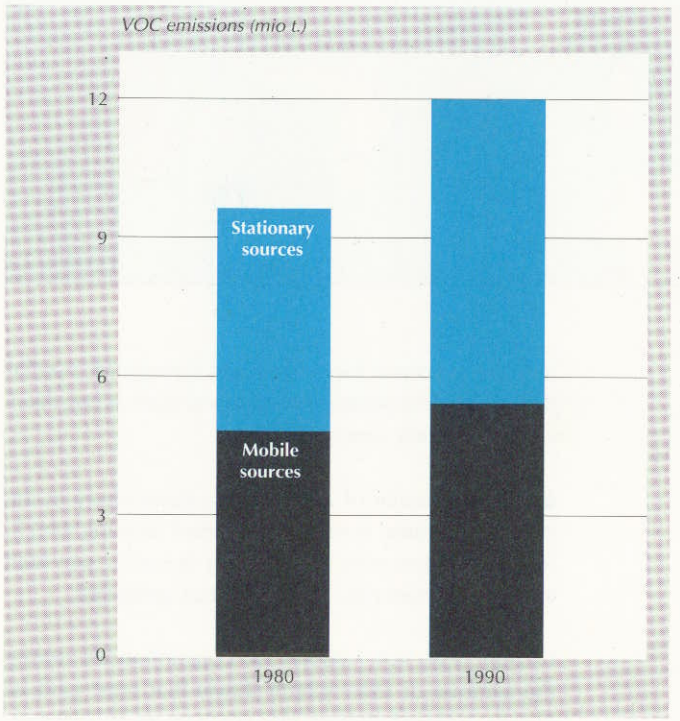


Figure 4.4.2: Source apportionment of emissions of VOCs (only in France Germany, Ireland, Italy, The Netherlands, Spain and the UK)
Source: Eurostat/OECD, 1995



mainly industrial and domestic coal combustion. In the UK, emissions have fallen by 40% between 1970 and 1990; this is considered to be typical for EU12

Figure 4.4.3: Development of emissions of particulates (only France, Germany, Ireland, Italy, The Netherlands and UK)
Source: Eurostat/OECD, 1995

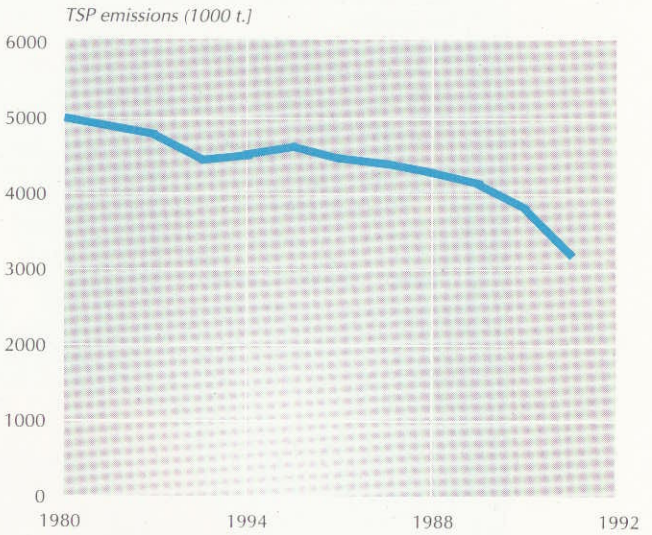
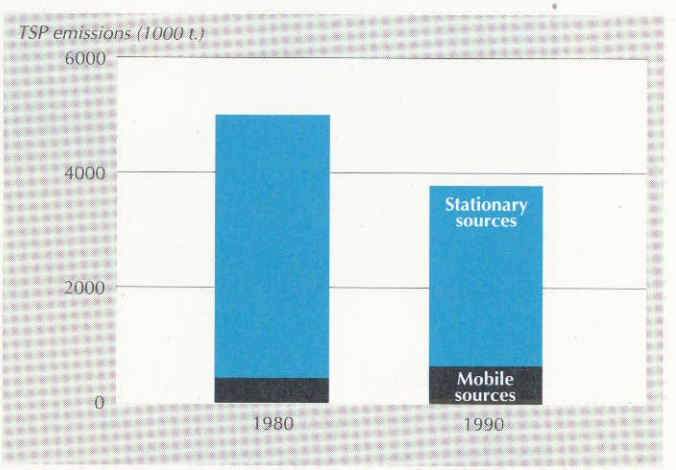
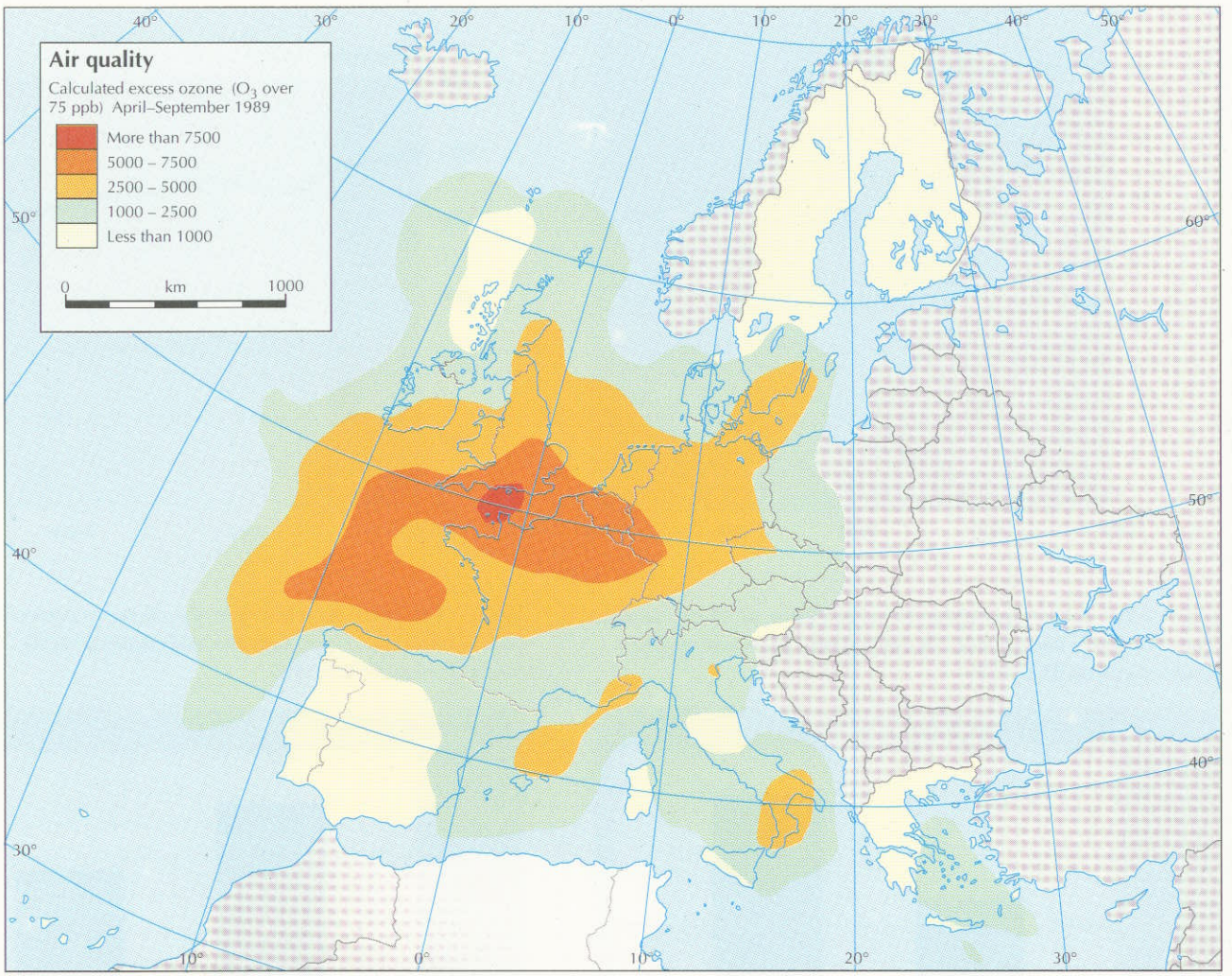


Figure 4.4.4: Source apportionment of emissions of particulates (only France, Germany, Ireland, Italy, The Netherlands and UK)
Source: Eurostat/OECD, 1995



Dioxin Emissions From Waste Incineration: Due to the nature of dioxins and increasing uncertainty about multiple sources, no trend data on emissions are available. The capacity and techniques used for waste incineration and cleaning of flue gases are key determinants of dioxin emissions. However, other previously unknown sources have recently been documented, such as steel works in the UK which are now thought to make up a significant proportion of national emissions. Other combustion processes may also be seen as increasingly important.

Map 4.4.1: Excess ozone (above threshold value of 75 ppb) during summer 1989
Source: Sandness and Styve, 1992



Underlying factors

The factors underlying emissions of SO_2 and NO_x are described in *Section 4.3* on Acidification.

- *Figure 4.4.2* shows that mobile sources of VOCs account for some 47% of the total (road transport accounts for some 30% of which 7% is associated with refuelling). Stationary sources account for 53% and solvent use is some 35% of this. The split between emissions from mobile and stationary sources has remained constant since 1980.

- Emissions of large particulates have minimal impact on human health, although they do contribute to soiling and nuisance. Smaller particles, such as PM10, contribute to the more serious health and respiratory problems. Emissions of larger particulates from industrial sources are expected to decrease as legislation requires industry to control these emissions throughthe installation of pollution abatement equipment such as bag filters and electrostatic precipitators.

- Another source of air pollution, particularly in the Nordic countries, is small scale wood burning which, in combination with winter smog episodes, can lead to higher cancer risk and respiratory problems.

Ozone: Map 4.4.1 shows O_3 concentrations during the summer of 1989 which shows that most parts of Europe suffered at least one summer smog incident. The WHO-AQG of 75 ppb one hour average was exceeded in about 80% of European monitoring stations in 1989

Progress and outlook

Policy measures are tackling the reduction of emissions to air from different sources; these are described below for the primary pollutants discussed in this section that will have a consequent impact on summer and winter smog episodes. Dioxins are also discussed below. Although certain pollutants need to be present to form smog, climatic conditions play an important role in the dispersion of the primary pollutants and the creation of secondary pollutants. This has led to some Member States considering measures such as introducing occasional car bans in urban areas to curb smog episodes when the likelihood of occurrence is high.

VOCs

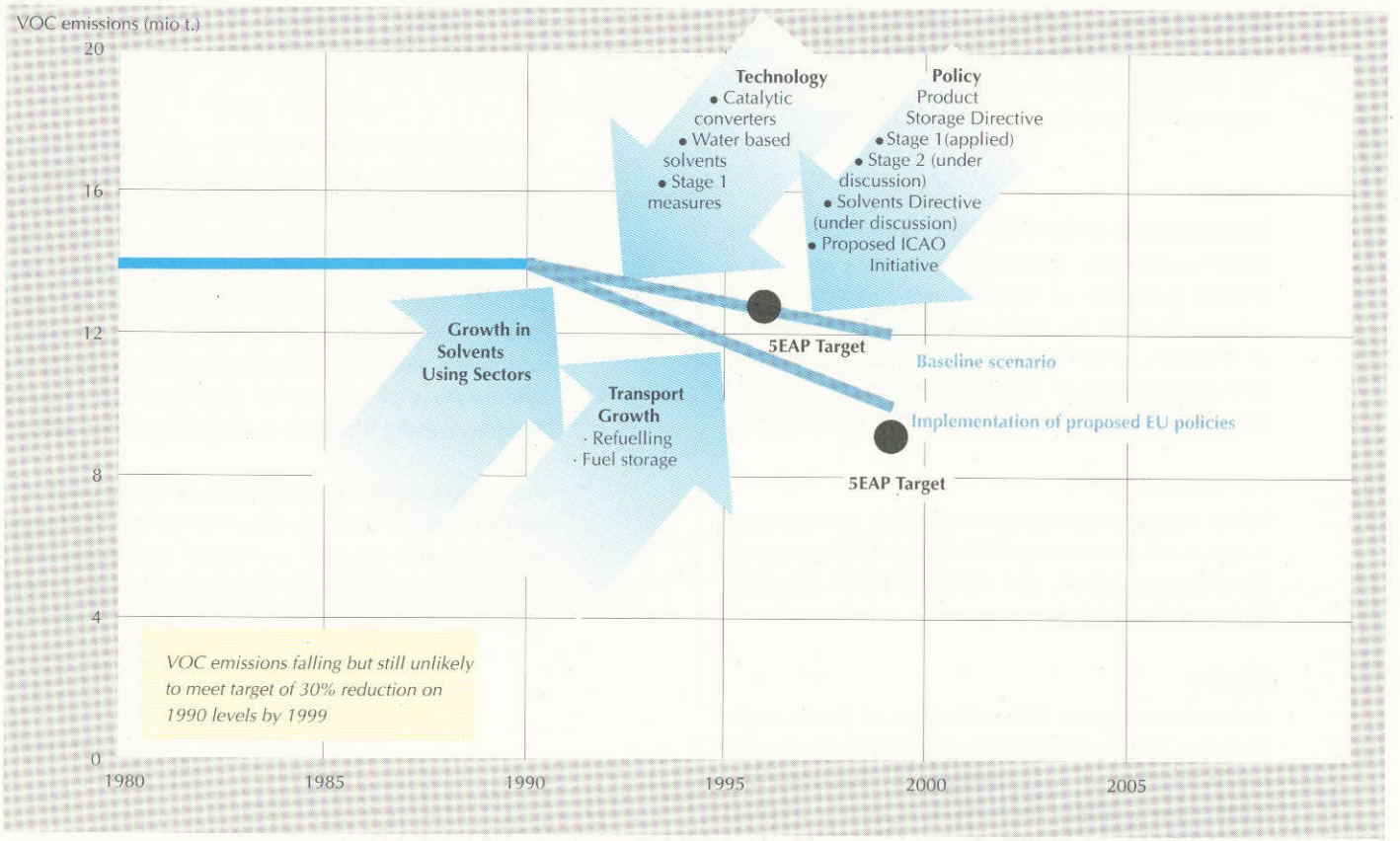
The reduction of VOC emissions, one of the main precursors for summer time smog, will contribute significantly to reducing the likelihood of ground-level ozone formation. The DRI Integration study (DRI et al., 1994) forecast a reduction in emissions of 5% by 2000 compared to 1990 levels for a reference scenario (based on projections of past trends) and reductions of 25% if EU policies in the pipeline are taken into account. The implications of these forecasts for 5EAP targets are shown in *Figure 4.4.5*, which indicates that the EU12 are unlikely to meet targets despite the measures which have been put in place, including those listed below.

- The Storage & Distribution of Petrol Directive. Stage 1, which relates to the capture of VOC vapours from refineries is already in place but derogations and long compliance times for some facilities are limiting impacts. Stage 2 of the Directive, which will require the capture of vapours from distribution of fuel (petrol stations) and car refuelling, are still under discussion and therefore unlikely to take effect before 2000.

- Product Content Controls Directive has reduced polluting content of liquid fuels.

- Three way catalytic converters, which are intended to reduce emissions by 75%, have been required on new cars since 1993. Although the current technology can take between 5-10 minutes to become fully effective (equivalent to driving 2-4 km in a typical urban situation), cars designed to meet the new 1996/97 emission standards will reduce this warm-up period to about 1-2 minutes. Further improvements in warm-up time are anticipated as a result of emission standards now being considered by the EC for the year 2000.

Figure 4.4.5: Progress towards VOC target



- Industry and transport standards have been tightened through BATNEEC; however, the transport standards do not reflect environmental and health standards; end-of-pipe solutions in industry have been prioritised over the introduction of clean technologies. The proposed Solvents Directive will set emission concentrations for different processes, but it is still under discussion and it will take a further 6-10 years before standards are implemented, making it unlikely to have an impact before 2000.

- In a few Member States, reductions from industrial sources are likely to progress faster than expected from the proposed Solvents Directive, as national strategies attempt to go further than required. For instance:

  - The Netherlands - Voluntary agreements for stationary sources of VOCs; and
  - Germany - some Länder have already adopted voluntary Stage 2 technologies (such as carbon canisters on cars to capture VOCs during refuel ling).

- Other initiatives, such as the Tripartite Initiative on Future Emissions (auto industry, fuel industry and European Commission - the Auto-Oil programme) is an attempt to adopt a coherent and rational methodology which goes further than BATNEEC and other standards currently require. No concrete proposals or voluntary agreements have yet resulted, but an initial study is expected to be published in Autumn 1995; it is likely to include proposals.

Ozone

Implementation of the 1991 VOC protocol under the LRTAP convention would result in most areas in a 40-60% reduction in ozone levels in excess of 75 ppb, ie 150µg/m^3, the health target for 1-hour exposure (EEA, 1995). While this would constitute a considerable improvement in the current situation, it would still not imply reaching targets for 2000 set in 5EAP.

TSP/black smoke

While industrial particulate emissions are expected to decrease as a result of Directives affecting most of the emitting sectors, the trend in future transport emissions is uncertain.

Dioxins

Meeting the target of 90% reductions of dioxin emissions by 2005 will depend on policy in the waste sector and further developments in measuring and abating dioxin emissions from 'new' sources such as industrial combustion processes.

Incineration capacity is expected to increase significantly after 2000 to replace landfill. BATNEEC legislation provides the general framework for emissions control, but questions persist over whether the emission limits are adequate to prevent dioxin emissions from some materials. The limits for incineration of hazardous wastes are more stringent than for other types of waste and tighter limits are proposed in the new Directive on Hazardous Waste Incineration (94/67/EEC). New state-of-the-art incinerators are unlikely to be in operation before 2000 due to the long lead times in approval of licenses.

General air quality

Although overall emissions of air pollutants is expected to decline, the predicted increase in road transport (22% between 1990 to 2000) will have an opposite effect in urban areas despite the increased penetration of three way catalytic converters as the fleet is turned over. This may offset the gains from technology and limits placed on stationary sources unless a more integrated approach to limiting demand for road transport is developed, particularly in the urban context *(Section 3.4: Transport)*.

Technological possibilities exist for greatly reducing local air pollution problems. However, past policies have focused almost exclusively on reducing impacts from stationary combustion emission sources; it is also important to recognise the interrelatedness of pollutants.

The impact that policy measures will have on future smog episodes is largely unpredictable, but policies are likely to result in an improvement of the current situation. This is concluded from the analysis of the likelihood of reductions in emissions of VOC, SO_2 and NO_x, discussed here and in *Section 4.3*. Although policy measures are able to reduce these emissions and hence affect the potential for smog creation, the simultaneous occurrence of emissions and climatic conditions make it difficult to predict the overall effect.

Improved and harmonised emission inventories and projections as well as the monitoring of human exposure and impacts on health and ecosystems will be required in order to help target policy more effectively and to monitor the impact of policy measures.

4.5 Waste management

The issue

Waste is generated by all forms of economic activity and involves environmental impacts during production and final disposal. Waste results mainly from inefficient processes and the non-optimal use of energy and materials; it arises from industry, agriculture and household consumption. Waste minimisation from production to consumption has become an important focus of policy.

Despite this focus, quantities of generated waste continue to rise. The resulting environmental impacts reflect the final disposal method used. Past practices have focused on landfill (both legal and illegal) and have led to contamination of soil and groundwater. Although improvements in technologies have been made, disposal continues to pose risks to environmental media and human health. The issues of dioxins and soil pollution are discussed in *Section 4.4* and *4.10* respectively..

Alternatives to landfill, particularly recycling (which reduces the need for final disposal) and incineration with energy recovery, are an important consideration in life cycle analysis and energy studies. The objective is to achieve sustainable consumption by closing the loop and reducing the requirement for final disposal of materials.

The disposal and transport of toxic and hazardous waste is the focus of increasing control (the Waste Shipment Regulation (259/93) came into force in May 1994) and international conventions (such as the Basel Convention). However, a significant amount of hazardous waste is still exported from, and transferred within Europe. The scale of movements of hazardous and chemical wastes within Europe reflect individual Member State's national waste management capacity, price development for waste disposal and recycling and regulatory standards. Very little reliable information on import and export of waste is available.

Environmental policies and EU targets

The EU's overall objective is to move towards sustainable waste management. The strategy for sustainable waste management involves a hierarchy of options emphasising firstly prevention, then recycling and reuse, and finally safe waste disposal options. This strategy incorporates the traditional objectives of disposing of waste while safeguarding public health and the wider objectives of reduction of land take for landfill and emissions of polluting substances. The strategy applies to both municipal and hazardous waste.

The waste management policies and targets outlined in the 5EAP are:

- waste management plans in Member States;
- considerable reduction of dioxin emissions (90% reduction on 1985 levels by 2005);
- stabilisation of quantities of waste generated at EU average 1985 level (330 kg/capita);
- no export outside EU for final disposal of municipal waste and hazardous waste (amberand red list);
- EU-wide infrastructure for safe collection, separati on and disposal of hazardous waste;
- recycling/re-use rates of all consumed paper, glass and plastics shall reach an average of at least 50% by 2000*[11]; and
- creating a market for recycled materials.

Priority waste streams programme

The objective of the Priority Waste Streams Programme, initiated by the Commission in 1990, is to develop action plans targeting the reduction of waste for a series of 'priority waste streams'. This will involve the preparation of strategy papers and draft legislation identifying sustainable measures (using a cradle-to-grave approach to disposal) and timescales for implementation. Responsibility for developing these action plans will be shared between all parties likely to be affected by their implementation (industry, governments, environmental and consumer groups).

The waste streams identified at present are chlorinated solvents, electronic waste, demolition waste, healthcare waste, used tyres and end-of-life vehicles.

A more detailed discussion of policy measures to achieve the targets is given in *Box 4.5.1.*

State of the environment

Past trends and current status

Waste generation

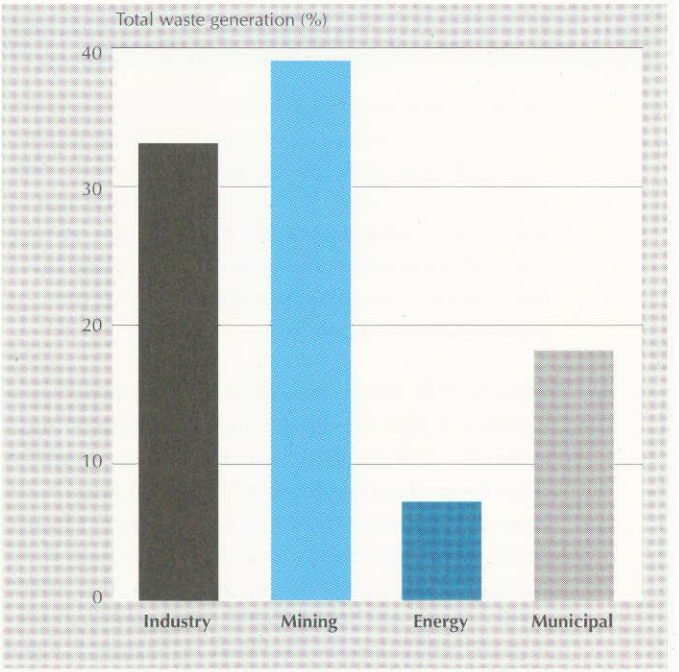
Total waste generated in the EU12 was nearly 700 million tonnes in 1990. The majority of this was generated from mining and quarrying activities and the industrial sector. The key sources and their contribution to the overall total are shown in *Figure 4.5.1.*

*11. The recent Directive on packaging and packaging waste (94/62) has the following target: between 50 and 65% by weight of the packaging waste should be recovered, no later than five years from the date by which this Directive must be implemented (presumably the target year will be 2001), with a minimum of 15% for each packaging material.

Box 4.5.1: EU state of action in the waste theme since 1992.

5EAP objectives for EU (1992-1995)	Actions achieved
Municipal waste management:	
• Landfill Directive operational not yet adopted)	(Amended proposal (COM(93)275)
• Directive on packaging operational	• Directive 94/62 on packaging and packaging waste adopted, formal compliance required by mid-1996
• Policy on priority waste streams,stop on landfill for specific wastes (legislation and voluntary agreements)	• Priority Waste Streams Programme - sixcurrent areas of study. No plans to start new projects. Proposed Directive (COM(88)559) would phase out the disposal of PCBs and PCTs
• Reliable EC data on waste generated, collected and disposed	• Packaging Directive 94/62 places a requirement on Member States to develop databases on packaging and packaging waste
	• Decision 94/3 - European Waste Catalogue and list of hazardous waste under Directive 91/689 - provide definitions of waste categories which will allow greater comparability of data for inventory purposes. Nevertheless there is no measure requiring the development of an EU-wide waste inventory
Hazardous waste management:	
• Landfill Directive operational	(Amended proposal COM(93)275 on landfill of waste)
• Directive on incineration of hazardous waste operational	• Directive 94/67 on hazardous wasteincineration adopted, formal compliance 1996
• Policy on priority waste streams, stop on landfill for specific waste	• Some waste types excluded from landfill by the proposed Directive (COM(88)559) to phase out disposal of PCBs and PCTs
• Inventory of risks	• Decision 94/904 establishing a list of hazardous waste

Figure 4.5.1: Total waste generation by sourcein the EU12 in 1990
Source: Eurostat/OECD, 1995



Data on waste generation and disposal in the EU12 is generally of poor quality and in many cases inconsistent between Member States. This partly reflects lack of data availability and partly the fact that definitions of municipal waste, industrial waste and hazardous waste may be independently interpreted in each country (resulting from, for example, the lack of a definition of municipal waste in Directives).

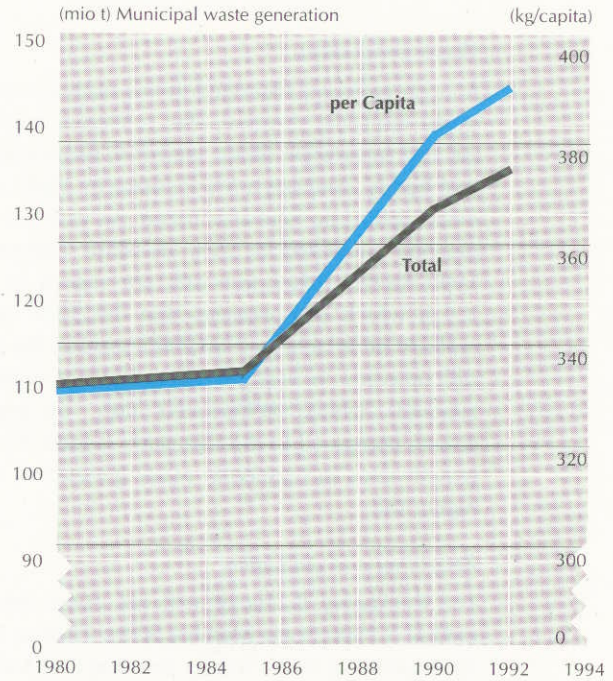
Municipal waste

Figure 4.5.2 shows trends in municipal waste generation per capita from 1980-1992 for EU12 and illustrates a steady rise from an average of 330 kg per capita (or 110 million tonnes) in 1980, a slight increase in 1985 (10% higher than the figure assumed in the 5EAP for the 1985 base year), 380 kg in 1990, and 390 kg per capita in 1992 (134 Mt)*[12]. This represents an increase of almost 20% in municipal waste arising in the EU12 during the period 1985 to 1992.

The Member States of the EU12 which generate per capita quantities of municipal waste substantially higher than the EU average in 1990 included France, Luxembourg and The Netherlands. The trend across all Member States is towards greater quantities of municipal waste generated in total and per capita.

*12. In arriving at these estimates of municipal waste generation per capita it should be noted that official data on municipal waste generation is not available for France in 1980 and 1985 (estimate in this report based on municipal waste statistics in 1990 and 1992 and the trend in household waste) and only household waste is available for the UK. The average figure used in the 5EAP (300kg/pc) for the 1985 base year used lower figures for household water generation in France.

Figure 4.5.2: Municipal waste generation in the EU12
Source: Eurostat/OECD, 1995



A substantial part of municipal waste consists of packaging materials. Based on data for six of the EU12, average packaging waste generated in 1992 was 154 kg per capita (OECD, 1992), equivalent to about 40% of per capita municipal waste generation. Eurostat data suggests that new entrants Finland (94 kg/pc) and Austria (132 kg/pc) are below the EU12 average but will not reduce this average significantly.

In 1990 the majority of waste was disposed of by landfill (69%), followed by incineration (18%) (see *Figure 4.5.3*). By 1993 the share going to landfill had fallen to 57%, while incineration had increased to 23%. Other routes for disposal, including options such as composting, have increased by about 10%.

Recycling

Figure 4.5.4 shows trends in average EU12 recycling rates for paper and glass. Recycling of paper and board rose from 33% to 43% for the period 1980 to 1992 and glass recycling increased from 17% to 48% for the period 1980 to 1993. The considerable success for these two materials partly reflects relative ease of collection and separation, and the existence of markets for secondary materials. Austria and Italy made significant progress in recycling of paper and cardboard over the period 1985-90. Most other Member States made slight increases with the exception of Germany, The Netherlands and Sweden where

Figure 4.5.3: Disposal of municipal waste generation
Source: Eurostat/OECD, 1995

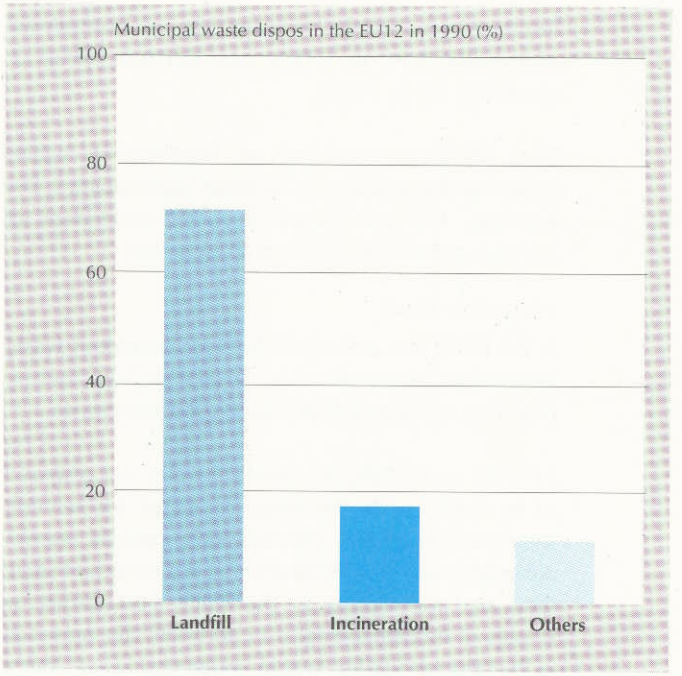
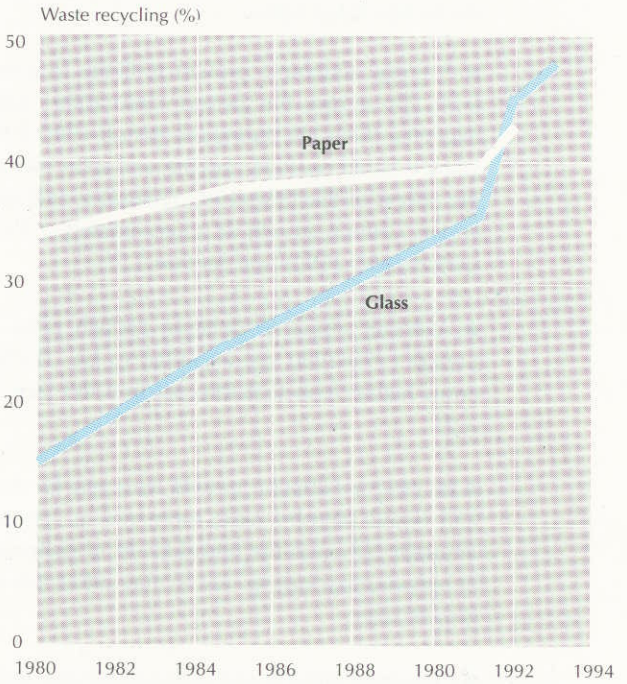


Figure 4.5.4: Waste recycling rates glass and paper and cardboard in EU12
Source: Eurostat/OECD, 1995



the recycling rate remained constant (at a high level) over the same period. Glass recycling rates have been greater with three Member States more than doubling their rate of glass recycling (Ireland, Spain,

Finland) although, in the case of Ireland and Spain this increase was from a much lower baseline rate.

For the EU as a whole, no trend data are available for aluminium (12% in 1991), steel (25% in 1990) or plastics (6.3% in 1991).

Data on waste recycling are inconsistent, again, reflecting the variation in national interpretation. For example, UK and France include incineration of packaging (for heat recovery) as recycling.

Hazardous waste

In the EU12, the annual estimate for hazardous waste generation ranges from 30 to 45 million tonnes, based on national definitions of hazardous waste.

In 1990, nearly 70% of hazardous waste was disposed of by landfill with the remainder either incinerated, recovered or treated. Household hazardous wastes, although much smaller in volume, are important since they are not subject to the same precautions as wastes of industrial origin. In addition, the presence of hazardous wastes within municipal waste often reduces recycling possibilities.

Underlying factors

Levels of municipal waste generation are affected by the factors listed below.

- Average economic growth is likely to average at least 2% during the period 1990-2000 (although expected to be 1% during the period 1990-1995, this value is based on 1995 insights and takes into account the effects of the 1992-1993 recession, and an accelerated annual growth of approximately 2.5% in the period 1995-2000) *(see Section 3.3).*

- Average annual population growth rates for the period 1990-2000 are expected to be 0.3%, three times higher than that forecast in 1988 *(see Section 3.2).*

- In 1992 production growth forecasts for the paper and board industry were estimated at about 2.9% annually although the introduction of policies aimed at reducing packaging waste may offset this forecast growth rate.

- Consumer attitude and activism surveys (Eurobarometer) show that, while waste arisings per capita increase with affluence and consumer disposable income, living standards in Northern EU Member States have reached the point at which awareness and willingness to reduce waste and recycle is apparent.

Progress and outlook

Waste generation

A target indicator identified in this study is municipal waste requiring disposal. The reference scenario in the DRI Integration Study, based on projections from past trends, forecasts a 5% increase by 2000, while a more optimistic scenario based on policies in the pipeline predicted a 25% decrease compared to 1990 levels. Other forecasts are shown in *Figure 4.5.5*, which demonstrates that the 5EAP target is unlikely to be achieved by 2000 because the trend is still upwards in most Member States (Coopers and Lybrand, 1995). Accelerated rates of economic growth compared to the DRI study suggest that actual growth rates in municipal waste generation may be higher still.

Recycling and packaging

The Packaging Directive will not come into effect until mid 1996; some Member States (Greece, Ireland, Portugal) have lower targets for recycling and re-use and there is no requirement for any Member State to provide full information to consumers until 1998. Despite the widely held view that the targets are not very challenging, it appears that EU legislation is unlikely to ensure that targets are met. Furthermore, sufficient information to monitor compliance is unlikely to be generated.

The greatest constraint to further recycling remains the cost of collection, sorting and recycling, and lack of markets for secondary materials. The German 'green dot' scheme, which arose partly in response to the achievements of the previous consumer voluntary system, has flooded the market for secondary materials in other Member States and has had some negative impacts on the motivation for, and economics of, increased recycling.

Waste management plans

Waste Management Plans have been produced by most countries, although some are late or incomplete. Some Member States have completed and submitted waste management plans to the Commission and these focus on incentives for households to minimise and recycle waste, and reduced use of landfill in favour of incineration. Measures targeted at households include:

- curbside and bring systems (local authority responsibilities);
- waste disposal charges by using charging systems based on volume (eg, charges per bag in The Netherlands)

or weight (electronic weighing and billing); and
- consumer product awareness through ecolabelling schemes.

Producers have been targeted through:

- producer responsibility schemes, (eg, the German Green Dot system and developments in areas such as electronics and battery recycling);
- encouraging cleaner technologies throughout the production cycle;
- deposit refund schemes on bottles and batteries; and
- BATNEEC and EMAS schemes which incorporate waste minimisation and recycling into environmental auditing schemes;

Landfill

The cost of landfill is expected to increase as a result of the Landfill Directive (not yet agreed). Any reduction in landfill is also expected to have positive impacts on soil and water contamination and general land use issues - unless illegal landfilling/fly tipping occurs. In addition, a number of Member States are taking specific actions as listed below.

- France is closing all uncontrolled landfill sites by 2002 After this date, only waste that cannot be treated in any other way may be landfilled.

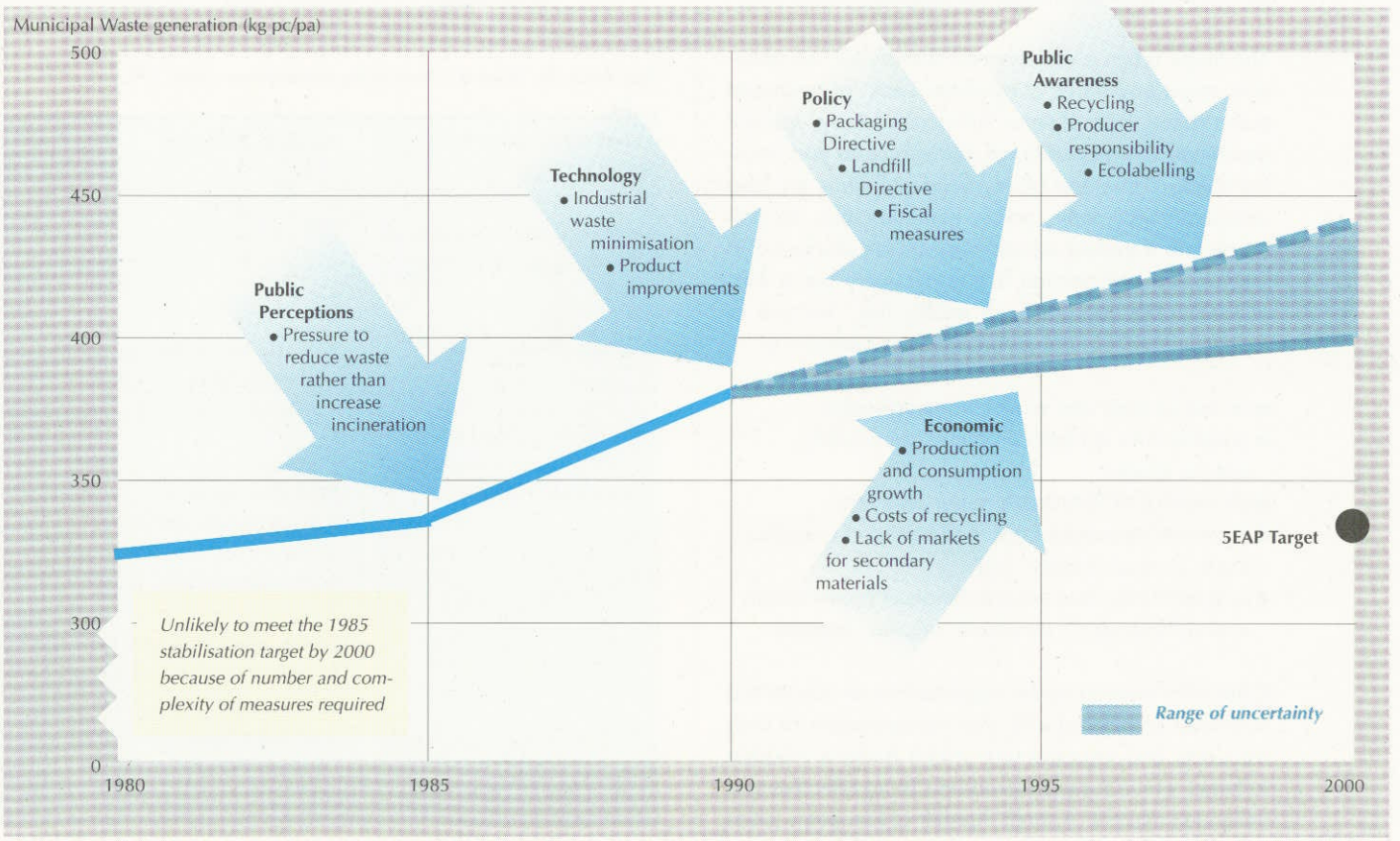
- The Netherlands has proposed an ecotax for landfill and has made a commitment to phase out landfill for combustible wastes by 2000. France operates a landfill tax, the revenues from which are used to fund innovative waste treatment techniques and improve treatment facilities. The UK is due to introduce a landfill tax in 1996. Finland and Denmark have systems of state waste charges for landfilled waste.

- Denmark is expected to ban the landfill of combustible wastes from 1997.

Hazardous and toxic waste

The DRI Integration study forecast changes in hazardous waste arisings from manufacturing industry. Under the baseline scenario, quantities will increase by 20% in 2000 compared to 1990 levels. However, implementation of all policies in the pipeline would imply generation of hazardous waste stabilising at 1990 levels due to policy measures related to waste movements and treatment/disposal.

Figure 4.5.5: Progress towards municipal waste generation target



4.6 Urban issues

The issue

More than two thirds of EU15 population now live in urban areas. Environmental issues in urban areas are very complex and may be considered in the terms of:

- *urban quality*, for which air pollution and noise are often used as indicators of stress; open and green space, population density, social and cultural diversity are all important to the quality of urban life;
- *urban flows of resources*, most importantly the use of water and energy by households and commerce for heating, lighting and transport and waste production; and
- *urban patterns* including their size, structure and infrastructure, all of which determine the nature and extent of impacts on the environment.

The links between the state of the urban environment and its impacts on the rural, regional and global environment cannot be overstated.

The major urban environmental stresses are: air pollution, noise and traffic congestion. Lack of open and green space, lack of some infrastructure (eg, sewage treatment), disintegration of infrastructure and housing stock, crime and other social problems are also associated with large, poorly planned cities. Air pollution and transport related impacts are discussed in *Section 4.4* and *Section 5.1* respectively but it should be noted that urban air quality has become of increasing concern due to increasing awareness of:

- recent summer and winter smog episodes;
- possible links to health problems, particularly asthma attacks;
- emergence of PM10 as a major concern;
- increased emissions from road transport contributing to poor air quality; and
- long term effects of accumulation of heavy metals and anthropogenic persistent organic matters.

Cities offer environmental opportunities or economies of impact associated with the concentration of their resources and infrastructure which make it possible to target environmental problems in an effective and integrated manner. A small number of European cities such as Heidelberg in Germany, which have reached a high level of affluence and environmental awareness demonstrate opportunities for increasing sustainability through careful planning and management.

Environmental policies and EU targets

The 5EAP does not include specific targets for urban areas, as the quality of the urban environment depends on the achievement of the targets set for a number of other themes and target sectors. However, there are targets in respect to noise identified in the 5EAP. Noise is an issue about which people feel strongly. It reflects the complex links between people and the location and timing of activities that characterise densely populated areas. The 5EAP targets include the following:

- no one should be exposed to more than 85 dB(A);
- the percentage of the population exposed to more than 65 dB(A) at nighttime should be reduced; and
- noise levels of less than 65 dB(A) should not increase (or those exposed to more than 65dB(A) should not increase).

The main EU instruments for achieving these targets are product related directives, summarised in *Box 4.6.1* below, which are to be implemented no later than 2000.

Box 4.6.1: EU State of action in the noise theme since 1992.

5EAP objectives for EU (1992-1995)	Actions achieved
Exposure not to endanger health or quality of life	
• Further reductions of noise emissions - directives are to be presented progressively, aiming at implementation not later than 2000	• Legislation has been adopted covering noise from exhaust systems of motor vehicles (Proposal on limiting noise from earth moving machinery (COM(93)154) and further proposals on noise at work and air craft noise are being developed) (Commission proposing to produce a communication on noise, which will discuss the issue of general quality standards)

State of the environment

Past trends and current status

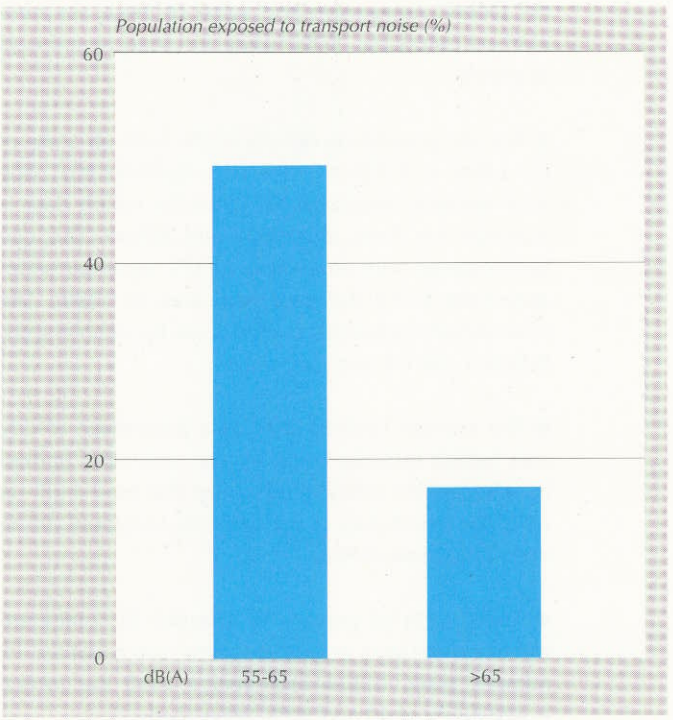
Statistical data on urban quality, patterns and flows of resources is not collected on a consistent basis by Member States; the existing data tends to be limited and fragmented.

Urban quality: noise

In large cities, the proportion of the population exposed to unacceptable levels of noise is two to three times higher than the national average (OECD/EECT, 1993). *Figure 4.6.1* shows that in 1990 about 17% of the population in selected EU Member States (Denmark, West Germany, Portugal, The Netherlands and France) was exposed to transport noise greater than 65dB(A), while less than 40% were exposed to lower levels between 55 and 65dB(A).

Based on information from selected cities about 8% of the urban population are exposed to outdoor noise at a level greater than 70 dB(A). The main source of outdoor noise is road traffic, followed by neighbourhood and aircraft noise (EEA, 1995).

Figure 4.6.1: Population exposed to transport noise in selected EU countries in 1990
Source: Eurostat, 1995



Major factors underlying urban noise levels include the points listed below.

- Noise levels depend on the location of sources of noise and the location of receptors (people, wildlife, etc) which are sensitive to it. The level of disturbance depends on the type, location and timing of noise emissions in relation to the expectations and sensitivity of the receiving population.

- *Chapter 3* shows that over the period 1980-90 car ownership and passenger kilometres increased by some 40%. Over this same period the proportionate use of road transport (mainly private cars) rose marginally (from 84% to 84.3%); while rail use fell from 9.5% to 6.5% (see *Section 5.1*).

- The demand for car use in cities partly reflects a decentralisation of economic activities traditionally located in urban centres (eg, offices, shopping centres and manufacturing) to urban fringes, thus resulting in increased use of private cars and subsequent increases in air pollution, traffic congestion and noise.

- The quality of the urban environment will be affected by policy measures in a number of areas such as noise reduction (eg, noise zoning, barriers, pedestrian zones and traffic flow control), planning policy, transport policy, measures to encourage efficient use of energy in households and commercial buildings, product schemes and provision of services (such as public transport and recycling).

Urban quality: air pollution

The major air pollutants in urban areas contributing to smog episodes are SO_2, particulate matter, NO_x, CO, O_3, lead (Pb) and other heavy metals and organic compounds. A fuller discussion of the occurrence and significance of these compounds and winter smog episodes is provided in *Section 4.4: Air Quality*. *Table 4.6.1* shows the exceedances from the WHO-AQG guidelines for the main pollutants in city locations in EU15 from which it is clear that ozone, SO_2 and particulate matter are the major areas of exceedance.

Poor air quality in urban areas is a factor of emissions of these pollutions from various sources, climatic conditions, and population density. The major sources of emissions are space heating, electricity generation, industrial activities and road traffic. *Section 4.4* mentioned the factors which interact to allow the creation of smog (natural and societal characteristics). Based on the occurrence of certain climatic conditions only, Mediterranean cities have a high summer smog potential (because of prolonged andhot summers) but

Table 4.6.1: Exceedances of WHO-AQGs on city background locations in EU15 cities in 1990 Source: ETC/AQ; Sluyter, 1995

Pollution type	Indicator	AQG (µg/m³)	Cities with observed exceedances (%)	Effects
Short term effects				
Summer smog	O_3	150-200 (hour)	84	Lung function decrements, respiratory symptoms
Winter smog	SO_2+PM	125+125 (day)	74	Decreased lung function; increased medicine use for susceptible children
Urban traffic	NO_2	150 (day)	26	
Long term effects				
Traffic/industry	Lead	0.5-1.0 (year)	33	Effects on blood formation, kidney damage; neurologic, cognitive effects
Combustion	SO_2	50 (year)	13	Respiratory symptoms, chronic respiratory illness
	PM	50 (year)	0	

Notes: 56 cities (with more than 500,000 inhabitants) selected; not every city has reported on each pollutant

low winter smog potential. Cities in the marine west coast temperate region have low winter and summer smog creation potential. Based on human factors, there is a higher potential for winter smog in the coal-burning cities of Central Europe and the UK.

Measures for reducing air pollution in EU cities over the past 20 to 30 years have been successful in reducing SO_2 particulates and heavy metals, particularly lead emissions. Daily and annual average urban atmospheric SO_2 concentrations have fallen by significant amounts in many cities. However, it is estimated that in nearly three quarters of EU15 cities with more than 500,000 inhabitants, WHO-AQGs for SO_2 and PM were exceeded at least once in a typical year (EEA, 1995), giving rise to winter smog episodes.

There has been little or no evidence of downward trends or regional variations in concentrations of NO_x, although the short-term WHO-AQG concentration for NO_2 was exceeded in only one quarter of cities providing data.

Urban patterns

Urban areas experience observable cycles in their development. The population densities in city centres grow and diminish over time as the population spreads to suburbs or rural fringes and as citizens can afford to move from city centres to avoid traffic, noise, air pollution, lack of green space and social problems.

Statistical data on urban patterns is fragmented as it tends to be gathered and held by a variety of organisations. Indicators were identified and data collected where available from selected European cities for the Dobris Assessment and some of these are summarised below for EU12 using the most recent data available.

- Average population density in the built-up areas of EU cities is 9,300 persons per built-up km². The most densely populated EU cities for which data is available are Paris, Barcelona and Bilbao. This can be compared with an average of 171 inhabitants/km² across the EU12 (for total land area in 1990). The most densely populated countries are the Netherlands, Belgium, the UK and Germany.

- The average built-up area as a percentage of city area (which includes fields, forests and water bodies) in selected EU cities is 60% and the most built-up cities for which data is available are Liverpool (95%) and Amsterdam (93%).

- About 87% of persons in selected EU cities are estimated to have access to green space within 15 minutes walk. Bilbao and Venice have the lowest accessibility of 40 and 50% respectively.

- The average number of persons injured or killed in traffic accidents in EU12 cities is 85 per 10,000 inhabitants (based on the cities for which data are available).

Progress and outlook

Urban quality: noise

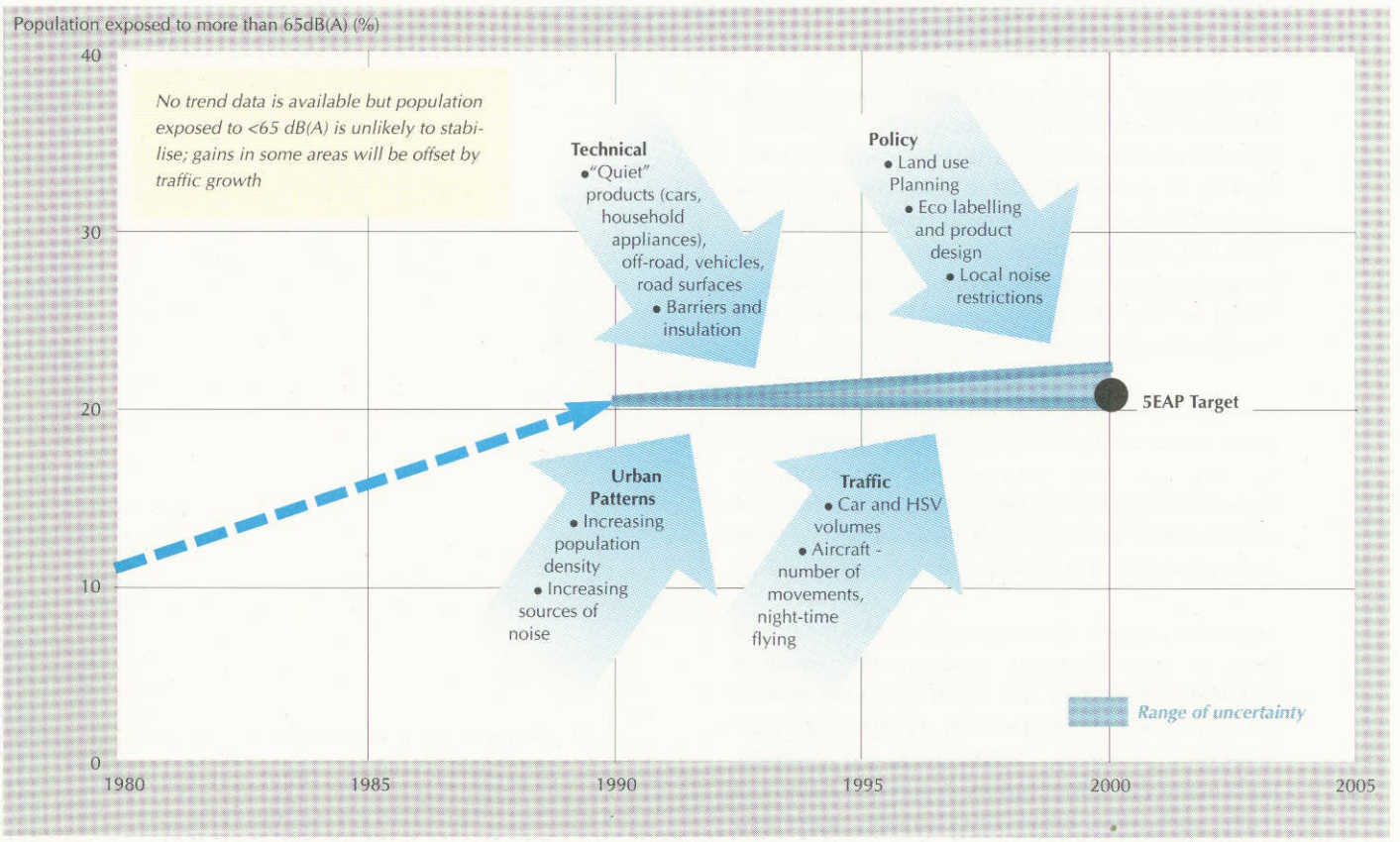
No forecasts of future noise levels have been made by any official source. However, given the close relation between noise and traffic and the accelerated growth in passenger and freight road traffic (now estimated at 2% pa) since 5EAP forecasts were made, it is unlikely that EU targets - interpreted here as stabilising the number of people exposed to >65dB(A) day time noise - will be met. In several Member States, such as Spain, traffic growth rates are expected to be even higher at 2.5% pa to 2010.

EU policies related to noise have focused on product standards for vehicles (cars, HGVs and off-road vehicles), household products (washing and washing-up machines) and construction equipment. In some cases these standards have forced the development of new technologies and, coupled with more stringent enforcement of noise emission limits, noise emissions from individual vehicles and sources are likely to fall. However, such gains are likely to be offset at least in past by increased vehicle numbers and congestion.

Figure 4.6.2 shows the implications of these trends for meeting 5EAP targets and suggests that the number of people exposed to more than 65 dB(A) day time noise is likely to increase or may (with concerted local action as indicated in the 5EAP) remain stable, which is the target.

Very little information is available on the number of people exposed to more than 85 dB(A). However, technical developments in abating traffic noise (visual barriers, low-noise road surfaces, speed limits and quieter vehicles) are likely to limit exposure and, in principle, could reduce noise levels by 40%. Exposure to night-time noise will also be reduced by local night-time lorry bans, zoning and noise regulations.

Figure 4.6.2: Progress towards noise target



Urban quality: air pollution

Overall air quality has improved considerably over the last twenty years in Northern and Western Europe, largely as a result of emission standards for SO_2 from industrial sources. However, increased emissions of other pollutants (NO_x and PM10 from traffic) have led to increased incidence of winter smogs. Proactive measures to curb emissions from the transport sector at source through the requirement for 3-way catalytic convertors and improved fuel standards will also have a downward effect on concentrations. However, increased economic activity and the projected increase in traffic flows will mean that emissions remain high and pollution episodes continue to occur.

Therefore a number of Member States are considering reactive measures to avoid the occurrence of smog episodes by banning car use in city centres when poor air quality is forecast.

Local action

The interrelated nature of urban air quality, noise and congestion problems makes them most suitable for tackling at a local rather than a national or EU level. Zoning and timing, traffic management (traffic calming, pedestrian zones and encouraging public transport) and the use of barriers and insulation have all been effective at a local level. The key to success has been an integrated approach to meeting urban and air emissions related targets.

The Charter of European Cities and Towns Towards Sustainability adopted at Aalborg (DK), recognises this and provides the basis to implement the Local Agenda 21 process in order to meet the mandate of the UN Conference on the Environment and Development. For instance, in the UK, the charter has so far been adopted by some 90 local authorities who each intend to draw up a Local Agenda 21 Covenant with local partners by 1996.

In some countries, such as The Netherlands, national governments are currently considering giving municipalities (and the citizens they represent) the responsibility for setting their own priorities for local environmental issues (such as noise targets) in order to arrive at their own vision of urban sustainability.

Important progress is being made at the municipal level in most European countries to establish systematic monitoring and reporting on the state of the urban environment, but data problems still exist in terms of availability, comparability and reliability, particularly for urban quality (water, air, noise and traffic safety) and urban flows (energy, water and materials consumption).

4.7 Inland water resources

The issue

Water is an important resource for all sectors of the economy: industry, agriculture, households, tourism, and energy generation. Each of these sectors also impact on the quantity of water consumed and the quality of ground and surface water resources. There are two main threats to ground and surface water resources.

- *Pollution*: water quality deterioration is caused by pollution from agriculture, industry, transport and households (eg, nitrate, phosphate, pesticides and heavy metals). Pollution arises from point and diffuse sources and also from accidental releases. Water can also be polluted by deposition from air pollution, which may have long-range trans-boundary characteristics. Impacts include deterioration of the quality of aquatic ecosystems and adjacent terrestrial areas, eutrophication and consequent algal blooms.

- *Over-exploitation*: over-exploitation of groundwater and surface water reserves can lead to the drying up of wetland habitats, deterioration of terrestrial ecosystems, low flow in rivers, salt water intrusion into aquifers and restrictions on legitimate uses. For Member States, the availability of water resources within the boundaries of their water systems will raise the importance of sustainability of consumption. The sharing of water resources between upstream and downstream countries and through trans-boundary aquifers is becoming an increasing problem with regard to quantity and quality of the resource.

Both pollution and over-abstraction lead to loss of habitats and biodiversity, threats to human health and limits to economic and social development.

Environmental policies and EU targets

Policy objectives indicated in the 5EAP in relation to the management of water resources are:

- the reduction of groundwater pollution, focusing on prevention at source;
- restoring and improving the ecological quality of surface water resources; and
- managing the demand and supply of water resources in an integrated, sustainable manner so that demand is in balance with its availability.

Box 4.7.1: EU state of action in the water quantity and water quality theme since 1992.

5EAP objectives for EU (1992-1995)	Actions achieved
Quantitative aspects	
● Groundwater and surface fresh water - integration of resource conservation and sustainable use criteria into other policies including agriculture, land-use planning, and industry	● The Commission is finalising a draft *Action Programme for Integrated Groundwater Protection and Management* concerned with both qualitative and quantitative aspects of water management. One of the main themes of the programme is the integration of groundwater protection requirements into other policy areas, focussing in particular on the Common Agricultural Policy and on Regional Policy
Qualitative aspects	
Surface fresh water - towards better ecological quality and safeguarding existing high quality	● Proposal presented on ecological quality of surface water (COM(93)680) ● Revision of Bathing water and Drinking water Directive
● Examine need for Directive to reduce phosphate	● No Directive developed; efforts to reduce nitrate in-puts considered appropriate
● Elaboration of specific emission standards to encourage development of processes and standards to prevent negative effects on water (using BAT and target standards)	● Draft proposal on dangerous substances in water presented to revise Directive 74/464. Progress delayed, due in part to proposed Directive on integrated pollution control (COM(93)423).
● Proposals for progressive replacement of harmful pesticides and progressive limitations	–

A list of policy measures to protect water resources and meet the targets provided in the 5th EAP is provided in *Box 4.7.1*.

Water consumption

Water use intensity may be used as an indicator of the sustainable management of the quantity of water resources. This is defined as the ratio between yearly abstractions and supply, which allows preservation of the stock of water resources. However, it is difficult to relate water use intensity to the objective of sustainable water use.

Few policies address water consumption specifically. However, measures to encourage the integration of resource conservation and sustainable use criteria into other policies are included in the Community Ecolabel Award Scheme (Regulation 880/92). Ecolabels are awarded using ecological criteria, including a requirement to minimise the 'consumption of natural resources' (including water) at each stage in the life-cycle of the product. The Action Programme for Integrated Groundwater Protection and Water Management will be directing towards a balance of use and availability of groundwaters.

Water quality

EU inland water quality targets for surface water and groundwater include:

- guide levels of 5.6 mg/l for nitrogen (NO_3-N) concentrations with a maximum concentration of 11.3 mg/l in groundwater for drinking water purposes (Drinking Water Directive 80/778/EEC);
- a limit on the use of nitrogen in artificial fertilisers or manure to 170 kg/ha; and
- non-exceedance of maximum concentrations of pesticides in groundwater abstracted for drinking water, which are set at 0.1 µg/l for individual substances and 0.5 µg/l for total pesticides (Drinking Water Directive 80/778/EEC). This directive is currently being revised and the parametric value for total pesticides was deemed unnecessary and unverifiable and hence has not been kept.

Policies to improve the quality of surface waters focus not only on controlling discharges from domestic and industrial sectors but also to protect the specific uses of water. Specific policies and proposals (in the period 1992-1995) targeting the main sectors responsible for surface water pollution are described below.

- The *Urban Waste Water Directive* (91/271/EEC) sets minimum standards for the collection, treatment and discharge of urban waste water (sewage and industrial effluent). More stringent treatment than secondary treatment (eg, tertiary treatment) is required for sewage discharges to designated sensitive areas' if nutrient removal will have an effect on the level of eutrophication. The requirements of the directive are to be met by the end of 1998.

- An EC proposal for a directive on *Ecological Quality of Water* was presented in 1993. It is a major, new, approach focusing for the first time on protecting the aquatic ecosystem and water uses as a whole. It is concerned with the adoption of measures in respect of all surface waters (including estuaries and coastal) to maintain and significantly improve the ecological quality of such waters.

- A proposal for a framework directive on *Integrated Pollution Control* (IPC) was submitted to the Council in 1993, which reached a common position in June 1995. The directive identifies installations for which integrated permits covering emissions to air, water and soil and containing emission values based on BAT must be issued by the competent permitting authorities.

Policies to improve the quality of *groundwater resources* focus on changing practices in the agricultural sector *(see Section 3.6)*, which is the main source of pollution by nitrates and pesticides (the Nitrates Directive). Policies also cover more broadly the issues of point and diffuse sources from all sectors. Specific policies are described below.

- The *Nitrates Directive* (91/676/EEC) seeks to reduce or prevent the pollution of water from the application and storage of inorganic fertiliser and manure on farmland. Member States are required to identify Nitrate Vulnerable Zones (NVZs) and design and implement action programmes for their protection by 1995.

- An EU *Action Programme for Integrated Groundwater and Management* is currently under preparation; this will require a detailed action programme to be drawn up by each Member State for the comprehensive protection and management of groundwater as part of an overall policy on water protection. The draft proposal is aimed at maintaining the quality of unpolluted groundwater, preventing further pollution, and restoration where appropriate of polluted groundwater. Aspects of protection and management of surface waters are included where these are relevant for groundwater protection and management.

State of the environment

Past trends and current status

Quantity of water resources

An estimated 65% of public water supply comes from groundwater sources (EEA, 1995). In the late 1980s (the latest period for which reliable data are available), total abstraction for all uses was estimated at 587 m3/pc/pa ranging from 156 m^3/pc/pa in Luxembourg to about 1000 m^3/pc/pa in Italy, The Netherlands and Spain. Water abstraction rates increased by 35% between 1970 and 1985.

About 60% of European cities are located in or near areas with potential groundwater over-exploitation. Most coastal aquifers are at potential risk of over-abstraction and are likely to suffer from salt water intrusion or drying out of wetlands. However, in many countries this risk is managed and summer saline intrusion is expelled during the wet winter.

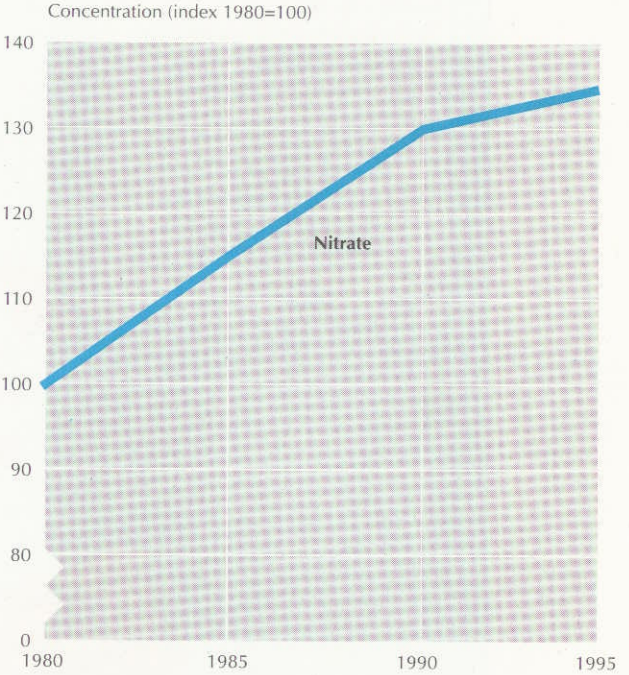
Water use intensity in EU15 in 1990 was 17% on average, but a regional imbalance between demand and supply exists. The highest water use intensities were found in Belgium, Germany, Italy and Spain. More recent data is expected to be available shortly from Eurostat on the basis of questionnaires returned by Member States and the trend is expected to be upwards.

Quality of groundwater resources

The guide level for nitrate concentration is estimated to be exceeded in groundwaters beneath more than 85% of agricultural land in Europe (including central and eastern Europe) and the maximum concentration limit is exceeded in waters beneath approximately 20% of agricultural land (EEA, 1995). Actual concentrations vary according to the aquifer geology, the activities on the land surface and rainfall which makes comparisons of data and detection of trends rather problematical. However, most recent evidence from aquifers of different types in Denmark, France and Great Britain shows that the trend in nitrate concentrations is still upwards (see *Figure 4.7.1).*

The *pesticide* target for groundwaters is estimated to be exceeded in less than 75% of agricultural land in EU/EFTA *(see Map 4.7.1).* Average use in high input countries (France, Germany, Italy, Netherlands, Portugal and Spain) has stabilised over the period 1980-92 *(see Section 3.6).* A reduction in use of plant protection products of up to 15% has been reported by some of the North Sea Member States over the last 5 years, although this partly reflects the increasing

Figure 4.7.1: Development of nitrate concentration in groundwater (France, Great Britain, Denmark)
Source: ETC/IW, 1995



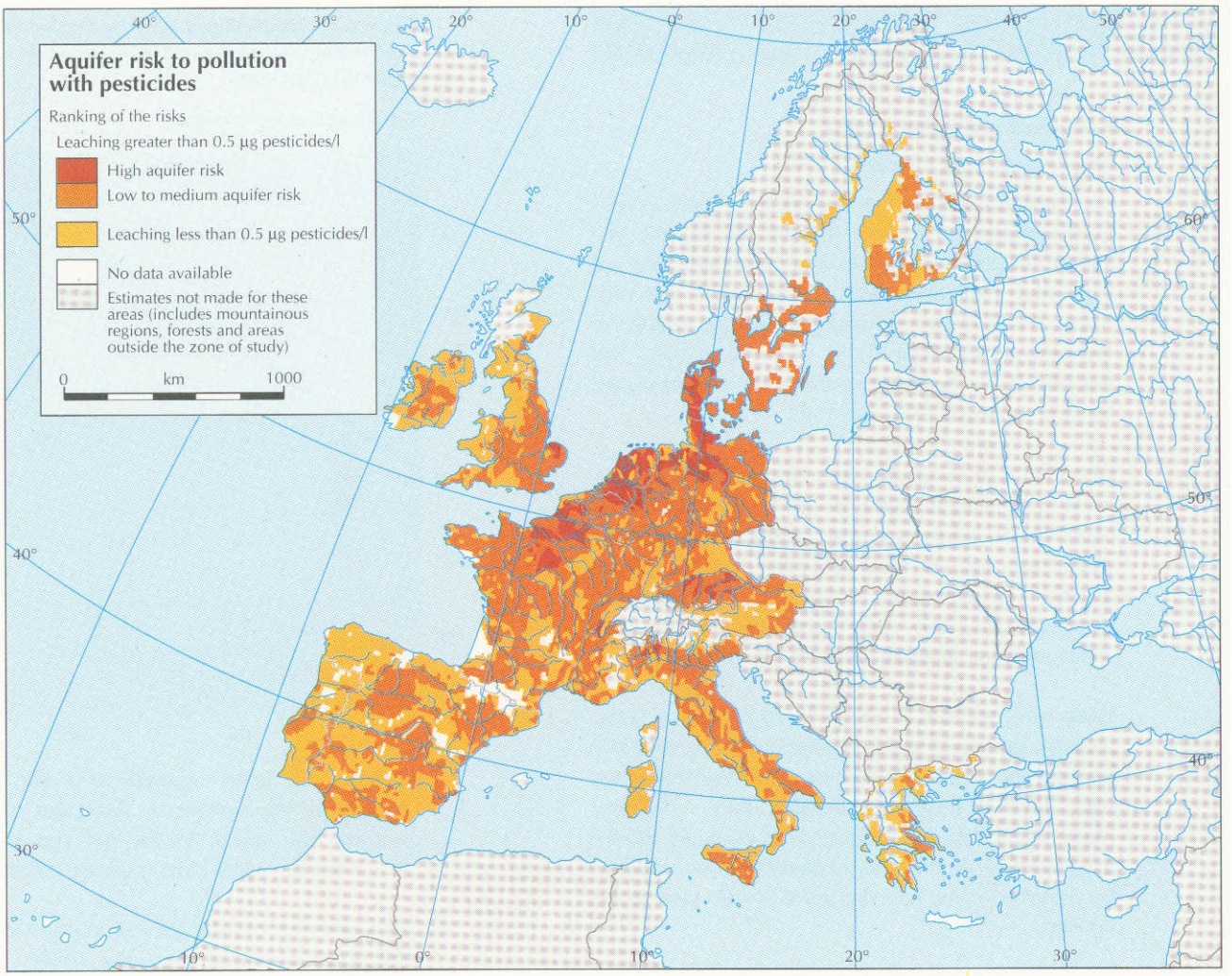
efficiency of active ingredients in the pesticides. Furthermore the number of pesticides continues to rise (now over 450 in the UK) and new products are being licensed while older ones are withdrawn.

Concentrations of pesticides in groundwater in Denmark have stabilised since the 1980s. However, every fifth sample taken from groundwater in Denmark exceeded the 0.5 µg/l limit for pesticides. Based on past patterns of pesticide use, the situation is assumed to be similar in The Netherlands, UK and Italy.

Quality of surface water resources

During the 1980s the percentage of the population connected to *municipal waste water sewage treatment* plants has increased *(Figure 4.7.2).* In the northern Member States generally more than 80% of the population is connected to sewage treatment plants, while in the southern Member States around 50% of the population is connected. More than 80% of waste water receives biological treatment (secondary treatment), while it is only a minor proportion of the waste water which receive tertiary treatment (eg, phosphorus removal). The Urban Waste Water Treatment Directive is expected to result in further reduction of the loading to surface waters.

The placing of organic waste into rivers results in oxygen consumption due to the breakdown of *organic matter.* Severe organic pollution may lead to rapid



Map 4.7.1: The pesticides 'hot spots' for groundwater Source: RIVM

deoxygenation of river water and the disapparance of fish and aquatic invertebrates. Decomposition of organic matter also results in the release of ammonium, which at high concentrations and under certain conditions may be toxic to aquatic organisms. The increased biological treatment of domestic and industrial waste waters during the last 15-20 years has consequently reduced the organic matter loading of many European surface waters.

A comparison of organic matter levels (BOD5) in 101 river stations in the EU12 Member States reveals signs of improving conditions *(Figure 4.7.3)*. From the period around 1980 to 1990-1992, the organic matter concentration decreased at almost 72% of the river stations, with the reduction in concentration level being greater than 25% at 44% of the stations. The improvement was greatest in the rivers in the north-western Member States where more than 83% of the stations having decreasing concentration, while in the southern Member States 15 stations had decreasing concentration and 16 stations increasing BOD5 levels.

The ammonium concentration at 65% of 130 river stations in the EU decreased between the beginning of the 1980s and 1990-1992, with the concentration decreasing by more than 25% at 45% of the stations.

Eutrophication may be defined as the excessive enrichment of a water body with nutrients, particularly nitrogen and phosphorus. This stimulates the growth of aquatic plants, thereby causing a variety of adverse effects (eg, toxic blue-green algae, treatment prior to use as drinking water). These effects are generally most apparent in lakes, reservoirs and coastal areas, as well as in large, slow-flowing rivers. Much of the excessive phosphorus loading to inland surface waters is attributable to discharge from point sources, especially municipal sewage water and industrial

Figure 4.7.2: Development of sewage treatment
Source: Eurostat/OECD, 1995

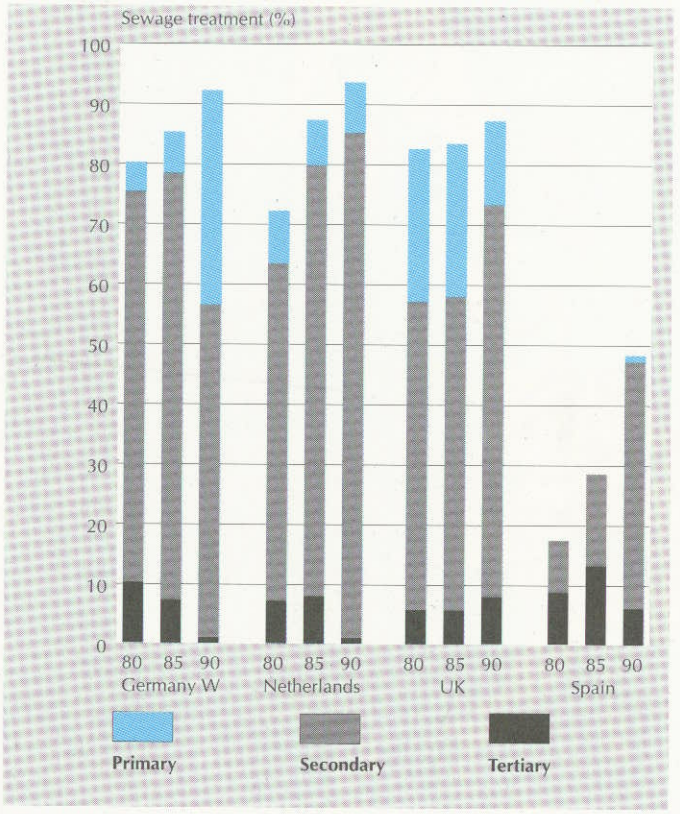
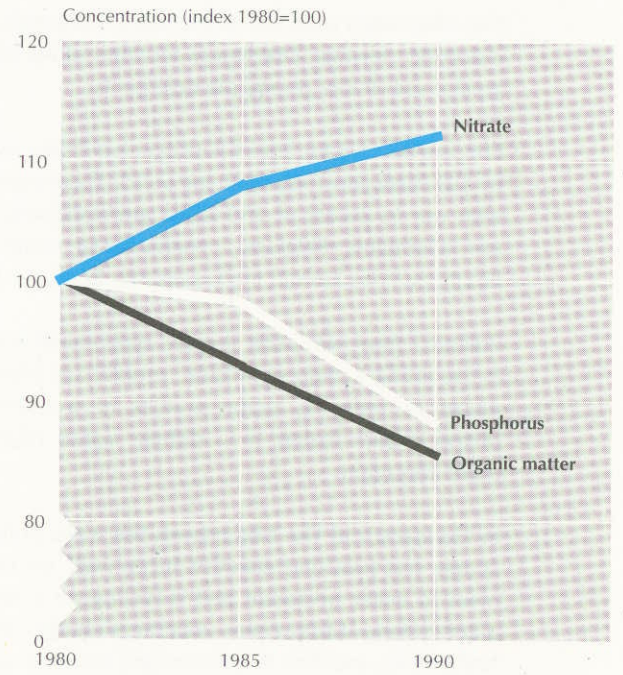


Figure 4.7.3 Development of organic matter, phosphorus and nitrate concentration in EU12 rivers
Source: ETC/IW, 1995



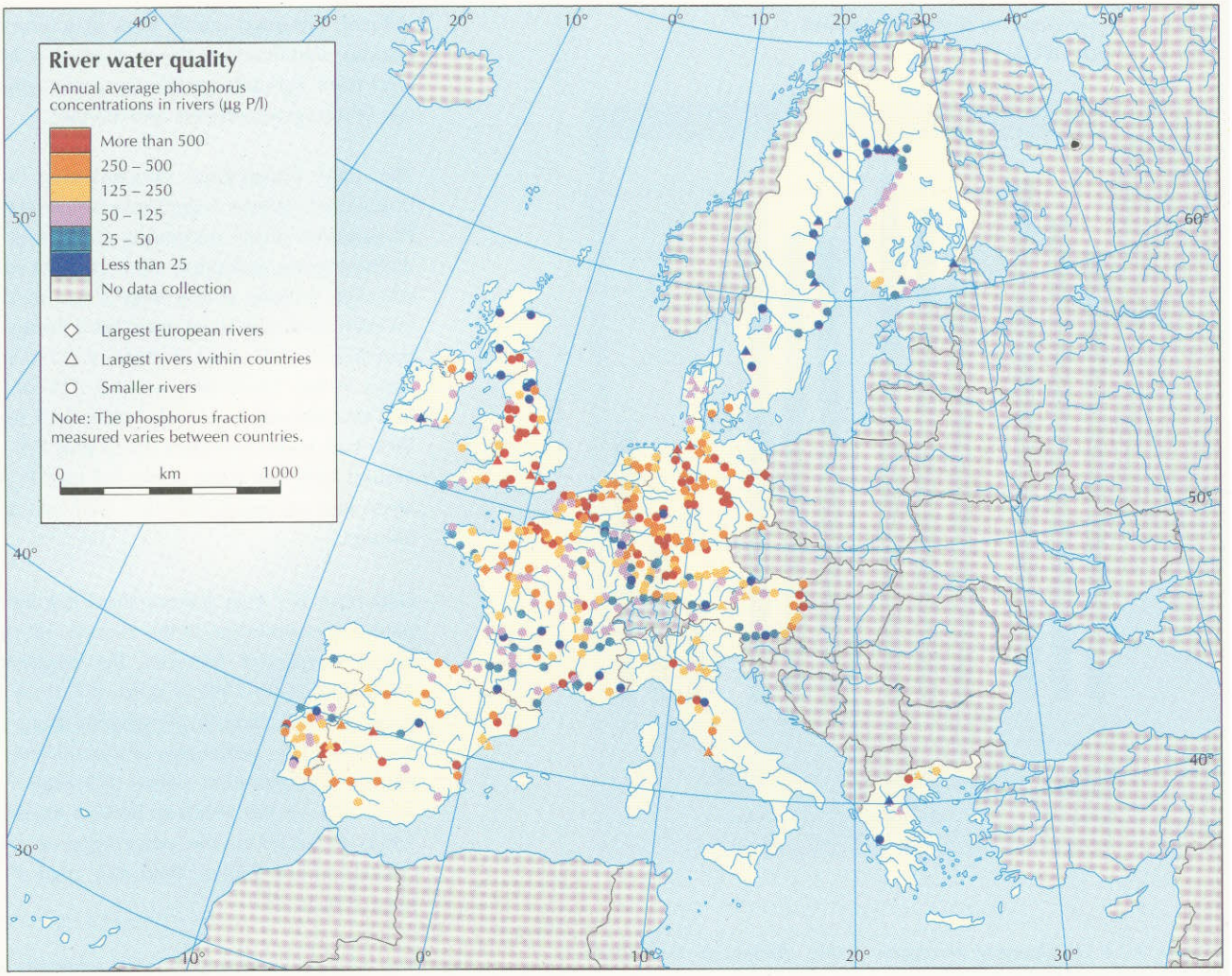
effluent, although inputs from agricultural land can also be significant. Nitrogen loading is primarily derived from agricultural activity, especially from the use of nitrogen fertilizers and manure.

The total phosphorus concentration in relatively unpolluted streams is generally below 0.025 mg/l P. Phosphorus levels exceeding 0.05 mg/l P indicate anthropogenic influence, such as from sewage effluent. The stations in the large rivers in Finland and Sweden generally have total phosphorus concentration below 0.05 mg/l P *(Map 4.7.2)*. In the large rivers in the EU12 only around 10% of the stations had total phosphorus levels below 0.05 mg/l P, whilst 58% had levels between 0.125 and 0.5 mg/l P and around 14% had levels above 0.5 mg/l P. These latter levels indicate heavy pollution, particularly by sewage effluent.

Data from 101 river stations show that the total phosphorus concentration in the majority of river stations (63%) decreased between the beginning of the 1980s and 1990-1992 *(Figure 4.7.3)*. In 40% of the rivers, the reduction in phosphorus levels was greater than 21%. The percentage of stations with total phosphorus concentration below 0.3 mg/l P increased from 67% in the 1980s to 80% in the period 1990-1992. In addition, the percentage of stations with concentrations higher than 0.5 mg/l P decreased from 18% to 7%.

The nitrogen concentration in relatively unpolluted streams is generally below 0.3 mg/l NO_3-N. Nitrogen levels exceeding 1 mg/l NO_3-N indicate anthropogenic influence eg, agricultural run-off. Generally the rivers in the north-western part of the Union (in northern France, the Benelux countries, Germany, Denmark and the UK) had nitrogen concentration greater than 2.5 mg/l NO_3-N. The rivers in southern Europe (Portugal, Spain, southern France, Italy, and Greece) and Sweden and Finland, as well as some stations in Ireland, northern England and Scotland, generally had nitrogen concentration below 2.5 mg/l *(see Map 4.7.3)*. The higher level of nitrogen at river stations in north-western Member States can be related to the high degree of agricultural intensification, with high application of nitrogen fertilizers and high livestock density.

In contrast to phosphorus, organic matter and ammonium levels, the nitrogen level in most EU12 rivers has increased during the last 10-15 years *(Figure 4.7.3)*. Thus, nitrogen levels increased between the beginning of the 1980s and 1990-1992 in nearly three quarters of 120 river stations.



Map 4.7.2: Annual mean phosphorus concentrations in specific European rivers Source: EEA, 1995

Percentage reductions in *pesticide* inputs to rivers and estuaries from the North Sea States have been estimated (Fourth North Sea Conference, 1995) and are considerable with Sweden achieving close to 100% reduction in each of the pesticides studied and the UK and The Netherlands averaging about 50% reduction. Similar reductions in heavy metals and other pollutants are being achieved through action programmes aimed at protecting the North Sea.

Underlying factors and new insights

Industry accounts for 53% of water abstraction, but this varies enormously from country to country depending on the renewable water resources available (EEA, 1995).

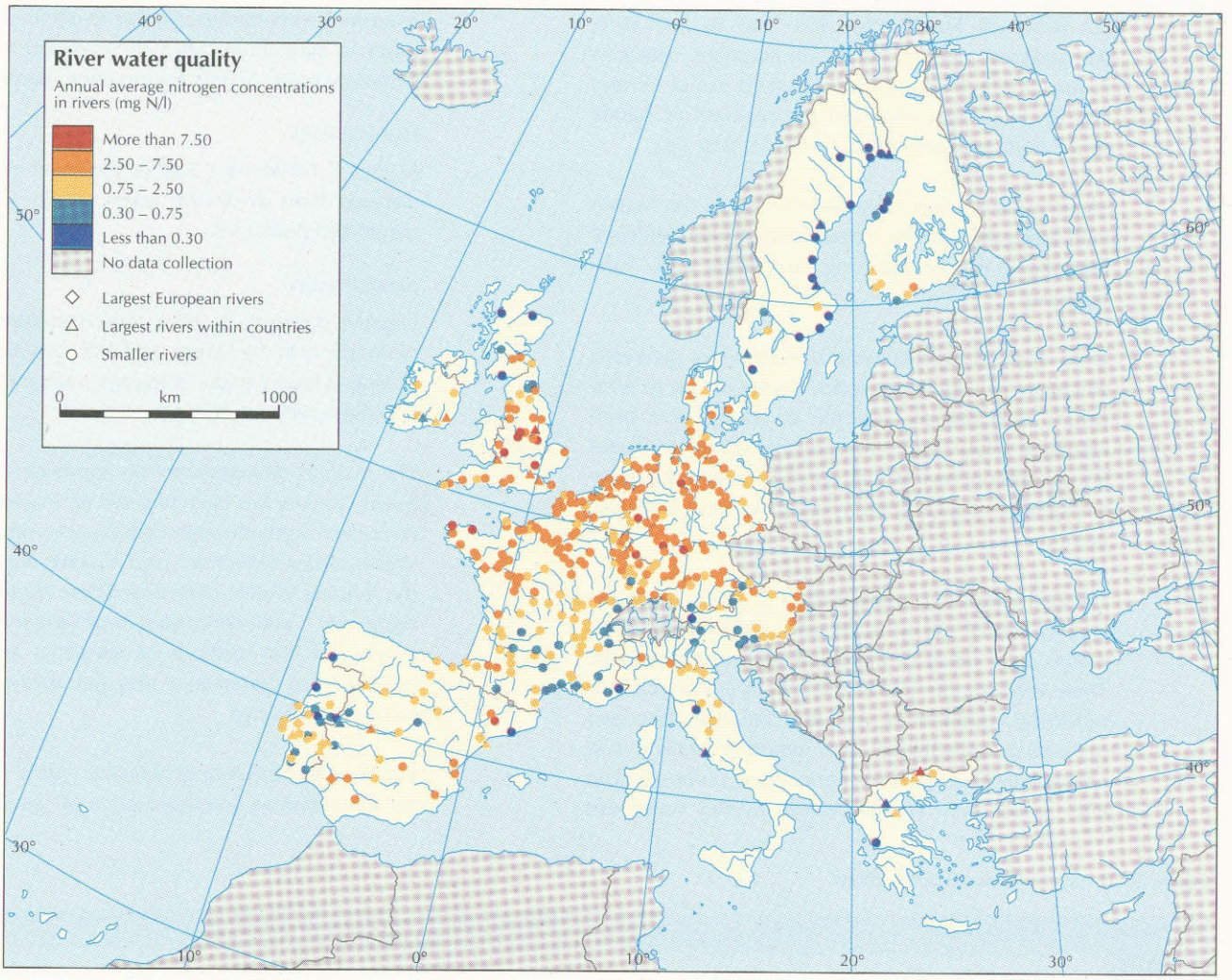
The average application of phosphorus fertilisers started to decline sharply at the end of the 1980s, resulting in a decrease in total phosphorus use of almost 40% between 1988 and 1992 in EU12 *(see Section 3.6)* .

The other main source of phosphates is domestic and industrial sewage. Discharges are also falling due to greater use of low phosphate detergents.

The use of nitrogen based fertilisers has fallen overall by 10% between 1980-92 in the EU15. Those countries with use in excess of 250 kg/ha are stabilising their use (Germany, Belgium, Netherlands) while low input countries are still increasing *(see Section 3.6)*.

Pollution from non-point (largely agricultural) sources is becoming a more significant problem as improvements in reducing point sources of pollution to inland waters makes the diffuse inputs relatively more important.

In Germany and The Netherlands the water pollution charge has provided effective incentives for investment in water treatment and recycling on a closed-plant system. Waste water treatment charges in The Netherlands and the UK were initially revenue raising,



Map 4.7.3: Annual mean nitrogen concentration in European rivers

Source: EEA, 1995

but in practice had a significant impact on investment in reducing effluent discharges and pollution levels of organic matter, nitrogen, phosphorus, and heavy metals.

A number of agencies and NGOs report that increasing consumptive and non-consumptive uses of water are leading to conflict between commercial uses (water supply, industrial cooling, irrigation etc) and recreational uses (bathing, sailing, fishing etc) of inland surface waters.

Progress and outlook

Water quantity

The issue of sustainable consumption is scarcely being addressed at the EU level, with only a few measures aimed at water usage. However, the Action Programme for Integrated Groundwater and Management under development will define the comprehensive protection and management of ground-water aimed at sustainability.

The major water resources problem is over-consumption since this affects both the quantity and quality of water resources. Some Member States have long established policies of metering and others are now beginning to introduce metering and economic instruments to reduce water use by households; some Member States are focused on waste water charges to provide additional incentives for water use efficiency and recycling.

Although continued growth of industry is predicted, intensity of water use in this sector is expected to fall (see *Section 3.3*).

Intensification of *agriculture* is expected in the Southern Member States (partly due the allocation of

EU Structural Funds); this will lead to increasing demands for water for irrigation purposes. Irrigation is also closely linked to the increased use of nitrates and is likely to compound the problem of nitrate concentration in groundwater (see *Section 3.6*).

Some water savings have been made in the household sector through the introduction of more efficient household goods (washing machines and dishwashers).

There appears to be considerable scope for increased efficiency of supply networks. Losses of up to 50% before consumption in some countries have been identified (EEA, 1995). Measures to control leakages from supply networks will require increasingly large amounts of capital investment to achieve improvements.

The DRI Integration study (DRI et al., 1994) forecasts an increase of 5% in water use intensity to 2000, mainly as a result of increased agricultural activity. There will be wide regional variations in this indicator reflecting differences in the balance between increasing population and industrial activity and changes in water use for agricultural purposes. The UK is the only country where overall water use intensity is expected to fall, due to declining use of water in agriculture. Spain is predicted to have the largest increase, mainly for irrigation purposes.

Water quality

Figures 4.7.4 and *4.7.5* show expected trends in the distance from achieving water quality targets for nitrate and pesticides.

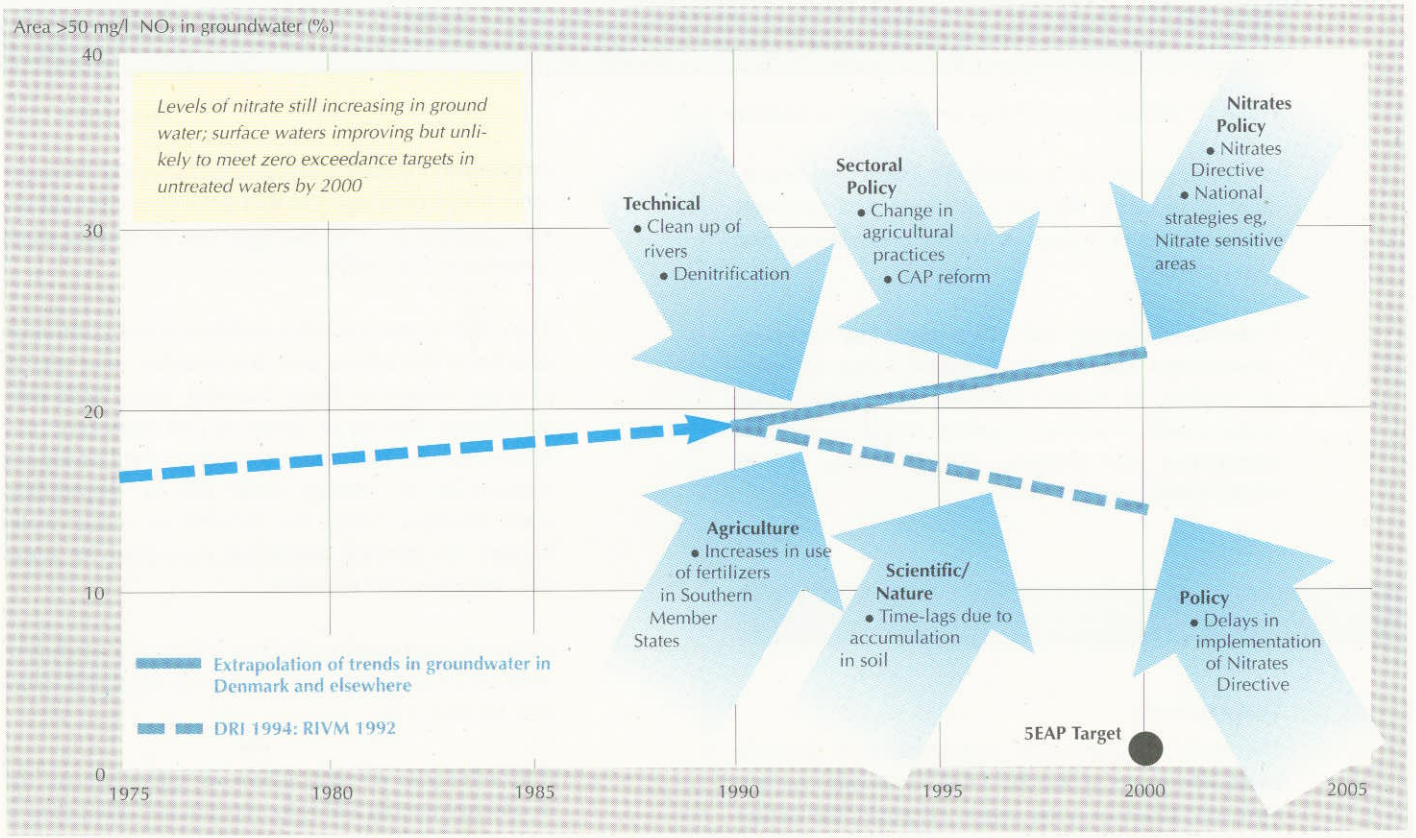
Surface water

Organic pollution is still a serious problem in some of the rivers in the Union, and will continue to be so as long as large amount of sewage water are discharged into rivers without being treated.

The majority of investment on improvement in water quality to date has been targeted at inland and marine surface water through compliance with the Urban Waste Water Directive and marine water through the Bathing Waters Directive. These should result in significant and continued improvements in water quality but the methods of sampling, analysis and estimation of compliance may not always allow this to be demonstrated.

Furthermore, the former directive has a feature that the identification and designation of sensitive areas'

Figure 4.7.4: Progress towards nitrate target



requiring more stringent treatment than secondary treatment is left to the Member States and will not

be subject to assessment at EU level. In addition, the timetable for implementation relates to the size of population served rather than the sensitivity of the receiving waters.

To date, actions and improvements prompted by the Urban Waste Water Directive in some of the Member States include:

- all waste water will be biologically treated by the beginning of 1998 in The Netherlands;
- in Finland 90% of phosphates to be removed from domestic sewage; nitrates removal is mandatory;
- an action programme is being prepared to treat all wastewater by 2005 in France; and
- 90% of the urban population in Portugal will have waste water treatment by 2000.

Sewage sludge will cease to be disposed to the sea by the UK by 1998.

The nutrient level in many areas of the European Union is still too high, and unless efforts are made to reduce inputs of nutrients, eutrophication is likely to be an important EU environmental issue. Phosphorus removal in wastewater treatment plants and reducing the phosphorus content of detergents, supplemented with measures to reduce particular nitrogen but also phosphorus loading from agricultural areas are in many cases a necessity.

The DRI Integration study forecasts an area reduction of 10% in nitrates loading to surface waters by the year 2000 although this does not fully take account of time-lags in the accumulation of nitrates. RIVM predicted the same reduction not by the year 2000, but by 2010 (RIVM, 1992). The reduction is mainly due to the CAP Reform, the adoption of the Nitrates Directive and the Drinking Water Directive.

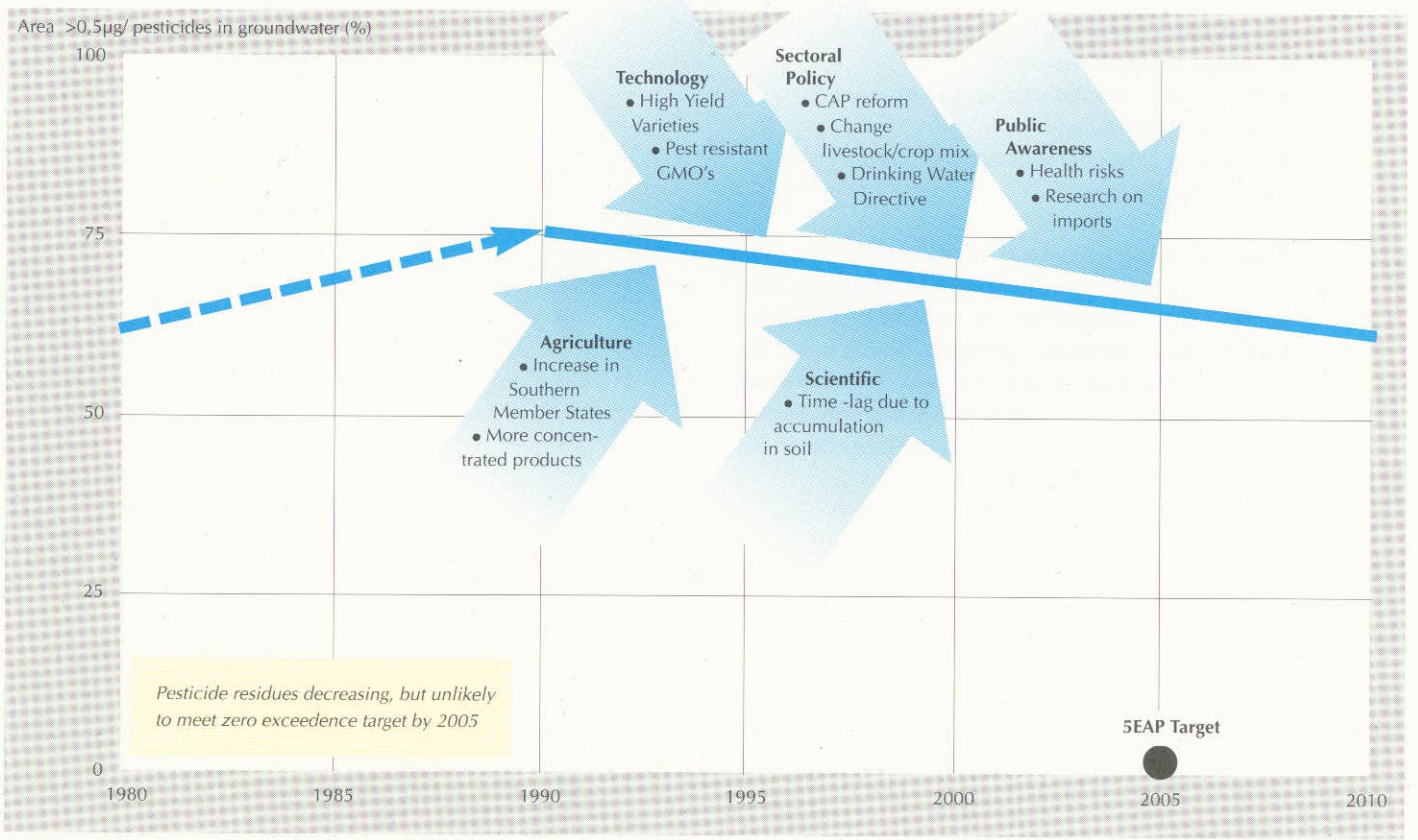
Groundwater

The Nitrates Directive also requires measures to control nitrate pollution of groundwater from agricultural sources although implementation is not required until 1999.

Particular issues in relation to the impact of the Nitrates Directive are listed below.

- The designation of NVZs is left to the Member States. Differences in interpretation of vulnerable' are

Figure 4.7.5: Progress towards pesticides target



likely to affect the extent of the territory designated, and the overall influence of the Directive, as standards are mandatory only in NVZs. In The Netherlands, the whole country is designated as nitrate sensitive and an action plan has been developed and a code on good agricultural practice elaborated. At the other end of the spectrum Ireland does not intend to designate any NVZ. Regulations (and bans) on manure spreading have been tightened.

- Although a limit of 170 kg N/hectare is set for application of manure, there is presently no standard means of measuring nitrogen content and therefore discrepancies are likely between Member States.

- The Directive is concerned only with 'nitrogen compounds' and does not address phosphorus as a cause of eutrophication.

- The success of the scheme is dependent on the co-operation of farmers and some of the rules, for instance those governing fertiliser applications, will be difficult to enforce.

In *Section 3.6* it was predicted that pesticide use will fall significantly by 2000, particularly its use for certain crops (vines, potatoes), leading to a slight reduction in residues in groundwater (RIVM, 1992). The main factors contributing to a decline in use are as follows:

- implemention of CAP reforms (set aside, prices);
- change of crop/livestock mix;
- increasing yields through, for example geneticly developed HYVs; and
- increasing consumer resistance to pesticide use due to health risks.

Based on the requirements of the 1993 Oslo and Paris Conventions, five EU Member States have produced Action Programmes on the Use of Pesticides in Agriculture. Denmark, Belgium, Sweden and the UK have developed codes for Best Environmental Practice (BEP). Of the North Sea States only France and Germany are not intending to use pesticide levies in order to meet their targets.

4.8 Coastal zones and marine waters

The issue

In the absence of a standard definition, coastal zones are defined as *land influenced by its proximity to the sea and vice versa insofar as man's activities affect marine water chemistry and ecology* (US Commission, 1969). EU12 has a coast line of about 58,000 km (excluding small islands and inland seas but including the Mediterranean, North, Baltic and North Atlantic Seas). The addition of Sweden and Finland considerably lengthens the EU coast line. Coastal zones represent a unique ecological heritage including dunes, wetlands and cliffs and are typically very fragile, facing complex threats from natural processes (coastal erosion, storms and flooding) and human activities as summarised in *Box 4.8.1*. An inventory of coastal evolution in the EU undertaken within the EC CORINE programme showed 55% of the coastline of the EU12 to be stable, 19% to be suffering from erosion problems and 8% to be depositional.

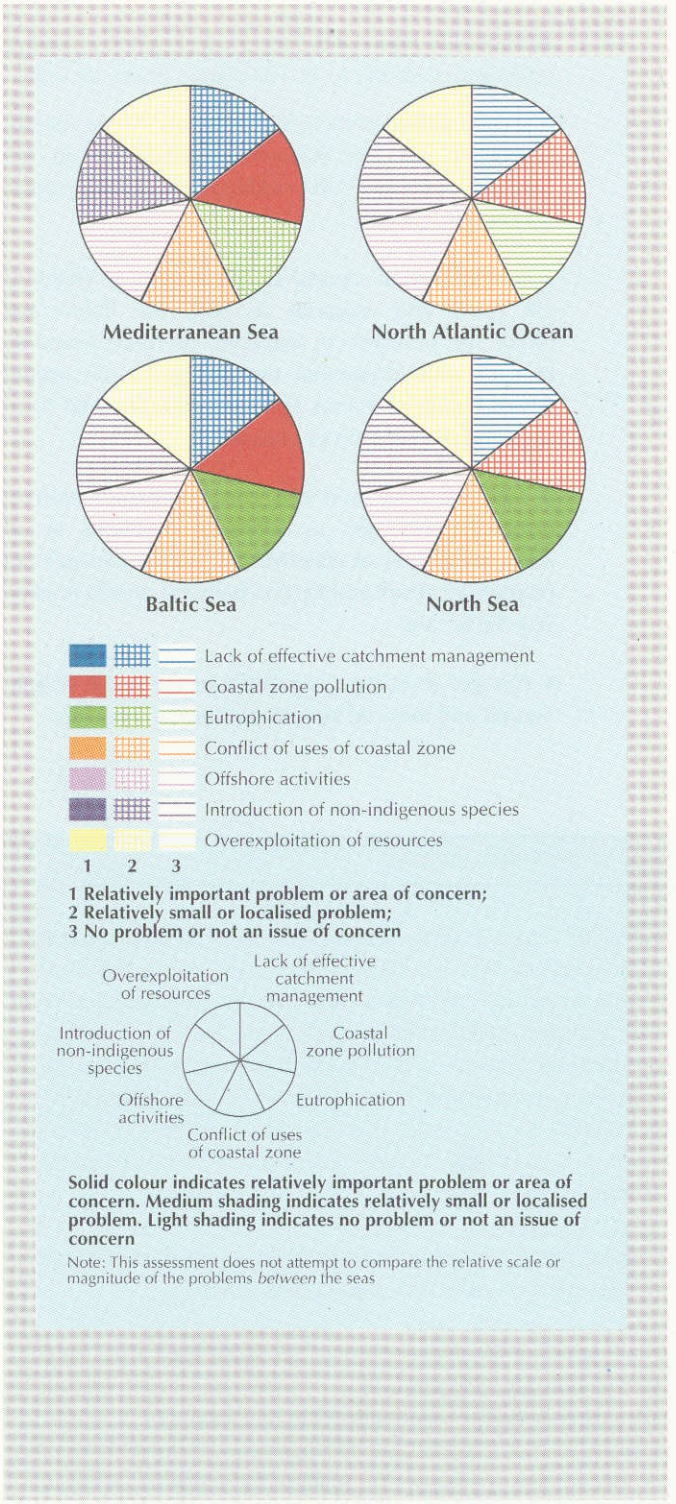
As shown in *Figure 4.8.1* the most common problems relating specifically to EU15s coastal zones include:

- coastal pollution including nutrients, heavy metals, chemicals, oil and hazardous substances in the Mediterranean and Baltic and in many estuarine areas (see also *Box 4.8.2*).
- eutrophication caused by discharges of nutrients via rivers and estuaries in both the Baltic and North Sea; problems in the Baltic are made worse by lack of water treatment technology in the former Soviet Union countries and slow rate of water turnover and degradation of pollutants;
- conflicts over land use and over-exploitation of resources are cited as localised problems in all areas, while lack of effective catchment management presents localised problems in both the Mediterranean and Baltic; and
- changes in Europe's coastline as the result of both natural and induced geomorphological changes.

Box 4.8.1: Impacts of human activities on coastal zones

Human activity	Type of (potential) impact
• Urbanisation and transport: Land use changes (eg, for ports and airports), congestion, dredging and extraction of natural resources (gravel and sand) and disposal of harbour sediments, spills at sea and disposal of sewage, waste water, sludges and abstraction of water	• Loss of unspoilt areas, natural and semi-natural habitats (dunes, saltmarshes, mudflats, cliffs, shingle etc) and coastal species as a result of human activities in the coastal zone itself and over exploitation of coastal and marine resources, (eg, in France some 15% of natural habitat in the coastal zone have disappeared since 1975, while only 100,000 ha of 700,000 ha of coastal marshes which existed 90 years ago in Italy exist today). Dune systems have also disappeared in many areas.
• Agriculture: Land reclamation, fertiliser and pesticide use, high livestock densities, water abstraction, waste water and waste disposal	• Water pollution and polluting activities within river catch ments or as a result of atmospheric deposition
• Tourism, recreation and hunting: Development and land use changes (eg golf courses, marinas), traffic congestion, water abstraction, waste water and waste disposal	• Human health risk and damage to ecosystems from substances that are persistent, toxic or liable to bioaccumulate through a cumulative build up in the food-chain
• Fisheries and aquaculture: Port construction, fish processing facilities, fish farming effluents	• Risk of major accidents, arising from the transport of radioactive and hazardous materials or the disposal of hazardous materials at sea (eg, material stored at offshore platforms, nuclear submarine wrecks and transport of fuels, chemicals and hazardous and radioactive wastes)
• Industry (including energy production): Land use changes, extraction of natural resources (oil), discharge of process effluents and cooling water, impoundments and barrages	

Figure 4.8.1: Relative importance of the 'common problems' in each sea
Source: EEA, 1995



Other problems which relate to the marine environment in general include: lack of effective catchment management, offshore activities, over-exploitation of resources and introduction of non-indigenous species.

Box 4.8.2 Contamination and coastal pollution

● Sewage

As well as being an important source of nutrients, sewage contributes to the microbial contamination of coastal waters (other sources include agricultural runoff and sea birds). In the EU, the quality of bathing water is regularly assessed for up to 19 microbiological and physical-chemical parameters according to Council Directive (76/160/EEC).

● Oil

Oil is a very noticeable contaminant which can adversely affect the quality of the environment. A major source to the marine environment is shipping (eg, from cleaning operations and bilge water) and it is heavy shipping routes and ports which are often most contaminated. Accidental spills cause localised and sometimes major damage to the marine environment, with sea-birds often being the most conspicuous victims. Riverine inputs and other land based sources often make the most significant contribution to the total oil loads (GESAMP, 1990).

● Organic compounds

Chlorinated hydrocarbon pesticides, PCBs and other synthetic organic compounds reach the sea mainly from the same sources as metals, known to accumulate in the sediments, as do some heavy metals. From here they can be recycled through the food-chain long after their initial introduction. Some marine mammals and sea birds are believed to have been harmed by a build-up of such organic compounds.

● Radionuclides

Nuclear weapons testing and discharges from nuclear power stations and reprocessing plants add to the inventory of naturally occurring radionuclides. The latter two sources are the most important to the coastal zone.

● Sediments

Sediments and suspended particles in shallow coastal waters act as both sinks and sources for many environmental contaminants and, therefore, play an important role in determining the impact of chemical contaminants in the marine environment.

● Litter

Litter, in particular that made of synthetic materials, such as ropes, nets, plastic bags and packaging rings and straps, is increasingly being introduced to the marine environment, and is particularly noticeable in the coastal zone. Such litter often floats in the sea, entangling and killing fish, birds and marine mammals. The accumulation of some litter on beaches is potentially dangerous (eg, medical litter) while all of it aggrav-ates beach users. The high prevalence of litter in the coastal zones of Europe's seas has been highlighted by the annual surveys undertaken by Coastwatch Europe (Coastwatch, 1994). In 1993, of the units surveyed by Coastwatch, approximately one-third were clean or almost clean of litter. This ranged from 50% on North Sea coasts to 20% in the Mediterranean. The survey revealed a general increase in the occurrence of medical and sanitary litter and in polystyrene and some grades of plastics.

Environmental policies and EU targets

The overall EU objective is sustainable development of coastal zones and their resources in accordance with their carrying capacity.

The 5EAP sets the following overall targets for 2000:

- better coordination of relevant policies between administrations at all levels;
- development of a framework for integrated coastal zone management;
- development of criteria for a better balance of competing land use and conservation priorities; and
- increasing awareness of coastal zone management problems.

Related specific targets to 2000 include reducing water pollution and contaminant loads in line with the specifications listed below.

- *EU Directive on standards for Bathing Waters* (76/160/EEC) for up to19 microbiological and physical-chemical parameters

- *The 2nd and 3rd North Sea Conferences* target a reduction by 50% of discharges of all substances that are persistent, toxic and liable to bioaccumulate and that could reach the marine environment, to levels that are not harmful to humans or nature. This includes 36 priority dangerous substances and a 'substantial' reduction in inputs of pesticides (a priority due to their contribution to nutrient loads and eutrophication) and a reduction of oil spills (a priority on the basis of their persistence, toxicity and bioaccumulation). Targets for the year 2000 include introduction of appropriate oil traps to reduce 1992 levels of run-off from new and renovated roads/runways/rail lines and reduce pollution of soil, surface and ground water (30% by 1997 and 50% by 2000).

- Treatment of all water from ships' tanks containing residues of oil or other chemicals by:
  - building treatment capacity in major ports (to meet Directive on protection of the Mediterranean region, 3rd North Sea Conference and MARPOL 73/78);
  - phasing out ship tank washing without approved facilities; and
  - phasing out of discharges of oil-contaminated cuttings by offshore installations (3rd North Sea Conference).

The EC is also a contracting party to a number of international conventions:

- Oslo & Paris Convention for NE Atlantic (the new Paris Convention, which is destined to replace the existing Oslo & Paris Conventions, was signed by all Parties (including EC) in September 1993 but has not yet come into force);
- Helsinki Convention for the Baltic; and
- Barcelona Convention for the Mediterranean Sea.

Action taken by the EU is summarised in *Box 4.8.3*

Box 4.8.3: EU state of action in the coastal zones and marine water theme since 1992.

5EAP objectives for EU (1992-1995)	Actions achieved
Sustainable development of coastal zones and their resources in accordance with the carrying capacity of coastal environments	
• Framework of integrated management plans on appropriate levels	• Communication on coastal zones (Integrated coastal zone management) is under preparation.
• Creation and improvement of data bases and relevant indicators	• Community network of resorts - 'COAST' (Under Article 10 of the ERDF Regulation 2083/93, financial support may be given for innovative measures and for the exchanging of experience between towns.)
• Pilot projects on integrated coastal zone management	
Marine water: Reduce discharges of all substances which could impact negatively on the environment due to toxicity of bioaccumulating impact. (Objec-tives and actions are similar to the North Sea Conference)	
• Develop proposals on maritime transport preventing environmental damage from shipping activities (oil spills, loss of cargo, reduction of operational pollution)	• Common policy on safe seas: legislation adopted concerning carriage of dangerous goods, segregated ballast tankers, training, flag state control; the Council has reached a common position on port state control; a proposal for establishing a European vessel reporting system is being examined. Work is continuing on the drawing up of marine environmentally sensitive areas.
• Proposal for a Directive on the reduction of operational an accidental pollution from small tonnage boats	
	• Financial assistance available under LIFE for measures to improve Baltic and Mediterranean Seas. Measures defined by Helsinki and Barcelona Commissions respectively. Objectives and actions are similar to those defined by North Sea Conference.

State of the environment

Past Trends and current status

No appropriate general indicators have yet been identified to describe the state of the coastal environment throughout the EU. Available indicators are mainly related to water quality. Factors of interest include points listed below.

- Compliance with the *Bathing Waters Directive*. For the 1992 bathing season 10,977 coastal bathing waters were assessed for compliance with mandatory microbiological standards for total and faecal coliformins 1992 some 88.6% complied (EC, 1993) rising marginally to 89.6% by 1993 (EC, 1994). In 1994 DG XI has also reported on compliance with guide values. This shows much greater divergence between Member States, reflecting climatic conditions and the range in number of bathing waters covered.

- *Blue Flag Beaches*. The Federation for Environmental Education (FEE) reports on the number of EU12 beaches receiving a Blue Flag. This increased from 697 in 1990 to a peak of 1454 in 1994. Data for 1995 (not yet published) suggest a fall to 1157 in 1995.

- *Oil pollution*. Since consent is not required for oil discharges, limited data is available on oil spills to the marine environment. However, an estimated 15% of tankers together account for 0.5 Mt of oil discharge pa (EEA, 1995). Oil spills are discussed in *Section 4.9*.

- *Discharges to Sea*. *Table 4.8.1* shows estimated reductions in aquatic inputs to the North Sea of mercury, cadmium, copper, zinc, lead, arsenic, chromium and nickel between 1985 and 1995 compiled for the Fourth North Sea Conference (1995) from progress reports submitted by each country. It can be concluded that there is considerable progress in the reduction of heavy metals by these countries, although reduction of nickel and copper requires extra attention. The implications are summarised in *Table 4.8.1* below. Similar data is not available for the Mediterranean, but riverine loads of selected chemical elements such as cadmium (55 tpa), copper (5,000 tpa), total nitrogen (1.05 mtpa) and total phosphorous (350 tpa) are known to be high (EEA, 1995). Discharges to the Baltic are comparable to those of the Mediterranean for cadmium and copper, but negligible for mercury and lead.

- Total nitrogen and phosphorous riverine loads (from fertilisers and sewage discharge respectively)

Table 4.8.1 Emissions of eight heavy metals to the North Sea Source: Fourth North Sea Conference, 1995

Heavy Metal	Member States where 50% reduction target for 1995 (on 1985 levels) will be met	Comment
Mercury	All except Sweden and France and phosphate fertiliser industries	Reductions in chloralkali process
Cadmium	As above	Reductions from metals, engineering and fertilisers industries
Copper	All except UK, The Netherlands and Sweden	Mainly from municipal waste water and industrial controls
Zinc	All but UK	Measures in waste water treatment plants, metal and mine sectors
Lead	All except UK and Netherlands	As above
Arsenic	All	Measures in metal sector
Chromium	All	Improvements in many industrial processes
Nickel	UK, Sweden, The Netherlands, Belgium will not meet targets	As with zinc

Note: UK data are based on riverine inputs and direct discharges to estuaries and coastal waters; all other countries have reported input at source.

are high in the Mediterranean (360 tpa phosphorous and over 1 mn tpa for total nitrogen) and the North Sea (0.93 mn tpa total nitrogen); total phosphorous loads are less than 50 tpa each in the North Atlantic, North and Baltic Seas. North Sea States have achieved a reduction of phosphorous inputs to surface water of approximately 50% between 1985-95 (except France, which has only achieved 25%) according to the North Sea Conference Progress Report. Improvements in quality have been achieved mainly as a result of measures to reduce discharges from point sources, particularly waste water.

Underlying factors and new insights

As summarised in *Box 4.8.1* there are five main groups of human activity resulting in impacts on the coastal zone through physical and chemical agents. *Box 4.8.2* presents some of the issues in greater detail.

The quality of bathing waters and beaches reflects both discharges from inland and marine waters, climatic conditions, land use in the hinterland and land use planning and management. Bathing water quality diverges between Member States partly reflecting the relative length of the coastal line (eg, ranging from 108 beaches in Ireland to 4,400 in Italy) and differences in climatic conditions.

Other major underlying causes include:

- *Oil spills* from shipping (cleaning operations and bilge water), municipal waste and coastal accidents. 85% of all accidents at sea (between 1974 and 1989) involved tankers, which pose the greatest threat because of their frequency and proximity to shorelines (International Tanker Owners Pollution Federation, 1990).

- *Untreated sewage*, which is a major source of nutrient and heavy metal discharges and is very seasonal. The Mediterranean has a catchment population of 130 mn; tourism in the area (estimated at 260 mn visitors pa by 2025) will more than double pressures for water use (leading to over-exploitation and risks of saline intrusion) (see *Section 3.7*).

- *Lack of effective coastal zone land use management;* development pressures are expected to increase because of limited land use planning capacity in many southern Member States and the less developed/peripheral status of coastal zones which make them attractive to development (see tourism, industrial, nature and urban chapters). There appears to be a lack of co-ordination between planning authorities and effective implementation of planning measures.

Progress and outlook

Coastal Zone Management (CZM) offers a strategic approach to planning and management of coastal zones and is based on identifying local priorities, issues and sustainability targets. However, no overall CZM scheme exists for the EU. France, Netherlands and Denmark have implemented national legislation for CZM, while UK action has taken the form of administrative initiatives. It must be also noticed that land use planning in Mediterranean states is still not rigorously implemented.

Sharing of experience will be important and the Commission is trying to facilitate better exchange of know-how and creation and improvement of data bases and relevant indicators.

The inclusion of the Baltic coasts of the new Member States Finland and Sweden offers greater opportunities for the EU to influence and contribute to the solving of pollution problems (eutrophication and persistent organic pollutants) in the Baltic and to maintain the unique biotopes, flora and fauna found in this coastal zone.

Since 1992, LIFE funds projects have been providing financial assistance to projects (including information campaigns, education and professional training), which aim to increase the awareness of the public, competent authorities and economic sectors. From 1993 demonstration Projects that advocate innovative approaches and improvement of criteria to ensure sustainability of projects and programmes (including EIA) have been supported.

In the next five years, an increased focus will be needed on integrated management of coastal areas via EU and Member State policies and international conventions dealing with regional seas and broader marine environmental issues.

4.9 Risk management

The issue

Environmental risks predominantly arise from "natural" and technological phenomena and include a diverse range of accidents, incidents and natural events ranging from earthquakes, floods and volcanic eruptions to oil spills, nuclear accidents and chemical releases. Risks to human health and eco-systems also result from pollution levels and contamination which are associated with ongoing activities rather than unexpected accidents.

Risks to human health and the environment result from a number of sources. Those related to human activities include:

- accidents at industrial installations;
- accidents at nuclear installations;
- transport accidents;
- offshore accidents;
- forest fires and floods resulting from changes to land use and unsustainable use of water resources; and
- risks associated with the release of Genetically Modified Organisms (GMOs) into the environ ment.

The principal risks considered in this section are major industrial accidents, nuclear accidents, (these two categories of risk are often termed 'major accident hazards'), chemical risk and natural hazards. The effects on the environment of risky events relates essentially to the effects of toxic materials on the human and physical environment and the physical degradation of the environment. There are significant gaps in our understanding of the long-term environmental impacts of such risks.

The causes of risks in each of the above categories are summarised below.

- *Industrial accidents.* The chief parameters of interest in terms of environmental damage are the toxicity of the substances discharged, the degradability, the volume and rate of release of the substances and, where relevant, their flammability and explosiveness. The environmental damage pathways can be very complex involving direct and indirect effects to more than one environmental medium. The likely long-term effects of some releases can be difficult to establish. Industrial accidents may result from a wide range of non-routine conditions at industrial plants (eg, fires, spillages, rupturing of pipework, and failure of vessels), which result in the release of pollutants into the environment.

- *Nuclear accidents.* The problem of nuclear accidents is how to deal with events that result in the release of radioactive materials and which have potentially serious trans-boundary impacts but which have extremely low probabilities of occurring. Incidents (which have less serious consequences than accidents) are frequently related to the handling of radioactive liquids, sludge deposition in piping, storage of combustible or pyrophoric materials and imperfect control and monitoring of plant operations. Most incidents which have occurred at nuclear power plants inWestern Europe have resulted from human error during operations.

- *Chemical risk.* Many chemicals are applied directly to the environment or are discharged after use. At present, adequate toxicological and ecotoxicological data have been produced for only a very small fraction of chemicals and data on environmental pathways and ecotoxicological effects are even scarcer. All new chemicals brought onto the market are controlled by recent directives. The human-generated sources of dangerous chemicals that enter the air, water and soil are widespread. In particular emissions from industry can be large in volume and complex in the mixtures of chemicals that are released. Another significant source of chemicals in the environment is the use of pesticides in agriculture, which can potentially lead to the leaking ofdangerous chemicals to groundwater (see *Sections 4.7* and *4.10).*

- *Natural hazards.* 'Natural' events include earthquakes, floods, mass movements, avalanches, volcanic eruptions, storms and tidal waves. The phenomena themselves are natural but their impacts on the environment and on human activities are often exacerbated by planning decisions which fail to take into account the vulnerability of certain areas to these phenomena. This is compounded by the unpredictable nature of many of the events which only occur relatively infrequently. In addition, the engineering of natural systems such as coastlines, river valleys and slopes can serve to intensify the impacts of natural hazards. Land use planning is therefore an important tool for controlling/mitigating the potential impacts of these phenomena.

In all cases risk assessment, management and reduction measures can be taken, but a level of residual risk remains and there is little agreement on the

acceptability of risk. In general terms, the assessment of risk and the prevention, preparedness and response strategies are better developed for technological hazards (including the risks associated with the production, transport and use of toxic materials) than for natural hazards. In a few areas and Member States, such as The Netherlands, risk acceptability criteria have been developed.

Policy measures and EU targets

The overall aims of policy in all fields of risk is to reduce exposure to risk based on the precautionary principle. This has been addressed in the following ways.

- The overall goal of EC chemicals control policy is to reduce the amount of toxic substances in the environment and the risk of exposure of humans and ecosystems to a target low-risk level where only negligible risks are expected. As proposed in the 5EAP, achieving this overall goal of chemical risk control involves:

  – effective data collection on new and existing chemicals;
  – classification of hazardous properties of chemicals and appropriate labelling of containers;
  – risk assessment of new and existing chemicals; and
  – risk management by banning or limiting the use of hazardous chemicals, or substituting them with less dangerous products.

- Chemicals which are particularly hazardous or are produced in high volumes are being targeted through legislation and risk reduction programmes. Additionally, Directive 82/501/EEC (the 'Seveso' Directive), which aims to prevent major industrial accidents involving hazardous chemicals, is being reviewed. The 5EAP specifies the selection process for prioritising risk reduction programmes for chemicals up to the year 2000.

- Genetically modified organisms (GMOs) are subject to risk management and assessment procedures under Directives 90/220/EEC and 90/219/EEC.

- Legislated safety standards have been implemented to reduce the risk of nuclear accidents.

There is no targeted policy to reduce Natural Hazards, although programmes such as EPOCH have specifically addressed this source of risk. The full list of measures and actions taken by the EU is summarised in *Box 4.9.1* and *Box 4.9.2*.

State of the environment

Past trends and current status

Environmental damage from accidents, incidents and natural disasters has risen consistently the last thirty years (EEA, 1995). The major areas of concern for which data exist include the following:

- About 100,000 chemicals are marketed in the EU according to the EINECS Inventory (European Inventory of Existing Commercial Chemical Substances) with some 200 to 300 new chemicals entering the market each year. The International Register of Potentially Toxic Chemicals (IRPTC) has a data profile of about 800 chemicals in 17 different categories. Concerns arise from the number of existing chemicals already in use about which little is known so far. The EC Existing Chemicals Directive (93/793/EEC) is expected to lead to a significant improvement in data availability over a three-stage long-term programme.

- The number of serious industrial accidents that have caused damage to human health or the environment is recorded under the EC Major Accident Reporting System (MARS). Most of the accidents occurred in petroleum refineries and in the petroleum industry; highly flammable gases were the substances most often involved in notified accidents; chlorine was also commonly released. The majority of incidents occurred during normal operations *(see Table 4.9.1)*.

- Nearly 85% of accidents at sea involve tankers. As a result of improved operating standards, the number of such accidents has decreased steadily since the early 1970s: from an average of over 60 spillages pa in the late 1970s to around 30 by the early 1990s.

- A significant number of nuclear 'incidents' have been reported to the International Atomic Energy Authority since 1987, although none have been classified as involving off-site risk.

- The European Commission receives notification of releases of genetically modified organisms under Directives 90/20 and 94/15. Some 290 GMOs were released in the period October 1991 to July 1994, of which the majority were plants; releases of genetically modified microorganisms accounted for only 18 of the total.

Box 4.9.1: EU state of action in the risk management issue since 1992.

5EAP objectives for EU (1992-1995)	Actions achieved
Management of industrial risk:	
● Improved safety standards and 100% coverage of dangerous establishments	● Proposal (COM(94)4) exists to review `Seveso' Directive 82/501 and is near to adoption.
● Development of safety management standards	● (Proposal for protection of workers from chemical agents (COM(93)155) and physical agents (COM(92)560)
Chemicals control:	
● Data collection	
- Notification of all new chemicals	● Directive 92/32 (`seventh amendment') requires notification of new chemical substances to the authorities before they can be marketed. ● Regulation 2455/92 - export and import, `Prior Informed Consent', also more comprehensive list of notification
- Data collection of all existing chemicals and Council Regulation on existing chemicals	● Three lists of chemical substances are required by Directive 67/584 and amendments: *EINECS* - European Inventory of Existing Commercial Chemical Substances on the market before 18 September 1981, *ELINCS* (European list of chemical substances) and *substances classified as dangerous.* ● Testing of chemicals on market before 18.9.81 under Regulation 793/93. Relevant data to be sent to the Commission
● Hazard Identification	
- Maintenance / improvement of existing classification criteria	● Directive 93/72, an adaptation to Directive 67/584, completely replaced list of dangerous substances under the 15 danger categories. ● Testing and assessment of chemicals according to methods set out in Annex V of Directive 67/584. Risk assessment to be carried out in accordance with principles set out in Directive 93/67. A Committee is established to adapt Annexes to technical progress.
● Risk assessment	
- Amendment of Directive 67/548	● `Seventh amendment' (Directive 92/32) introduced unified scheme for the Community for the assessment of possible harmful effects upon humans and the environment. (A proposal exists to consolidate all Directives related to testing of new chemicals (COM(93)638))
- Council Regulation on existing chemicals	● Directive 93/67, adaptation of Directive 67/584, which sets out principles for risk assessment ● Data collected under Regulation 793/93 is used to prioritise substances requiring more detailed analyses. Regulation 1179/94 is the first list of priority substances established. Evaluation of risk is carried out on the basis of principles set out in Regulation 1488/94 for the assessment of risks to man and environment.

Box 4.9.1 (continued)

5EAP objectives for EU (1992-1995)	Actions achieved
- Council Directive on non-agricultural pesticides	● No action - proposal for a Council Directive establishing an EC regime for the registration of non-agricultural pesticides ('Biocides Directive' COM(93)351)
● Risk management	–
● Risk reduction programmes for 50 priority chemicals - Legislation and voluntary agreements	● Directive 76/769 relating to restrictions on the marketing and use of certain dangerous substances and preparations creates a framework for reducing risk posed by certain chemicals. The Directive has been amended 14 times and adapted twice. The Directives also ban specified applications of some chemicals (eg, Directive 94/27 bans the use of nickel in costume jewellery).
Biotechnology:	
● Risk management for contained use GMOs	
- Comprehensive review of implementation	● Directive 94/51 - new classification, adapting to technical progress Directive 90/219
- Development of more detailed criteria (safety measures)	
● Risk management for release of GMOs to the environment	
- Comprehensive review of implementation and technical adaptation	● Simplified procedure for certain releases established by Decision 94/730 ● Only one adaptation to technical progress by adoption of Directive 94/15 applicable to notification of genetically modified higher plants
- Proposal for regulatory instrument on export to third countries	–
● Risk assessment	
- Development of methodologies	● Presentations by Member States within the Working Group of Competent Authorities Work for establishing framework approach to environmental risk assessment
- Assessment and common acceptance of, for example, testing and identification methods	● Draft standards under preparation within CEN working groups
- Legislation on safe transport of GMOs	● Requirement for risk assessment in advance of transportation under Directive 90/219. GMOs included within the Directive 94/55 on the transport of dangerous goods
Protection of animals used for experimental purposes:	
● 50% reduction in vertebrates used - Directive 86/609 & Maastricht declaration on protection of animals	● Report (COM(94)195) on the statistics on number of animals used for experimental or scientific purposes

Box 4.9.2: EU state of action in the nuclear safety issue since 1992.

5EAP objectives for EU (1992-1995)	Actions achieved
Upgrade safety measures:	
• Basic Safety Standards Directive (BSS) 80/836, according to 1990 ICRP standards	• Proposal for a Directive (COM(93)349) to amend BSS awaiting adoption
• Keep safety standards up to date	• Report COM(93)649 on implementation of Decision 25.7.75 published
• Harmonise Community nuclear safety requirements	
• Extend Community safety culture to former Soviet Union and CEE	• Council Resolution concerning technological problems in the field of nuclear safety (18.6.92) to encourage coordination of safety requirements and extend the safety culture to Eastern Europe • Bilateral assistance projects have been funded through PHARE and TACIS programmes. ECU 20 million were transferred to a nuclear safety account of the EBRD in 1994.
• International framework convention	• Framework convention opened for signature in 1994, proposal (COM(94)362) for a decision on conclusion of international convention on nuclear safety
Reactivation of Treaty provision for monitoring installations (Art 35 EURATOM)	• 3-4 inspections per year
Waste management strategy:	
• include transfer of waste in BSS	• Directive 92/3 on supervision and control of radioactive waste, not incorporated into BSS.
• strategic management plan for all radioactive waste	• Council Resolution on renewal of Community Plan of Action, 15.6.92 - approval of plan for period 1993-99. The Commission published a communication on a Community Strategy for Radioactive Waste Management
Enhancing public information and education	• Manual on radio-active protection for primary and secondary school
Adequate training in radiation protection	• Programme set up in 1993 for EU and Eastern European nuclear experts

Table 4.9.1: Consequences of accidents notified on the MARS database, situation until July 1995
Source: Major Accidents Hazards Bureau, 1995.

Consequences	Number of accidents
No or negligible damage	38
Fatalities	39
- off-premises	3
Injuries	106
- off-premises	16
Material damage	165
- off-premises	55
Traffic disruption	29
Ecological harm	34
Evacuation (public and plant)	42
Public annoyance	71
Public deprived of potable water	3

Underlying factors and new insights

As indicated earlier, environmental risk covers a wide variety of sectors which do not, in general, share common underlying factors or 'drivers' in terms of the overall levels of risk.

In many instances the factors (either human or environmental) defining the level of risk are difficult to quantify, or depend on random or low frequency events. It is agreed however, that all risk management requires improved risk assessments and the translation of that assessment information into policies for prevention, preparedness and response.

Work is being done on the development of risk assessment criteria for hazards and accidents, especially technological hazards. This work often focuses on the development of 'acceptable' risk criteria for societal risk. Societal risk limits are a convenient tool for setting criteria for the acceptability of hazardous activities to society as a whole rather than to individuals.

Planning approaches to natural hazards also require a quantitative approach to risk assessment. Protection against high-magnitude low-frequency natural events may be uneconomic, so a 'design event' is chosen for planning or construction purposes (such as a flood or storm). The application of such techniques to land use planning (as opposed to the design of structures) is less common and in many Member States changes in land use (eg, waterside and coastal wetlands, which once acted as natural flood defences to agriculture) have exacerbated the potential scale of impacts which would result from a periodic incident (eg, risks of dyke failure due to high rain fall in Germany and The Netherlands in early 1995).

Progress and outlook

In some areas (such as chemical risk, industrial accidents, nuclear incidents and GMO releases), frame-works are already in place for improving and updat-ing risk assessments; this should lead to a decrease in levels of risk from these sources. In other areas (such as natural hazards), difficulties in forecasting and prediction, coupled with limited technical or adaptive behavioural responses, seem likely to lead to lower improvements in both levels of exposure and associated damages from significant events.

In the case of industrial accidents more attention is being paid to prevention and to developing guidance eg work on oil spills by the IMO and other organisations on safe practices. This is likely to reduce levels of risk - especially high frequency, low magnitude incidents - but may not lead to a significant reduction in larger events. In the cases of both technological and natural hazards the problems of low frequency high magnitude events is likely to remain a key issue in terms of risk management, despite efforts to reduce occurrence of major incidents incorporated in amendments of the "Seveso"/directive, which reached political agreement in 1995.

There are some cases where changes to technology and/or management procedures could have a significant impact on current levels of risk to the population in EU Member States and in the rest of Europe. An example is the additional risk (mortality) associated with possible accidents at European Nuclear plants. The predicted risk levels vary from 1-3 per 10 million-/year in The Netherlands to areas of the former Soviet Union where the risk is 10-100 per million/per year. The distribution of risk is dominated by plants in Eastern Europe using Soviet technology (RIVM, 1994).

It has been calculated that the implementation of western technology and safety procedures at plants in Eastern Europe could mean a 50% reduction of risk (from accidents) in one receptor country - The Netherlands. This example is indicative of the sensitivity of some risk sources to improved management.

In terms of other areas of risk, further improvements in assessment and management of risks from the release of GMOs are likely to occur both as a result of greater experience in the design and implementation of assessment protocols in biotechnology and as a result of international interest in this area of applied research.

In the case of technological and industrial risk, the proposed revision of the Seveso Directive and initiatives such as EMAS and ISO14000 will all help to improve standards of risk management in industry.

Natural Hazards are most amenable to planning measures and some Member States have procedures in place for taking account of the risks of flooding, avalanches, landslides and earthquakes in their planning and development processes. However, it does not appear, from the available evidence, that this has so far had a significant impact on the economic losses resulting from this type of risky event.

4.10 Soil quality

The issue

This section deals with soil degradation and contamination, which are both issues that were not specifically covered in the 5EAP. The main environmental pressures on soils are physical, chemical and biological degradation. Degradation in this context can be defined as a reduction in soil quality and implies changes in soil properties and processes; these changes can have an adverse impact on their stability and productivity.

Human activities such as agriculture, industry, urban development and tourism give rise to soil degradation, the extent of which is determined by, among other things, the physical, chemical and biological properties of the soils.

Soil performs a number of valuable functions:

- it acts as a medium for living organisms (animal, vegetable and microbial);
- it acts as a natural filter for solid and liquid materials;
- it provides natural buffering capacity via processes of adsorption and neutralisation;
- it assists in chemical, biochemical and biological processes; and
- it provides pathways for the subsurface water transmission via groundwater recharge and subsurface flow.

The most severe causes of soil degradation in Europe in terms of their irreversibility are erosion and pollution (including acidification and contamination by heavy metals).

Soil Erosion. Surface erosion (surface wash) consists of the detachment, transport and deposition of soil particles. While a certain level of surface erosion occurs naturally in all ecosystems, rates can be accel-erated by soil disturbances, changes in plant cover, or by other human activities that generate concentrat-ed overland flow and expose more soil to the forces of rainfall and runoff. Additionally, natural ecosystem processes such as wildfires can also accelerate surface erosion. One of the most important impacts of surface erosion is the decrease in site productivity caused by the loss of nutrient-rich surface soil. Furthermore, the sediment (and the nutrients and toxic chemicals adsorbed on the sediment) can degrade surface water supplies and deposit in beds of reservoirs, lakes and streams.

Soil pollution may be more site specific (contaminated sites) but residence times of substances (acids, heavy metals, pesticides and fertiliser residues, nitrates, etc) are much longer than in air or water, so effects can remain hidden over many years until the pollutants become released to contaminate food supplies and drinking water. The effects of past waste disposal and agricultural practices may influence wide surrounding areas. Other forms of soil pollution are diffuse: acidification and fertilisers/pesticides are dealt with in *Sections 4.3* and *4.7*.

Other major threats to soils include soil compaction, loss of organic matter, loss of soil fauna and flora, sterilisation, salinisation and waterlogging. Many of these impacts are interrelated and can result in a downward cycle of degradation. Some are irreversible (eg, loss of organic matter) and others are reversible (eg, compaction).

The extent of soil degradation depends on physical conditions such as the climate, topography, soils and geology of the area. In addition, economic activity (agriculture, industry, tourism, energy and transport) have both site-specific and wider catchment area impacts, since the impact on one site may have far greater impacts on users (other farmers, industry or urban dwellers) downstream.

Environmental policies and EU targets

While the processes of soil degradation and contamination have been evident for many years, the need for Europe-wide action to protect soils has only recently been recognised. The issues of erosion and contaminated land have been seen as national, regional or site specific and have not been addressed in the 5EAP. Policy targets and measures to date have been limited to those listed below.

- UNECE, European Soil Charter, 1977, which recognised the need to implement soil protection measures.

- EU Directive on Sewage Sludge (86/278/EEC) which regulates the use of sewage sludge in agriculture and sets limit values for concentrations of heavy metals in sludges and soils. Recommendations for lowering of upper limits for all metals are under discussion.

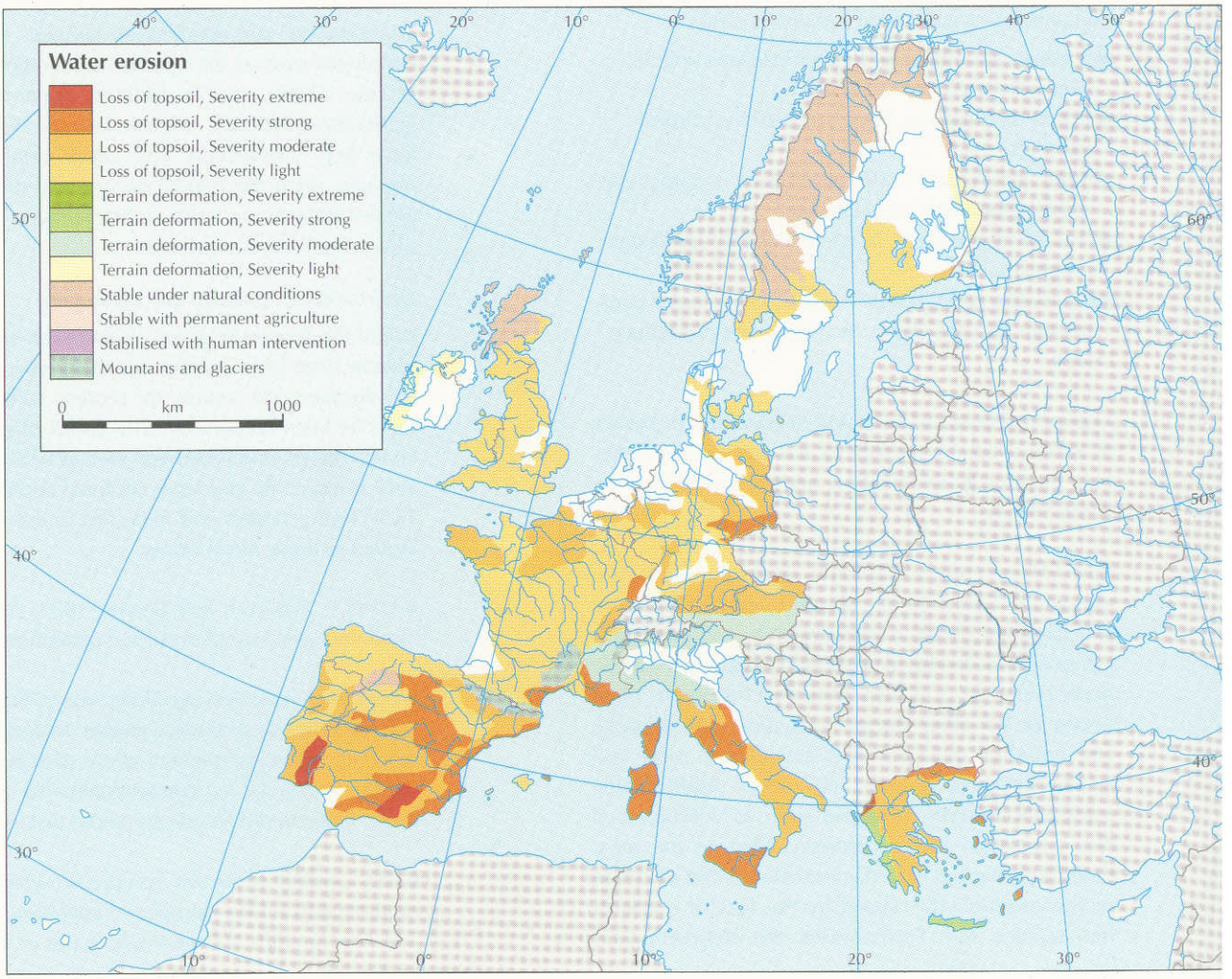
- EU Landfill Directive (proposal) which will set requirements for the design and operation of existing and new landfills and particular types of waste to be

landfilled on dedicated places. EU Drinking Water Directive and air pollutants directives which set permissible values of pollutants, but do not apply directly to soils.

State of the environment

Soil mapping in Member States is generally carried out using national soil mapping systems based on the diagnostic properties of soil horizons within the overall soil profile. The terminology and descriptions of these frequently vary from country to country. Traditionally soil mapping has focused on agricultural applic-ations. Soil parameters of environmental significance are not routinely analysed and so the data on which an overall analysis of the state of soils in the EU15 with regard to problems of soil erosion and soil pollution could be based are very limited.

Map 4.10.1: Water erosion of soils in EU15
Source: Van Lynden, 1991



Soil erosion

While it is clear that soil erosion is increasing in Europe (Blum, 1990) the information is not available to calculate the extent or trends in loss. However, maps in the Dobris report show the occurrence of water and wind erosion in 1994, based on assessment of the severity of loss of topsoil and terrain deformation (EEA, 1995). These maps highlight the features listed below.

- *Water erosion:* there is widespread potential for water erosion on the land surface of the EU *(see Map 4.10.1)*. The area of land with a high erosion risk in the Southern Member States is 22.9 mio ha (about 10% of the rural land surface). The extent of this risk extends to one third of land in Portugal, 20% in Greece, 10% in Italy and 1% in France. A report by ICONA in Spain (1991) shows that some 44% of total land area is affected by erosion and 9 mio ha (18%) currently loses more than 50 t/ha pa, which is considered the critical load for erosion; national average losses of 27t/ha/pa were reported, compared to soil

formation of 2-12 t/ha/pa. The cost of soil loss, including reduced lifetime of reservoirs, loss of agricultural production and damage due to flooding, is estimated at 280 mio ECU pa. The cost of rehabilitation to restore plant cover, improve water retention and protect soil is estimated at some 3,000 mio ECU over a period of 15-20 years.

- *Wind erosion* affects mainly localised parts of the east of England, west of France and The Netherlands, Northern Germany and the coasts of Sicily.

- Areas susceptible to *desertification* are shown in the CORINE data base, but much more detailed assessments are needed to delineate areas susceptible to this complex process and to further understand the process itself.

Soil pollution and contamination

The pollution of soil by heavy metals, excess nutrients, acidification and organic pollutants is a widespread form of environmental degradation. The effects of large scale contamination due to air emissions and long range transport in the atmosphere are also worth mentioning. The long history of agriculture and settlement, the intensive mining of minerals, and the widespread agricultural management of soils contribute to a complex pattern of soil pollution in Europe.

Contaminated sites can be viewed as local point sources of soil pollution. Since the second half of the 1980s, initiatives have been taken to record the extent of contaminated land in the EU. A Commission report in 1992 identified some 200,000 ha of derelict land in EU12, of which some 25% is caused by past mining and iron and steel activity (of which more than 90% is in Belgium, France, Germany, Spain and the UK). In addition, some 70,000 ha in former East Germany is contaminated as a result of abandoned lignite mining. However, the actual extent of contaminated land is unknown and is likely to be several times larger than the area identified in the Commission's report.

Table 4.10.1 shows that an estimated 55,000 registered contaminated sites exist in EU12 countries, of which some 22,000 are in a 'critical' condition. The vast majority of the identified sites are associated with past waste disposal activities.

However, this information is incomplete for a number of countries that have only included landfill rather than old industrial sites, but work done in Germany and The Netherlands indicates that:

- serious pollution has occurred at some 20% of present and former industrial sites in The Netherlands (Meeder and Soczó, 1992); and

- 10-20% of 135,000 suspected sites (industrial, landfill and military) will turn out to be contaminated (NATO/CCMS, 1992).

Little information is so far available on levels of potential contaminants, which are numerous, some with unknown effects on human health and ecology.

The estimated cost of a 15 year clean up programme for critical sites alone is expected to be in excess of 26 billion ECU. These figures probably underestimate the true extent of contamination, since information on registered sites is lacking in many countries.

Underlying factors and new insights

Soil erosion is a natural process with soil from some areas being deposited in others through the action of wind and water. However, the following human activities have considerably sped up the process:

- agricultural activities such as intensification, removal of vegetation cover and hedgerows, ploughing against the contours of slopes, late planting of winter crops, overgrazing, abandonment of terraces and use of heavy machinery leading to compaction of soils, exposure to wind and rain and an increase in the amount and speed of surface water run-off;

Table 4.10.1 estimated numbers of contaminated sites in the EU12
Source: Carrera and Robertiello, 1993

	No. registered contaminated sites	No. sites in critical condition	Clean up costs (already spent) mio ECU	Estimated costs for clean up of critical sites - 15 year programme
Belgium	8,300	2,000	*	1,000
Denmark	3,600	3,600	*	200
France	*	*	*	4,000
Germany	32,500	10,000	228	7,000
Greece	*	*	*	200
Ireland	*	*	*	180
Italy	5,600	2,600	89	3,000
Luxembourg	*	*	*	50
Netherlands	5,000	4,000	1,300	1,000
Portugal	*	*	*	*
Spain	4,300	*	*	1,000
UK	*	*	267/pa	9,000
Total EU12 (estimation)	> 55,000	> 22,000		26,630

Note: * means available data is not complete

- deforestation of traditional forest cover and conversion to agricultural land or in some cases afforestation with exotic species, such as Eucalyptus with high water requirements and lack of understorey species;

- tourism, building of roads and dams have also contributed to localised erosion in fragile areas such as mountains; and

- urbanisation of flood plains and development of unstable slopes leading to increased numbers of severe erosion events;

This intensified erosion and degradation of natural vegetation has in turn led, especially in arid and semi-arid lands, to changes in the micro-climate, sometimes exacerbated by natural events such as forest fires and eventually irreversible desertification (defined as, land degradation in arid, semi-arid and dry-subhumid areas resulting from climatic variations and human activity'). Areas in danger of desertification naturally support only sparse vegetation. Intense land uses can cause loss of organic matter, deterioration of soil structure, changes in salt and water balances, reduced infiltration capacity and higher erosion rates. The above factors have in turn contributed to a declining viability in many marginal farming areas, leading to abandonment of farms and accelerated erosion. Desert areas are now largely uncultivated, although some problems exist on irrigated lands. Desertification has long been recognised as a major problem in Asia and Africa, but only recently in some parts of Spain, Sicily and Greece. Further climate change as a result of global warming may lead to a greater area of the EU being susceptible to desertification (Conte and Colacino, 1995).

Contaminants affecting soil may be in the form of gases, solids or liquids. The most common toxic soil pollutants include metallic elements and their compounds, organic chemicals, oils and tars, pesticides, explosive and toxic gases, radioactive materials, combustible materials, asbestos and other hazardous minerals. Contamination can be caused by spillage, leakage, handling of materials from:

- ongoing activities or storage of materials or waste on industrial sites;
- disposal and leaching of industrial and domestic waste in controlled landfills or illegal dumps;
- as a result of mining or minerals extraction, including deposition of heavy metals downstream in flood plains; and
- military activities.

Sites are often only identified when there is a change in use (eg, conversion to residential use, on transfer of property, or closure of an installation), although there is no mandatory requirement for soil investigation.

Progress and outlook

There is no EU policy to combat soil erosion or desertification, although Community funds through some agriculture, forestry and environment programmes are used for specific projects in Member States to combat erosion. Most affected Member States in the Mediterranean area have plans or programmes to fight erosion; many are linked to reforestation, forest fire prevention and protection of water catchments.

The situation is not visibly improving, because the underlying factors and processes are mostly long term in nature and the inertia is difficult to counteract, despite a large number of available techniques for reversing and remediating damage. If current measures to combat climate change are not successful, then a larger area of the EU may become susceptible to desertification in the longer term.

The extent of contaminated land is still unknown but new information is likely to reveal an even greater problem than previously thought. There is no soil-specific legislation at EU level but many countries have guidelines or standards related to target or threshold values for specific potentially hazardous substances, but these vary widely. Specific regulations and standards for the remediation of contaminated areas have only recently been developed and do not yet exist in the majority of Member States. There is therefore no agreed standard for clean-up or for the subsequent after use of sites.

However, several Member State (such as Denmark, Sweden and The Netherlands), have started a systematic recording, monitoring and clean-up programme of contaminated sites based on established clean-up technologies. However, the rate of clean-up is constrained by legal, technical and financial factors and in particular the very high costs, which are expected to exceed 100 billion ECU for EU12 (for both critical and non-critical sites). The Polluter Pays Principle has proved difficult to apply due to the long periods over which contamination has occurred, making it difficult to identify the original polluter, apply obligations retrospectively and impose such high costs, when the benefits will be shared between individual companies and society as a whole.

Current policy proposals have therefore focused on prevention of future contamination by developing corporate responsibility for reducing industrial emissions and the amount of generated waste (through application of Best Available Technologies) and requiring companies to develop Environmental Management and Auditing Systems (EMAS) and risk management facilities (Seveso Directive). In addition the increasing attention being paid by industry to environmental management systems and to standards help to focus attention on preventative management of potential sources of pollution.

The EC published a White Paper on Liability for Industrial Pollution in 1994. Studies are currently being undertaken to explore how a common liability system and a compensation fund for the clean-up of past pollution might work, and on how the costs and burdens of such a system might be shared.

Better data on the extent of soil degradation and contamination and establishment of monitoring networks to assess the effectiveness of measures that have been put in place is a pre-requisite to any more co-ordinated approach to soil protection in the EU.

4.11 Nature and biodiversity

The issue

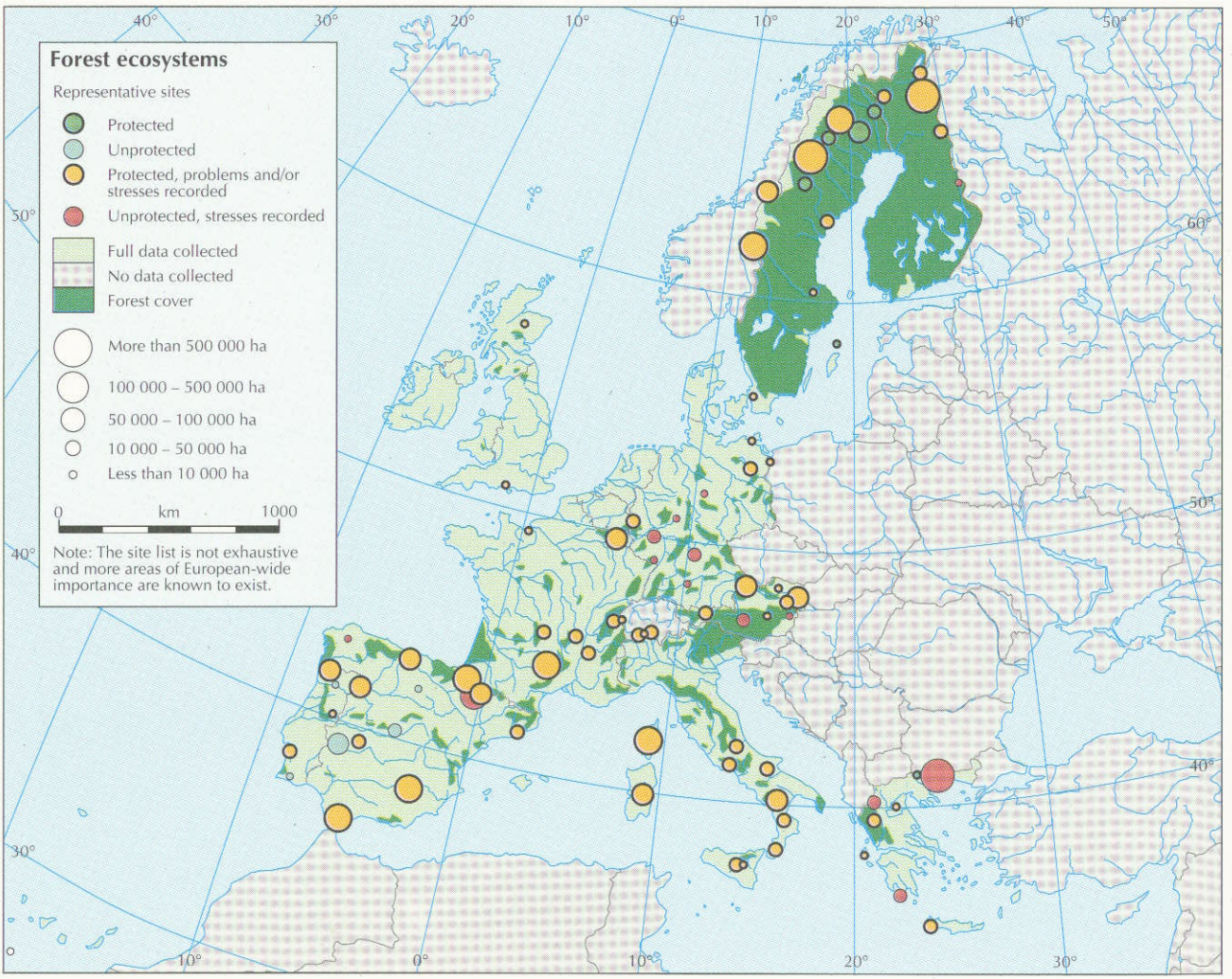
Biodiversity in the EU is under pressure from a broad range of human activities. Loss of unique or endangered biota and their habitats is a continuing process. The focus in Europe has mostly been on the protection of valued habitats/ecosystems, on endangered or threatened species and on important migratory species.

Biodiversity may be considered at four levels, which are all under pressure: landscapes; ecosystems/habitats; species/populations; and genes. Landscape ecology and genetic diversity are relatively new concepts to nature conservation and face difficulties in terms of standardised definitions and measurement; they have thus attracted less policy attention.

The focus for many years was traditional, dealing with conservation aspects of threatened or endangered features. Recently, the broader range of issues is beginning to be taken into account, incorporating the general environmental functionality of all four levels. The biodiversity components associated with biological production, recycling, pollution, etc are starting to be considered, thus rendering integration of biodiversity with human activities possible.

The CORINE biotopes project identified 8 key ecosystem types:*[13] forest; scrub and grassland; inland waters (excluding major rivers); wetlands (bogs, fens and marshes); coastal and marine; mountains; deserts and tundras; and agricultural/urban ecosystems. *Maps 4.11.1* and *4.11.2* show the extent and pressures to two exemplar ecosystems (forests and wet lands respectively), while *Table 4.11.1* summarises the impacts and degree of severity on forest ecosystems of the pressures arising from human activities and failure

Map 4.11.1: Forest ecosystems: representative sites Source: EEA, 1995



*13 Plant communities are organised into 8 broad categories of 'ecosystems groups' with numerous sub-categories referred to as habitat types, which are in turn differentiated into sub-units, each of which is characterised by the presence of typical species. See (EEA, 1995) or CORINE Biotopes directory.

to meet 5EAP targets for the major environmental themes by the year 2000.

In general, the intensity of all human activity (agriculture/forestry, industry, energy, transport and tourism) can impact biodiversity negatively or positively as a result of either general and specific pressures.

- *General pressures* include land use, destruction or fragmentation of habitats, pollution, over exploitation of resources (over harvesting or overgrazing) etc, which directly affect landscapes or ecosystems, but indirectly affect also species and genetic diversity.

- *Specific pressures* include consumptive uses such as hunting, fishing, collecting etc, which directly affect species and populations, but which also have severe affects on ecosystems.

However, it should be noted that while pressure from climate change, air, soil and water pollution affects biodiversity in general, the major factors affecting the quality of specific habitats and the species that they support relate mainly to land use and land management, including the chemical and livestock regimes. Since agriculture and forestry account for some 80% of land use in the EU, the intensity of agricultural management is a major factor for many habitats. It should, however, also be noted that the cultural landscapes in Europe are a result of traditional agricultural practices over a long period of time, which have contributed to a diversification of habitats and thus biodiversity.

Environmental policies and EU targets

The overall goal identified in the 5EAP is the maintenance of biodiversity through sustainable development and management in and around natural habitats of European and global value and through control of use and trade of species. Specific targ ets include those listed below.

Map 4.11.2: Bog, fen and marsh ecosystems: representative sites

Source: EEA, 1995

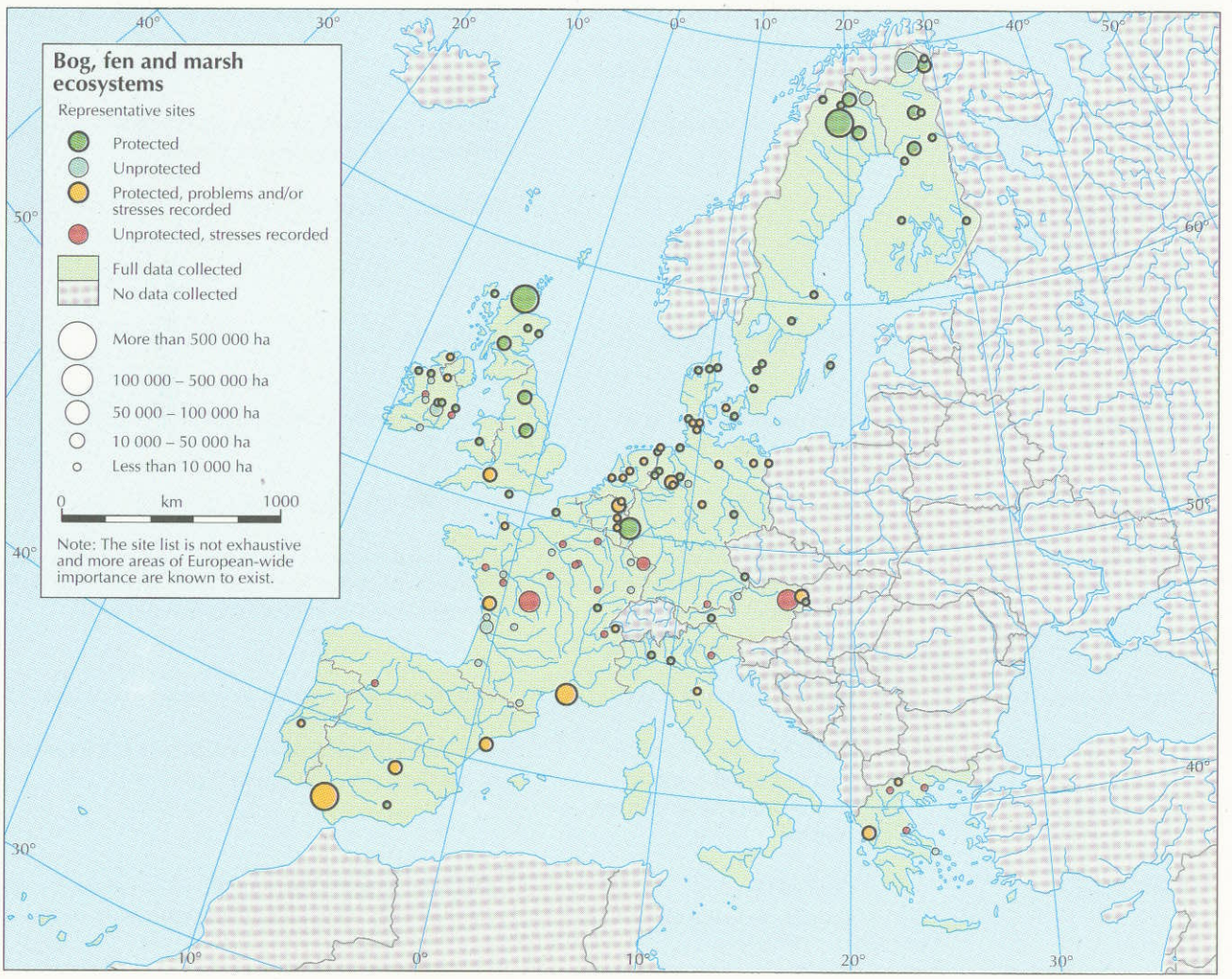


Table 4.11.1 Potential impacts on forest ecosystems of not reaching targets for 5EAP environmental themes

Environmental pressure	Pressure	Impact (I = irreversible; R = reversible; L = local)
Global scale		
Climate Change	1-3 degree temperature rise in next 50 years	Loss (or expansion) of species at limits of their range (I)
	Changes in rainfall by season and region	Variable, may reduce diversity of lichens, which is currently highest in regions with moist climates (Sweden, UK and France)
	Wide range of estimates for sea level rise	Limited impact except for coastal forests (L, I))
	Increase of CO_2	Increased rate of growth
Ozone Depletion	Increase in ground level UV even if targets for 2000 are met	Not well known yet, may increase vulnerability to other pressures (R), may also impact on species at limits of their range (I?)
European/Trans-boundary scale		
Acidification	Deposition of acid substances in exceedance of critical loads over 34% of land area (Europe)	Dieback of trees (R), acidification of soil, lakes and water courses
Airborne pollution	Nitrogen deposition; TSP	Changes in growth and species composition (L, R), (loss of lichen species, oligotrophic plants)
Radioactive risk		Impacts on biota and food chain (I), genetic change (I)
Regional scale		
Waste	Emissions of dioxins	Uncertain
Water • quality	Nitrates loads leading to eutrophication Pesticide residues	Loss of diversity in forested areas
• quantity	Lowering of water table	Increased risk of forest fire
Urban Issues	Air quality; traffic congestion; roads and residential developments leading to pressures on green space	Pollution damage to urban trees Pressures on green belts and small woodlands (L,R), Fragmentation of habitats and tranquil areas
Chemical and oil risk	Risk of accidental spills	Less impact than coastal or waterside ecosystems
Coastal zone management	Lack of sewage treatment Loss of natural habitats Loss of wetlands and dune systems	Less impacts than marine ecosystems but increased risk of flooding; saline intrusion (L,I)
Soil Erosion	Change in micro climate, reduced rainfall	Soil compaction, faster run off, loss of nutrients, reduce viability of existing natural and plantation forests (L,R)

- *Maintenance or restoration of natural habitats and species* of wild fauna and flora at favourable conservation status. Methods include: promotion, negotiation and ratification of international conventions; or introduction of legislation if EU is nonparty (see *Table 4.11.2*). Four of these treaties also include establishment of networks of protected areas.

- *Creation of a coherent European ecological network of natural and semi-natural biotopes under NATURA 2000*, which is based on:
  - the Habitats Directive (92/43 EEC) and its annexes and updating of the Birds Directive (79/409/EEC);
  - setting ide zones and migratory corridors (which are likely to become increasingly important for maintenance of biodiversity);
  - developing action programmes for efficient conservation and monitoring of the sites designed for Natura 2000; and
  - increasing funds available for the management of sites through the LIFE programme.

- *Strict control of abuse and trade of wild species (CITES)* through inventories and monitoring systems for endangered and overexploited species and regulations concerning internal and international trade of endangered species.

Table 4.11.2 International conventions related to nature conservation

Convention	Secretariat/Focal point	Aim
Ramsar Convention* (Ramsar sites - 296)	Bureau de la Convention Ramsar	To ensure protection of wetlands of international importance, particularly as habitats for waterbirds
Paris Convention* (World Heritage Sites - 7 and 59 Biosphere Reserves)	UNESCO	To ensure national and international protection of cultural and natural heritage of exceptional universal value
Washington Convention* (CITES)		To control the international trade of animals and plants (dead or alive)
Bonn Convention	UNEP	To provide international obligations for conservation of migratory wild animal species
Biodiversity Convention	UNEP	To ensure conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising from the utilisation of genetic resources
Bern Convention	Council of Europe	To provide international obligations for the conservation of European flora and fauna and their natural habitats
Barcelona Convention (linked to 94 sites Mediterranean Action Plan)	UNEP	To prevent, reduce and fight pollution in the Mediterranean and to improve the marine environment
Alpine Convention*	–	To improve protection of the alpine environment in the framework of sustainable economic development
Helsinki Convention (Baltic Sea Protected Areas - 41 (in EU)	HELCOM	To improve the quality of the Baltic environment including marine and coastal protected areas
Community Directives		
Birds Directive (Natura 2000 sites 1157 Special Protected Areas)	EC	To protect wild birds and their habitats through a system of Special Protected Areas
Habitats Directive (Natura 2000 sites)	EC	To maintain biodiversity through conservation of natural habitats and specific flora and fauna

* EU non member

Finally one of the key themes of the 5EAP is integration of environmental issues into wider policies affecting other sectors and activities. Since all human activities impact on biodiversity, and land use planning and management are such key determinants, integration of environment into agricultural policies must be seen as a key objective of the 5EAP.

EU policy measures since 1992 are summarised in *Box 4.11.1.*

State of the environment

Past trends and current status

Ideal indicators for biodiversity would cover landscape, habitat, species and genetic diversity and provide a picture of how and why biodiversity is changing over time and in relation to human activities and geoclimatic factors. However, as noted above, current knowledge of landscape ecology and genetic diversity is limited. Attempts to identify useful indicators have

Box 4.11.1: EU state of action in the nature and biodiversity theme since 1992

5EAP objectives for EU (1992-1995)	Actions achieved
Maintenance or restoration of natural habitats and species of wild fauna and flora at favourable conservation status	
• Habitats Directive	• Lists of potential SACs (Special Areas of Conservation) to be provided by June 1995, most Member States not produced draft lists by spring 1995. One Member State has delivered and 4 have partially delivered lists (September 1995).
• Updating Birds Directive	• Commission communication on the *Wise use and conservation of wetlands*, adopted 30.5.95
	• Annex II amended, proposal to amend hunting seasons (COM(94)39)
European network of protected sites, including Natura 2000	
• Setting identification criteria for habitats, buffer zones and migratory corridors	• Identification had been based on CORINE and national inventories. No criteria for buffer zones and migratory corridors yet.
• Action programmes for efficient conservation and monitoring of the sites designed for Natura 2000	• No specific action programmes for sites. LIFE and Regulation 2078/92 provide funding programmes.
Strict control of abuse and trade of wild species	
• Inventory, monitoring systems, and recovery plans for endangered and over-exploited species	
• Regulations concerning internal and international trade of endangered species	• Regulations 3626/82 and 3418/83 continuously amended (eg, by Regulations 1970/92, 1534/93). Another proposal (COM(91)448) exists which is likely to result in a complete overhaul of the existing system.
• Reform of CAP, notably zonal programmes for support of environmentally friendly agricultural practices	• Proposals under Regulation 2078/92 were due to be submit ted by July 1993. New programmes are supposed to be launched for the period 1994-99. Many of these are now in place.
• Measures to maintain and protect forests	• Several amendments have been made to Regulation 3528/86 on the protection of forests against atmospheric pollution. The European Forestry Information and Communication System monitors forest health. (Amended proposal (COM(94)153) concerning action in the field of tropical forests)

have so far mainly focused on the existence and quality of habitats/ecosystems and species/populations diversity rather than on the functionality of the system and the relations to environmental pressures. Development of indicators for habitats face problems of characterisation, classification, mapping and establishing links to other sectors, while species data relate only to a limited number of well known taxa and their presence or absence, rather than to their viability and functionality.

At present the most commonly used indicators are:

- the extent of protected areas (which still does not reflect on the quality of habitats and the extent to which they are being protected);
- the number of known, endemic and threatened species; and
- some pollution pressure indicators using algae, lichens and invertebrates.

Figure 4.11.1 shows average numbers of species and the proportion which is threatened. There is an estimated total of 3,300 wild plant species in EU12, of which some 10% are threatened. *Figures 4.11.2* and *4.11.3* illustrate the levels of endemicity for higher plants and vertebrates for EU15. Although the concept of endemicity only really makes sense with a natural system with boundaries (eg, an island, mountain chain or climatic group), the indicator clearly demonstrates the importance of the contribution of Mediterranean States (France, Greece, Italy, Spain and Portugal) and the need for effective conservation of biodiversity in these locations. In addition the points listed below are worth high-lighting.

- *Freshwater fish:* Despite the existence of large river systems, Europe has relatively low diversity of species, of which almost one third is threatened.

- *Reptiles and amphibians:* Out of 10,550 known species worldwide, Europe as a whole has only 71 amphibians and 199 reptiles, with the greatest diversity found in the Mediterranean region – almost one third of reptiles in the EU12 is threatened.

- *Birds:* Due to its particular interest for conservation and recreation, this taxonomic group is the best known from the point of view of inventory and quantitative data; diversity of bird species is particularly rich in the UK (520), France (353) and Greece (407), but more than 100 species are threatened in each of these countries (28% for EU12 as a whole); many of the threatened species, such as the Bustard, are good indicators of wider threats to disappearing habitats such as extensive moorlands and steppes.

- *Mammals:* Europe has some 5% of the world's species, nearly 10% of those found are not endemic but have been introduced from elsewhere; nearly 40% of species are currently threatened. The largest number of all species are found in Mediterranean countries (Greece, Italy, France and Spain), which each have more than 80 mammal species (compared to less than 50 each in UK, Netherlands, Denmark, Belgium). However in several Mediterranean countries the absolute and relative number of threatened species is also very high - up to 65% in both France and Greece.

- *Higher Plants:* Europe has some important centres of endemism, particularly in the Mediterranean mountains and islands *(see Figure 4.11.2)*.

- *New EU15 habitats:* The new Member States will increase the range of biodiversity by adding new types of habitats to the EU, including:

  - Austrian and Swedish Alpine habitats;
  - Finnish and Swedish boreal forests (a new EU habitat which has led to amendment of the Habit ats Directive), which will increase average EU forest cover; and
  - both Finland and Sweden have extensive areas of wetland; between 1950 and 1990 some 23% of

Figure 4.11.1: Average percentage of threatened mammals, birds, freshwater fish, reptiles and vascular plants in EU12
Source: Eurostat, 1995

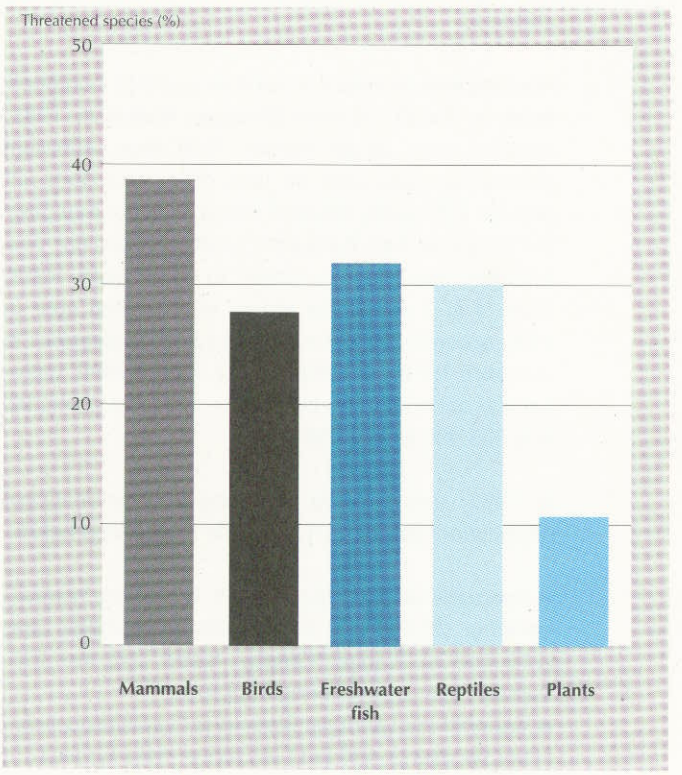
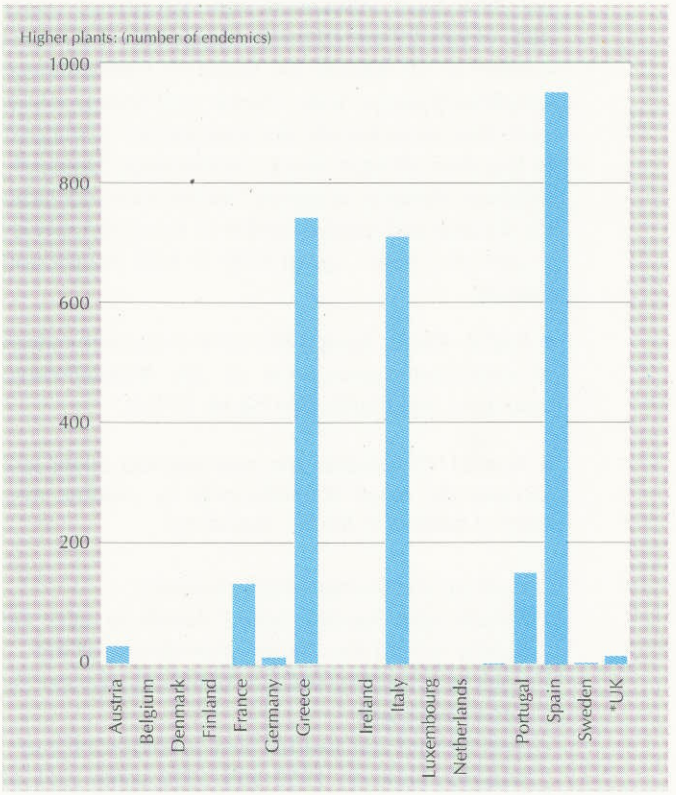


*Figure 4.11.2: Number of endemic higher plants at national level **
Source: Groombridge (1992) cited in ETC/NC, 1995



*Data to be checked

Finnish marshland has been lost through conversi on to pastures; Sweden has extensive areas of bog and fen.

No complete inventory of habitats and their condition exists in the EU. Corine Biotopes, started in 1985, contains now approximately 7000 sites. Although information does exist on land cover, this does not provide sufficiently detailed information for mapping the extent of key European habitats. Thus the best available information relates to designated areas. *Table 4.11.3* shows the extent of protected area in 1990 according to the equivalent IUCN categories in use since 1978, covering sites of international, regional and national importance. The total area protected was 205,900 km² in 958 sites.

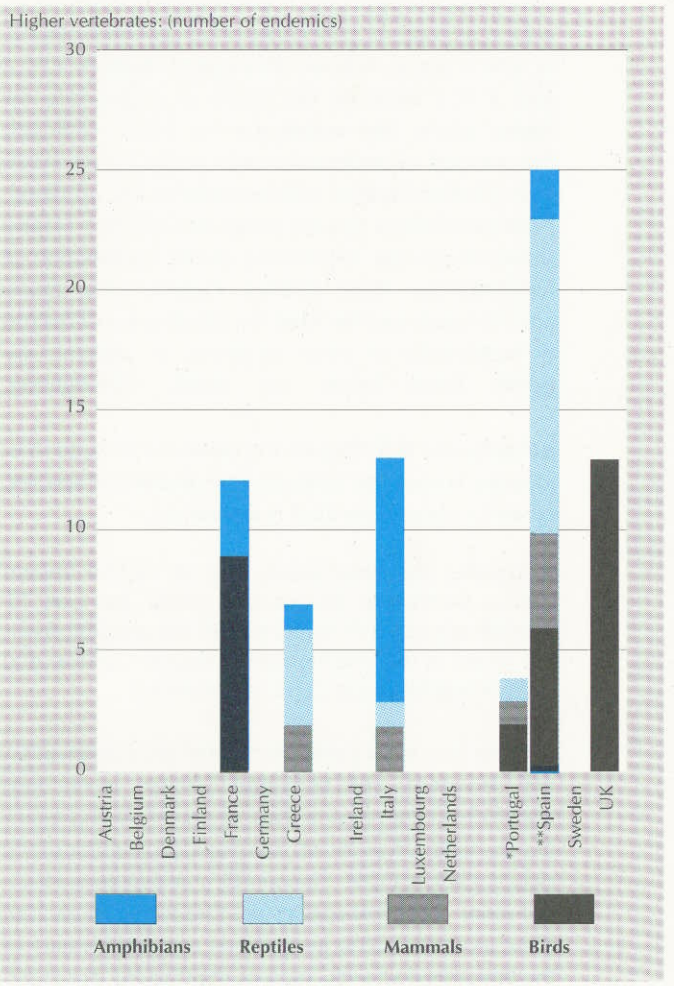
In 1995, sites covered by recognised international designations for the EU15 include those listed below.

- *International designations*: 59 biosphere reserves covering 32,000 ha and 7 World Heritage sites (170 km² in France, Greece, Spain and the UK); Ramsar: 296 sites covering 33,430 km²;
- *Regional conventions*: Barcelona Convention sites cover 94 sites (3,400 km²) in France, Italy, Greece and Spain; Helsinki convention covers 41 sites in Denmark, Finland, Germany and Sweden; and
- *European designations*: Birds Directive includes 1157 sites covering 69,000 km².

This suggests a total area with international designations of 127,000 km² at nearly 1,600 sites (adjusted for multiple designations of some sites) (Roekarts, 1995).

However, the extent of designation does not provide an indication of the state of habitats or the pressures upon them. In the absence of an inventory of key habitats or their status, the Dobris assessment provides data from surveys of 'representative' sites to give an indication of the pressures and status of key habitat types. *Table 4.11.4* summarises the key findings for four 'representative' habitats, based on an

Figure 4.11.3: Number of endemic vertebrates at national level excl. fish
Source: Groombridge (1992) cited in ETC/NC, 1995



** Azores and Madeira included*
*** Canary Islands not included*

assessment of nearly 370 sites in the EU15. This suggested that, despite the fact that some 70% of the area under consideration had some form of protective designation, nearly 60% of sites were under threat.

Related to habitats, *forest condition* could be considered an indicator, albeit only partial, of general condition of natural habitats in Europe. Forest condition reflects the impact of different adverse environmental factors: air pollution and acidification, forest fires, weather conditions, particularly drought, and pests and diseases; the latter ones being mostly the consequence of trees being weakened by other environmental stresses.

Since 1988 the EU and UNECE reports on 'Forest Condition in Europe' provide information on the health status of samples of European trees. The indicator used in this monitoring exercise is the percentage of damaged trees (with more than 25% defoliation.) In all climatic regions of the European continent the share of damaged trees has increased since 1988. Overall, this share was 9% in 1988 and 19.3% in1994, showing a continuous increase in adverse environmental conditions for forest ecosystems. The figures for the EU countries are slightly lower, but also increasing. In the last two years the share of damaged trees in the EU has been 16% in 1993 and 17.7% in 1994, increasing both in conifers (17 to 18.6) and broadleaves (15.1 to 16.9) (UNECE/EC, 1995).

Underlying factors and new insights

Threats to habitats and to biodiversity are closely related to land/resource use and to land management of the habitat itself and are summarised in *table 4.11.5*; this table shows that energy and industry mainly impact through pollutant emissions, while the main impact from agriculture and tourism are through land take and land management and associated impacting factors.

Progress and outlook

A number of positive initiatives have been undertaken to protect and enchance biodiversity in the EU. In particular:

Integration of nature conservation policies

Nature conservation has been integrated into agricultural policy since the 1992 CAP reforms (2078/92) through: the general reform of commodity prices; the requirement for arable land to be set aside; the reduction of cattle stocking rates; and the accompanying agri-environment measures. The impact has been to reduce the amount of land under agriculture (see *Sections 3.2* and *3.6).*

The agri-environment measures are being applied at Member State level, although the allocated budget is equivalent to only 3% of all CAP spending. Zonal programmes for environmentally friendly agriculture are intended to further reduce adverse impact. New programmes including long term set aside (Habitats programmes), support for environmentally friendly (low input and organic) farming and support for wood-land and conservation management. These measures have been introduced with positive impacts since 1994 and from much earlier in some Member States such as Germany, The Netherlands and the UK.

Table 4.11.3 Protected area by IUCN category, EU12

IUCN Category	Management aims	Number sites (EU12)	Area covered km²
I - Strict Nature Reserve	Mainly for science or wilderness protection	11	300
II - National Park	Mainly protection and recreation	34	7075
III - Natural monument/ landscape	Mainly conservation of specific feature	28	2490
IV - Habitat & Species Management Area	Mainly for conservation through landscape intervention	327	25,800
V - Protected Land/seascape	Mainly land/seascape protection & recreation	558	170,550

Afforestation of agricultural land is promoted under Regulation (EEC) 2080/92 and grants under the agri-environment package support management of neglected woodlands. Afforestation for commercial forestry is likely to continue. While insensitive plantation systems of the past have had a negative impact on biodiversity and nature, sustainable multi-purpose forestry principles and practices introduced in most Member States are offering opportunities for increasing biodiversity in plantation forests.

Establishment of a network of sites

International Conventions shown in *Table 4.11.2* have been ratified establishing an international network of sites.

More limited progress has so far been made in the development and management of a Europe-wide system of biotopes. The CORINE biotopes programme has been implemented, but it is an information rather than a management system. More than 7000 sites are described in the data base. Not all countries have participated in this work and criticism has been expressed regarding the classification (geographic and taxonomic) system and the extent to which it therefore represents all important habitat types. An assessment of the status and users of the system is currently being undertaken by the European Environment Agency.

The Birds Directive designated sites have increased from 843 sites covering 67,000 km² in 1993 to 1,157 sites covering 68,900 km² in 1995. Annex II has been amended and modifications to hunting seasons are proposed (COM(94)39), although some opposition is expected from Member States where hunting is culturally important.

The Habitats Directive is still in the process of implementation; lists were due for submission by June 1995 but most Member States still have not produced draft lists of nominated sites. The Natura 2000 network has the potential to become an important tool for conservation of natural and semi-natural biotopes in Europe with: the designation of sites; mangement and monitoring requirements; and the option to identify corridors and buffer zones for the selected sites. The total time frame for implementation of the Directive is 9 years and the European Environment Agency will monitor progress.

Nature recovery programmes

The LIFE programme and Regulation 2078/92 provide funding for a wide variety of initiatives of international importance including restoration of rivers in Denmark and the UK, and the development of sustainable tourism in rural areas in Southern Member States. The LEADER programme for rural areas has funded a number of projects to restore species diversity through protection and re-introduction of indigenous species (fruits, ponies, wildlife, etc) that diversify agricultural production in marginal areas. In addition, Member States have provided financial assistance for pilot projects related to national nature recovery priorities including:

- liming of rivers and recovery of salmonoid fisheries in Scandinavia;

*Table 4.11.4 Key ecosystem types and threats to habitats, EU15*on).

Ecosystem type	Habitat threats	Extent/comment
Forests	Fragmentation and limitation of size, type of forest management & exploitation, quality of regulation; forest fires in the south; pollution in the north	82 sites; 59 protected - 70 under threat
Scrub & grassland	Agriculture (ploughing, drainage, grazing, fragmentation), afforestation & tourism developments	125 sites; 74 protected - 53 under threat
Wetlands: bogs, fens & marshes	N/A	109 sites: 76 protected - 50 under threat
Mountains: rocks & screes	N/A	51 sites; 43 protected - 44 under threat

Table 4.11.5 Impacts of sectoral activities on biodiversity

	Type of activity	Impact on biodiversity
Energy	Land take (power plants, dams, barrages)	Loss of habitats
	Air borne pollution, acidification, climate change	Damage to species and ecosystems
	Afforestation for energy forestry; planting fuel crops	Introduction of mono-culture; loss of genetic diversity
Transport	Land take	Loss of habitats (small area) fragmentation of habitats.
	Noise	Disturbance species, loss of tranquil areas
	Congestion	
	Air pollution, acidification, climate change	Stress to vegetation and fauna
Industry	Land take (extraction of materials, processing plants, infrastructure, storage/disposal of waste)	Loss of habitats
	Global issues: emissions of CO_2 and ODPs	Climate change and increased UV levels will have different impacts on different habitats but will change species composition of many ecosystems
	Transboundary and local air quality related pollutant emissions, use of ODPs, climate change	Persistent and accidental damage to ecosystems and species from acid deposition and concentrations of pollutants in air
	Water pollution (emissions of organic, toxic and persistent pollutants)	Surface and groundwater contamination leading to loss of species and genetic diversity
	Risks of accidents (chemicals, oil spillages, ongoing discharges)	Soil contamination
	Noise and odour	Disturbance of sensitive species
Agriculture and forestry	Land use change; clearing, ploughing and drainage of land	Loss of natural and semi-natural habitats; 80% of land area under agricultural uses, extensive systems which maintain semi-natural habitats (dehesa, moorland, heathland) being lost due to intensification or conversion to plantation forestry.
	Intensification of traditional farming systems	Eutrophication, pesticide residues - loss of genetic diversity
	Increased use of nitrates, pesticides	
	Introduction of high yielding varieties exotic monocultures and Genetically Modified Organisms (GMOs)	
	Abstraction of water	Drying out of wetlands, desertification, soil erosion, saline intrusion, forest fires leading to loss or changes of landscape, habitats, species and genetic diversity
	Increased stocking rates (overgrazing, methane emissions contribute to climate change)	
Tourism	Land take (marinas, golf courses, hotel developments, road etc)	Loss of natural and semi-natural habitats
	Traffic: congestion, emissions	Disturbance of sensitive species
	Destruction of habitats	
	Disturbance	

- dismantling of artificial embankments and recreation of natural water courses; restoration of dune systems in The Netherlands; and

- schemes for recreation of key semi-natural habitats in the UK (including lowland heaths, calcareous grasslands, uplands, waterside and coasts) and for increasing the biodiversity of plantation forestry.

Impacts sectorial activities

However, negative impacts on biodiversity as a result of the activities in each of the target sectors continue. Habitats and species are still subjected to stress from air, water and soil pollution, from land development pressures and simply from the intensity of human activities. In order to safeguard wider areas (outside of the 200,000 km^2 currently protected) from development and over use, and to reduce air and water borne stresses on all areas and all levels of bio-diversity, reduction of environmental pressure is required across a number of sectors (CAP, forestry, transport, energy, tourism, structural funds) on: land/soil use, erosion/desertification and pollution. Management of catchment areas for large aquatic systems is also required.

5. INTEGRATION ECONOMY AND ENVIRONMENT

This chapter presents a summary of the contribution of the 5EAP target sectors to each of the environmental themes (described *in Chapter 4*). For a full assessment of each target sector, the reader should link this discussion with *Chapter 3* on societal trends. 'Households' is also included as a target sector here; although not addressed specifically in the 5EAP, it merits discussion of the issue of sustainable consumption. Other candidate sectors for inclusion in this section, but which have not been considered are: fisheries, the construction sector and the environmental industry.

Finally, this chapter presents a short overview of environmental expenditures in the EU (by theme and by sector), data availability and the impact of environmental policy measures on economic development.

5.1 Target sectors

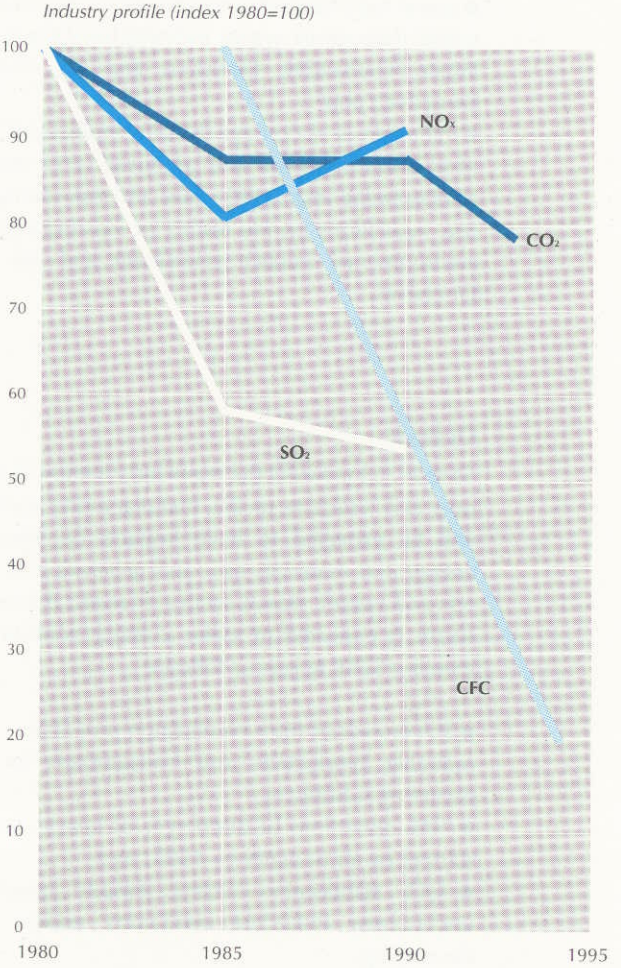
Industry

Emissions and other environmental impacts

This section covers the manufacturing sector with a particular focus on those activities that most contribute to the 5EAP themes described in *Section 3.3*. These sectors include ores and metals, non-metallic minerals, refineries, chemicals, textiles and clothing, pulp and paper; they impact on most of the 5EAP themes as summarised in *Table 5.1.1*.

Pollutant air emissions from industry have fallen significantly since 1980; CO_2 emissions have fallen by 22% by 1993, while SO_2 emissions had almost halved and NO_x emissions had fallen by 9% by 1990. Production of CFCs was almost completely phased out by 1994 *(Figure 5.1.1)*.

Figure 5.1.1: Development in emissions from the industry sector and CFC production in the EU12 (Data on CO_2 emissions excludes the former GDR.)
Sources: Eurostat; Eurostat/OECD, 1995



EU policy measures

One of the key messages of the 5EAP is that in the field of environment, industry must not only be seen as part of the problem but as also part of the solution through development of new processes, technologies and products. The programme therefore adopts the

dual and coordinated approach of high environmental standards (set through regulations for almost all pollutant emissions and discharges and wastes) combined with positive incentives for industry to further improve performance.

Key measures which are intended to reduce emissions at source are summarised in *Appendix 1* and include:

- prevention of further ozone depletion through the phase out of CFCs, carbon tetrachloride, halons and 1,1,1-trichlorethane;
- reduction of air emissions at source (eg, the Air Framework Directive);
- reduction of discharges to water (Directives for the Discharge of Dangerous Substances to Water and Urban Waste Water Treatment);
- waste minimisation and control of emissions from waste (hazardous waste Incineration Directive, the Waste Framework Directive and the Packaging Directive); and
- initiatives to encourage the development of 'clean' production processes and products; and initiatives to encourage responsible care and risk management (eg, regulations on the testing of existing chemicals, environmental impact assessment and the Seveso Directive).

Outlook

Section 3.3 presents the expected changes in the outputs and structure of the manufacturing sector; this will be expected to have impacts on intensity of energy and materials use, and generation of emissions and wastes. Based on this analysis, the industrial sector is expected to make a major contribution to meeting 5EAP targets as follows:

- SO_2 emissions from combustion processes;
reducing production and consumption of ozone depleting substances;
- 70% reductions of discharges of heavy metal substances by air or water by 1995; and
- CO_2 stabilisation where, despite considerable uncertainty, industrial emissions appear to be decreasing.

In general, point sources of pollution have been well targeted by regulations, which have often forced the development of new end-of-pipe technologies. However, diffuse sources, such as products, have been far less effectively tackled. The greatest successes to date have been:

- in environmental themes with a small number of players, such CFCs and, to a lesser extent, VOCs;
- where technical fixes through end-of-pipe solutions are possible (such as filters, electrostatic precipitators, water treatment, etc); and
- where measures have involved low or no cost (including increases in energy efficiency, input and waste minimisation, and changes to process).

Areas where success have been limited include:

- the Urban Waste Water Directive, where action programmes and designation of sensitive areas are not yet complete and implementation has been delayed because of costs;
- reduction of packaging waste where systems are not yet in place for monitoring; and
- marketing and use of certain chemical substances, where the rate of adoption has been constrained by the slow process of selecting substances and agreeing on the necessary control measures.

There has also been only a limited focus on: controlling fugitive emissions, integrated approaches to pollution control and development of clean technologies. The proposed IPC Directive will provide an increased focus on clean processes and products rather than emissions, but is not expected to take effect before 2000. In addition, other directives (such as VOCs, Seveso amendment and liability for industrial pollution) that have not yet been approved will take at least 4-5 years to come into effect and, where derogations are offered to specific Member States or sectors, may not be fully implemented for a further 10 years.

Given this long lead time, further gains by 2000 are likely to result from voluntary mechanisms, self-regulation and producer responsibility initiatives and the use of economic instruments. These types of instruments are being developed in the environmental policy-making of Member States such as The Netherlands, Denmark, Germany, UK, France and new entrants Austria, Finland and Sweden.

Table 5.1.1 : The impact of industry on 5EAP environmetal themes

Sources: ETC/AE, 1995; Eurostat/OECD, 1995; EEA, 1995

Theme	Impact
Global scale	
Climate change	27% of total CO_2 emissions from refineries, combustion and cement (2.7% of total) 24% of total N_2O emissions
Ozone depletion	About 80% of emissions from total CFC consumption (refrigeration, aerosols, foam blowing, solvents)
European/Transboundary scale	
Acidification	29% of SO_2 and 13% of NO_x from combustion processes: refineries, chemicals, paper, iron and steel, non-ferrous metals and cement
Other air pollution	30% of total VOC emissions from solvents, paint: heavy metal emissions to air include cadmium, arsenic, lead, zinc, copper, chromium, etc from mining, metal sector, TiO_2, cement and glass, tanning etc Particulates and fibres emissions; dioxins from paper
Regional scale	
Waste management	29% of total waste arisings including process slags, materials waste and packaging Hazardous and chemical wastes including untreated wastes and sludges from air and water effluent treatment
Water resources	53% of total water abstracted; uses for processes and for cooling waters. Effluents include Phosphorous (7% of total); Nitrogen (10% of total); heavy metals (cadmium, mercury, arsenic, lead, copper, zinc, chromium, etc); organic matter; suspended solids
Urban environment	Factories in urban areas account for 10% of total noise emissions, and contribute to odour nuisance, air pollution and traffic
Risk	Storage of chemicals, risk of fire, explosion, soil contamination and seepage to water; landtake for hazardous and industrial waste disposal
Coastal zones	Spillages and discharges to marine waters
Soil	Soil contamination from past and ongoing activities; heavy metals in soils.
Impacts	
Nature and biodiversity	Land take, noise and traffic disturbance, releases of GMOs and toxic substances to ecosystems, affecting biodiversity

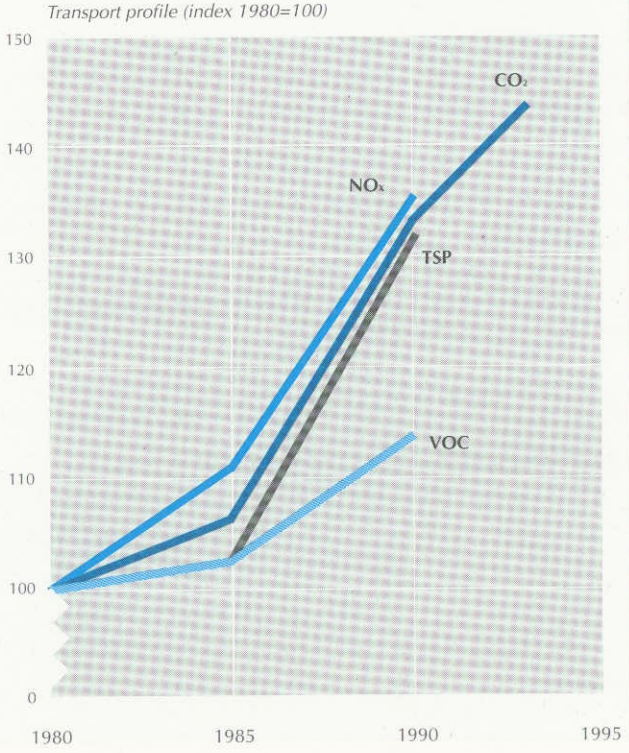
Transport

Emissions and other environmental impacts

Road, rail, aviation and shipping transport each have impacts on the key environmental themes covered in *Chapter 4*, which are summarised in *Table 5.1.2* below. Road transport, in particular, is a major contributor to climate change and acidification, air pollution, urban environmental problems (congestion, land take, noise, etc) and waste generation. The development of infrastructure for all forms of transport modes results in loss and fragmentation of habitats; traffic may cause disturbance to wildlife, while acid deposition damages human health, buildings and habitats such as heath and moorlands.

Emissions from the transport sector have increased substantially: CO_2 emissions have increased by 43% between 1980 and 1993; emissions of NO_x, total suspended particulates (TSP) and VOCs have all increased between 1980 and 1990 by 35%, 32% and 13% respectively *(Figure 5.1.2)*. Data is not yet available on a consistent basis to determine whether this trend has stabilised or accelerated in the last 5 years.

Figure 5.1.2: Development in emissions from the transport sector in the EU12.
Sources: Eurostat; Eurostat/OECD, 1995



EU policy measures

Transport is not subject to 5EAP targets but encompasses overall 5EAP objectives for CO_2 stabilisation, reductions in anthropogenic emissions and noise. These targets are being addressed through a number of measures including those to reduce environmental problems at their source, and those to reduce demand for private road transport through modal shift or demand management measures. All demand related measures are described in *Section 3.5*. Some key measures relating to reduction of emissions at source include:

- reducing pollutant emissions (a series of directives set technical standards and testing requirements for exhaust emissions for new cars, commercial and diesel vehicles);
- reducing noise emissions (Directive 70/157);
- improving fuel standards and fuel switching (eg, limits on sulphur content of diesel fuels, economic instruments to promote the use of unleaded petrol and the ALTENER Programme).

The Auto-Oil project is an initiative by the EC and industry to develop a new methodology for setting future emission standards in an integrated manner and going beyond BATNEEC.

Outlook

Reductions in emissions of NO_x, CO and VOCs are expected to have occurred from policy measures such as the requirement for all new cars since 1993 to be fitted with catalytic converters. Progress has also been made on policies aimed at vehicle operating standards for HGV and aircraft. Emissions from fuel have resulted from technological improvements and the marketing and distribution of lead free petrol.

However, standards have been criticised for being too lax and not addressing the cold start problem of catalytic converters. Furthermore, the issue of particulates, particularly from diesel engines, has not been fully addressed; this is expected to become a major problem in urban air quality and smog episodes to 2000. Achievement of the target of 5% use of biofuels in the transport sector by 2000 appears highly unlikely due to the unfavourable economics of biofuel production.

A large part of the reduction in NO_x emissions achieved to date has been offset by rising traffic levels and the failure to significantly modify infrastructure provision, land use planning or user behaviour. This has, however, been the focus of action at the Member State level. EU and national measures are described in *Section 3.4*.

Table 5.1.2: The Impact of transport on 5EAP environmental themes
Sources: ETC/AE, 1995; Eurostat/OECD, 1995; EEA, 1995

Theme	Road	Rail, air and shipping
Global scale		
Climate change	14% of total CO_2 emissions	4% of total CO_2 emissions
Ozone depletion		Stratospheric ozone depletion
European/Transboundary scale		
Acidification	51% of total NO_x emissions	Electricity generation for rail; NO_x from plane take-off, taxiing and landing
Other air pollution	Lead emissions 34% of total VOC emissions (7% from refuelling) 18% of total particulates 5% of total CO emissions	Diesel trains emissions of particulates Associated road traffic to airports and railway stations
Regional scale		
Waste	Disposal of used cars, tyres and batteries	Discharge of oil and hazardous materials from shipping
Water resources	Run off oil, anti-freeze, etc from roads, runways, car parks to sewage and seepage to ground water	
Urban environment	80% of total noise emissions; urban congestion increases emissions, loss of working and leisure time, functional efficiency of urban areas	Noise close to railways, goods yards; Noise from early and late night flights
Risk	Human health risks from accidents and carcinogens (benzene, etc).	Transport of hazardous substances Aviation and shipping are major causes of oil seepage and spill
Coastal zones	Protection of infrastructure provides justification for impeding natural coastal erosion and sediment deposition processes Coastal shipping is a major cause of oil seepage and spill	
Soil	Erosion from new road building; slope destabilisation and soil contamination from run off	Contamination of soils in old railway yards
Impacts		
Nature and biodiversity	Extraction of aggregates and infrastructure development leads to land take, severance and fragmentation of habitats. Landscape impacts from new roads and airports, dereliction of obsolete rail facilities and secondary development associated with infrastructure	

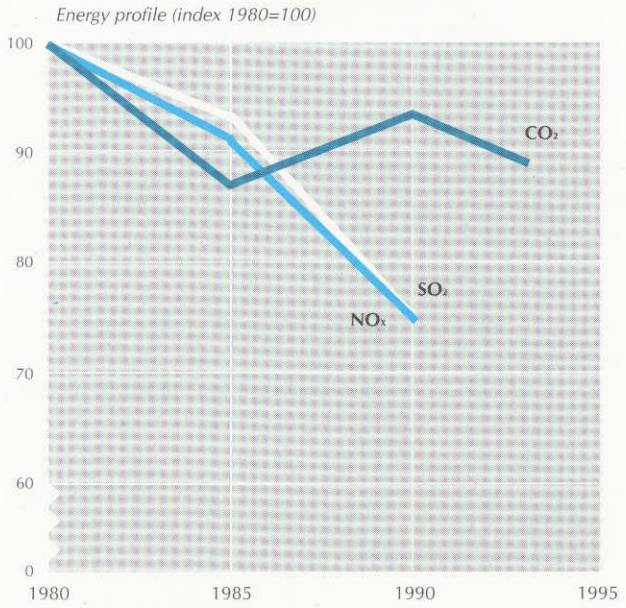
Energy

Emissions and other environmental impacts

The production and consumption of energy produces a number of environmental impacts, most important of which are atmospheric pollution of SO_2, NO_x, CO_2 and particulates arising from fossil-fuelled power generation from power plants and refineries. Emissions contribute to a number of the environmental impacts discussed in *Chapter 4* and summarised in *Table 5.1.3* below and particularly acidification (SO_2 and NO_x), climate change (CO_2), local air pollution (SO_2, $NO_x$and particulates) and risks associated with nuclear safety and transport of petroleum.

Emissions of CO_2 from energy production for EU12 have fallen by 11% between 1980 and 1993, and by 25% for both SO_2 and NO_x emissions between 1980 and 1990 *(Figure 5.1.3)*.

Figure 5.1.3: Development in emissions from the energy sector in the EU12. (Data on CO_2 emissions exclude the former GDR).
Source: Eurostat; Eurostat/OECD, 1995; UNECE, 1995



EU policy measures

EU environmental policies for reducing the environmental impacts of energy in 5EAP focus on the reduction or stabilisation of atmospheric emissions of SO_2, NO_x and CO_2 through reduction in emissions at source and overall reduction of energy use. Programmes to reduce energy demand include THERMIE, SAVE, JOULE and PACE; these are discussed in *Chapter 3*. Some key policies on the supply side include:

- reducing emissions at source (eg Large Combustion Plant Directive, Air Quality Directives, Directive on the Sulphur Contents of Liquid Fuels);
- fuel switching (ALTENER Programme); and
- reducing risk (PHARE and TACIS Programmes).

Outlook

The energy sector is expected to make a major contribution to meeting climate change, acidification and local air quality objectives. Substantial investment is expected to continue in fuel switching, end of pipe technologies (flue gas desulphurisation, catalytic reduction, etc), least-cost planning and improved distribution systems (eg, gas pipes with reduced N_2O and CH_4 leakages). Recent forecasts concerning gas emissions are listed below.

- *CO_2 targets* for the year 2000 will probably not be met (within a range of 1-10%) by EU12 and EU15. This wide range of uncertainty is the result of uncertainties about: delays in implementation of appropriate measures by many Member States in order to improve energy efficiency; the extent of the contribution of renewable energy; the level of further switching of fuel to natural gas and, though likely to be unpopular, nuclear power.

- *5EAP SO_2* targets will be easily achieved as a result of fuel switching, the use of low sulphur coal and the retrofitting of FGD to power plants. Member States have developed national plans to achieve further reductions averaging 55%, with up to 80% for some Member States by 2010.

- Switching to natural gas and improved generation technologies will also contribute to *NO_x objectives*, although the overall target is unlikely to be met.

Agriculture and forestry

Emissions and other environmental impacts

Agriculture and forestry accounts for some 80% of land use in the EU and has significant impacts on many of the 5EAP themes as summarised in *Table 5.1.4*. Ongoing changes in agricultural techniques, equipment and agro-chemicals have led to intensification and greater efficiency (increased production and reduced crop loss from the same land area or the same output from a smaller area) but have resulted in substantial environmental problems. Intensification requires increased use of fertiliser, pesticides, water, mechanical equipment and supplementary feedstuffs for livestock and has been responsible for exceedance

Table 5.1.3: The impact of energy on 5EAP environmental themes
Sources: ETC/AE, 1995; Eurostat/OECD, 1995; EEA, 1995

Theme	Impact and comment
Global scale	
Climate change	26% of total CO_2 emissions 16% of total CH_4 emissions from leakages from gas distribution 8.7% of total N_2O emissions from combustion of fossil fuels
European/Transboundary scale	
Acidification	52% of total SO_2 emissions, of which 80% from coal 18% of total NOx emissions
Other air pollution	Heavy metals (mercury, cadmium, lead, zinc, copper and arsenic) emissions from combustion processes
Regional scale	
Waste management	8% of total waste arisings from coal slag and power station ash
Water resources	Use of water for coal washing, discharge of cooling waters may raise water temperatures
Urban environment	Local air pollution (particulates, heavy metals, SO_2, NO_x) impacts from household fuel consumption contribute to winter smog episodes
Risk	Nuclear power gives rise to operational and storage safety problems
Coastal zones	Siting of nuclear installations in coastal zones; offshore operations and transport of oil major causes of oil spillage
Soil	Contamination from mining (eg, lignite mining in former East Germany, coal mines in Northern Member States) and former gas works
Impacts	
Nature and biodiversity	Landtake for mining, hydro schemes, barrages, distribution networks, acid deposition, discharge of effluents and cooling waters

of nitrate and pesticide guide levels in 85% and 75% of agricultural land respectively.

In marginal farming areas of Europe, the combination of poor soils and past practices have led to low farm incomes, abandonment of the land and migration to urban areas, accelerated erosion, and reduced viability. Some 10% of the land area of the Southern Member states is prone to severe erosion.

The results of the 1994 report of the EU and UNECE on 'Forest Conditions in Europe' indicates that forest damage continues to be a serious problem in Europe. In 1994, the share of sample trees considered as damaged (defoliation exceeding 25%) reached 17.7% in the EU12, which represents an increase from the level of damage in 1993. Adverse weather conditions, particularly drought and heat, as well as insects, fungi, game, air pollution and fires were the most important causes of forest damage in 1994. Air pollution is generally considered a pre-disposing, accompanying and locally triggering factor in weakening forest ecosystems. In 1994 forest fires affected more than 670,000 ha in the EU.

EU policy measures

The CAP was reformed in 1992, largely as a result of the increasing cost of the price support mechanism, which had encouraged over-production, as described in *Chapter 3*. CAP now focuses on other income support measures combined with environmental protection objectives. The environmental targets to 2000 outlined in the 5EAP are:

- stabilisation or reduction of nitrate levels in ground water;
- reduced incidence of surface waters exceeding 50 mg/l nitrate concentration;
- stabilisation or increase of organic material levels in the soil;
- significant reduction in pesticide use per unit of land under production;
- 15% of agricultural area under environmental management contracts; and
- increased forest cover.

Apart of the agri-environment schemes and the Nitrates Directive, some key measures to reduce emissions at source include:

- preventing ozone depletion via Commission Decision (95/107) on methyl bromide, which will allocate production, import and use quotas;
- reduction of emissions to water, addressed by a series of directives (eg, drinking water, ground water, and dangerous substances); and
- protection of nature and biodiversity through measures to combat forest fires and protect forests from atmospheric pollution.

Outlook

The greatest progress in respect of 5EAP targets is being made in two areas.

- *Nitrates in drinking water*: Use of nitrates has fallen substantially and is expected to continue falling as a result of structural shifts from arable to other crops (although pig farming and its associated manure leaching problems is predicted to increase; see *Section 3.6)*. Specially designated areas, such as NVZs, have been introduced successfully in several countries (UK, Germany, The Netherlands, Denmark) and farmers are developing a better awareness of the need to have regard to the dangers of nitrate leaching. Most Member States appear to be prioritising areas where ground water is used for drinking water. However, due to the longevity of nitrates in groundwater, the targets will not be met without denitrification of groundwater.

- *Conservation and protection of biodiversity*: Changes in CAP and the accompanying measures have enabled Member States to provide incentives for farmers to protect and enhance habitats and biodiversity *(see Section 4.11)* through:

  - reduced reliance on agriculture through rural diversification;
  - extensive or organic agriculture by providing guidance, promotion and marketing support (eg through labelling) and improving training and information about ecological farming methods;
  - providing subsidy by unit of surface area for conservation, landscape and amenity values of rural areas in conjunction with long term set aside; and
  - introducing an element of cross-compliance into EU subsidies to encourage environmentally sound agricultural practice.

So far, 3.7 billion ECU have been allocated to projects adopted for the 1993-1997 period. However, the agri-environment measures still only account for some 3% of the overall CAP budget, with proportions allocated to such measures varying widely between Member States.

However, the issues of water consumption and pesticide levels in groundwater are still not really being tackled with the result that the EU12 are unlikely to meet targets for 2000. Water use is expected to become an increasingly important issue requiring further action to encourage water efficiency and reduced demand. There are no policy measures with targets aimed at reducing NH_3 emissions (although this issue will be addressed in the future Acidification Strategy), despite the fact that agriculture is the almost exclusive source of emissions.

Tourism

Emissions and other environmental impacts

Tourism provides real economic and social benefits in many EU Member States;*[14] it is of particular importance to peripheral areas (the Mediterranean, rural and Alpine areas) as a contributor to regional development. Given the importance of environmental quality to the long term success of tourism in any area, it can also provide positive incentives and resources for environmental management and protection. However, poorly managed or excessive tourism (which exceeds the area's carrying capacity*[15]) may have complex and wide ranging negative impacts as summarised in *Table 5.1.5*.

*14 Accounting for 5.5% of GDP, 5% of export earnings 6% of total jobs, and more than 7 million full time jobs in 1990.

*15 Carrying capacity delimits the number of people that an area can support from the ecological, economic, social, infrastructural and tourist perception point of view

Table 5.1.4: The impact of agriculture and forestry on 5EAP environmental themes
Sources: ETC/AE, 1995; Eurostat/OECD, 1995; EEA, 1995

Theme	Impact and comment
Global scale	
Climate change	35% of total CH_4 methane emissions (from livestock); CO_2: loss of carbon sink from the removal of forest cover (positive impacts from afforestation) 35% of total N_2O emissions
Ozone depletion	Methyl bromide used as crop fumigant
European/Transboundary scale	
Acidification	95% of total NH_3 emissions from extensive livestock, animal manure and fertiliser spreading. Acid run off from conifer plantations can cause acidification of water bodies
Other air pollution	Emissions of TSP and dust (from crop burning and use of heavy machinery); Odour from silage and slurry
Regional scale	
Water resources	Over-abstraction of water resources for irrigation leading to risks of salt water intrusion in aquifers or salinisation of soils from waterlogging or use of saline/brackishwater. Run-off of agro-chemicals into surface water and leaching into ground water accounts for 25% of total Phosphorous and 60% Nitrogen discharged to water
Risk	Pesticide residues may have impacts on human health; risks of poisoning of wildlife from pesticide drift or accidental spillage of agro-chemicals
Coastal zones	Eutrophication in marine waters; heavy metals in manure
Soil	Soil compaction from use of heavy machinery, changes in chemical and organic composition of soils, loss of nutrients through over-grazing, loss of soil fertility and adsorption rates, increased run off and erosion. Irrigation may lead to soil salinisation. Also positive impacts from agricultural activities such as increase in green cover, reduction in soil erosion
Impacts	
Nature and biodiversity	Loss of habitats and biodiversity (particularly wetlands, woodlands, natural grasslands and hedgerows) through conversion of semi-natural habitats to arable, over-grazing, drainage, spraying with pesticides, over-use of water, introduction of mono-cultures and loss of traditional species and varieties. Loss of some nutrient poor habitats (heath, chalk grasslands, grazing marshes). Positive effects where activities adapted to provide maintenance of habitats, water management, and provision of intermediate elements

In addition, unmanaged tourism can have negative social impacts causing cultural dislocation, noise and conflict between visitors and host communities.

EU policy measures

There are no specific targets for tourism in the 5EAP. However, *Section 3.7* summarises the three areas of action identified by 5EAP and the horizontal measures which address them. Additional measures to directly or indirectly reduce the impacts of tourism at source include:

- environmental standards for drinking water, bathing water, waste water and air emissions are incorporated in EC directives;
- Cohesion Fund finance for infrastructure for Spain, Portugal, Greece and Ireland; and
- LIFE, which provides financial assistance for implementation of EU environmental policy including projects for protection and management of coastal areas and water protection and waste water treatment.

In addition, the proposed amendments to the Directive on Environmental Impact Assessment (85/ 337/ EEC) will extend the number of tourism projects covered by Annex II (those likely to require EIA) from the current list of holiday villages and complexes, to include a wider range of potentially damaging tourism projects such as ski-runs, lifts, artificial snow installations; golf courses and associated developments; marinas; holiday villages, hotel complexes and associated developments; campsites and caravan sites; and leisure centres.

Outlook

Continued growth is forecast in the tourism sector, particularly from international tourism. This places stress on tourism 'hot spots', local resources and transport infrastructure and, when unmanaged, can lead to deterioration of the tourism asset. Despite continued growth in number of tourist visits, changes in the seasonal and spatial distribution of tourism is likely to reduce stress at peak times and areas. Increased awareness by the public and the tourism industry of environmental concerns and increased demand for more sustainable types of tourism such as eco-tourism, farm holidays, etc are also expected to relieve pressure on sensitive areas.

The EU's main influence on tourism has been through its assistance to infrastructure investment and by demonstrating the benefits of more sustainable approaches (eg, through the LIFE Programme). In 1995 the Commission presented a Green Paper on Tourism, but this does not propose specific mechanisms for delivering sustainable tourism.

Other key policy instruments such as tourism planning, marketing, management and fiscal measures have been considered subsidiarity issues and been implemented at the local, regional or Member State level including:

- Planning and bed capacity control:
  - *controls on land use* have been introduced with zoning for protected areas, controlled development areas and transferable development rights, which may be used in other uncontrolled zones;
  - building controls, maximum density guidelines and requirements for open space;
  - *voluntary building restrictions* and controls on bed capacity or infrastructure development to eliminate down-market capacity and halt the downward spiral of degradation experienced in many down-market resorts; and
  - *limits to tourist numbers* – function ratios for visitor management have been introduced for some islands, national parks and historic sites;

- Increasing awareness of good practice through:
  - good practice guides developed by hotel chains, resorts and touring and automobile clubs;
  - training of those involved in the management of reception areas through partnerships and alliances; and
  - demands for better information about environmental management by individual tour operators and hotels by consumer organisations.

Households

Emissions and other environmental impacts

The importance of the household sector lies in its demand for resources, the waste generated by the consumption of those resources and its capacity to influence industrial and commercial activities through its spending power. The households sector, although not specifically included as a key sector in the 5EAP, is targeted through policies to reduce the environmental impacts of the direct use of energy, transport, tourism, agricultural and industrial products and services by this sector. The environmental impacts of this sector are summarised in *Table 5.1.6*.

Households have proved an extremely powerful lobby group for changing company and government attitudes by demanding less environmentally damaging products and policies, as demonstrated by the impact that consumer boycotts have had in changing the recent Shell decision on deep sea burial of decommissioned oil rigs.

Table 5.1.5: The impact of tourism on 5EAP environmental themes
Sources: EEA, 1995; ERM, 1994; World Bank/European Investment Bank, 1990

Theme	Impact and comment
Global scale	
Climate change	CO_2 emissions from energy and traffic
European/Transboundary scale	
Acidification and other air pollution	Impacts associated with road and air traffic include congestion, emissions, parking, etc– particularly in coastal zones, mountains, historic cities.
Regional scale	
Waste management	Lack of sewage and effluent treatment and disposal. Only 30% of sewage from Mediterranean coastal towns receives any treatment before being discharged and as a result some Mediterranean beaches failed EC bathing water quality tests (Spain 7%; France 13%; Italy 8% and Greece 3% in summer 1992). The total cost of developing the necessary level of sewage treatment is estimated at more than ECU 8 billion.
Water resources	Unsustainable water use in southern Europe (for drinking, bathing, golf course and water theme parks) contributes to increased forest fires (estimated at 200,000 ha pa of Mediterranean forests). Induced pressures for water use in agriculture.
Urban environment	Congestion, noise, litter, overcrowding and damage in historic towns and sites.
Risk	Spillages from pleasure boats are a source of pollution.
Coastal zones	Water pollution and unsafe bathing waters; development pressures for second homes; coastal erosion from recreational activities
Soil	Compaction of soils and erosion from walking, cycling and winter sports in sensitive or mountainous areas
Impacts	
Nature and biodiversity	Loss of habitats associated with tourism infrastructure (accommodation, marinas, golf courses, roads, airports, etc); eg, around the Mediterranean 75% of dune systems have been lost since 1960, leading to loss of breeding grounds eg, for loggerhead turtles. Over 500 Mediterranean plant species are threatened with extinction (see *Section 4.11*). Degradation of natural and built heritage, disturbance to flora and fauna from excessive visitor numbers or concentration at peak times

Table 5.1.6 : The impact of households on 5EAP environmental themes
Sources: ETC/AE, 1995; Eurostat/OECD, 1995; EEA, 1995

Theme	Impact and comment
Global scale	
Climate change	19% of total CO_2 emissions, mainly from coal burning, 7% of total CH_4 emissions from domestic sewage
Ozone depletion	About 20% consumption of all ozone depleting chemicals from use of aerosols and fridges (experience from The Netherlands)
European/Transboundary scale	
Acidification	5% of total SO_2 emissions from coal and oil burning; SO_2 and NO_x from private car use
Other air pollution	10% of total VOC emissions from paints, solvents and refuelling of cars; emissions of particulates, black smoke, heavy metals and dioxins from energy use and incineration of waste
Regional scale	
Waste management	8% of waste generation directly (estimated at 380 kg/pc/pa in 1992) including chemical and toxic wastes include pesticides, oil, paints, batteries, medicines; indirectly waste generated at earlier stages of production of consumer products plus building wastes, used cars etc
Water resources	65% of public water supply is taken from groundwater; households account for 5-30% of total water consumption (EU12), most of which is treated to drinking water standard. Discharges to sewage account for 50% total phosphorous, 24% of nitrogen as well as organic matter and suspended solids, oils and lubricants
Urban environment	75% of households have at least one vehicle, an increase of over 20% in past 10 years
Risk	Use/emissions of dangerous substances in building (asbestos, radon, etc) and in consumer goods (bleaches, disinfectants, chlorinated compounds)
Coastal zones	Demand for second homes
Soil	Waste requiring disposal to landfill; fly tipping
Impacts	
Nature and biodiversity	Demand for land for housing, retail and leisure activities. Average land use figures for housing in EU12 range from 80m^2 (Greece) to 105-7m^2 (Denmark and The Netherlands). 2% increase in the extent of urban areas over the decade to 1991

EU policy measures

There are no specific policies or targets in the 5EAP in relation to the household sector, although it is affected by policy measures in other sectors and themes including: control of emissions from mobile sources and products; improving energy efficiency; and reducing waste generation.

To date, policies have been mainly targeted at producers of consumer goods and services (car producers, household white' goods, packaging, agricultural produce), but include a number of measures to increase consumer awareness about particular products and means of disposal and waste separation and about sustainable lifestyles. Ecolabelling of washing and dish washing machines, light bulbs, fridges and labelling of environmentally friendly and organic food products have been achieved so far but only cover a tiny proportion of household consumption.

Outlook

If there are to be significant reductions in pollution and environmental problems in the years to 2000, then future policy needs to focus on consumers and domestic consumption of energy, water and transport. This will prove to be difficult to tackle due to:

- the large number of players involved;
- the difficulty in developing messages which are acceptable to consumers while bringing about the necessary changes in lifestyle; and
- reluctance to increase price levels to anything like the levels which would be required to change consumption patterns.

For these reasons the focus until now has been on sustainable production rather than consumption. The period between 1990 and 1995 has been one of significant development of technologies and products to reduce environmental burdens associated with products and production processes (eg, catalytic converters, consumer white goods, CFC-free goods etc).

The Eurobarometer survey shows that consumer environmental awareness or willingness to act increases with living standards. This trend is already observable in northern Member States, where policies are beginning to focus on households; the economic implications of fiscal measures such as eco taxes and road pricing are targeted at this sector.

Increased environmental awareness and its asociated improvents have been initiated from a variety of sources:

- initiated by Member States (eg, in Sweden, information on dangerous substances is being provided by local authorities to households in order for them to develop their own actions, which have included boycotts, demands for product labelling, discussions about chemical storage and use etc with companies);

- initiated by producers associations (eg, producer responsibility, voluntary agreements/codes of conduct and covenants) to provide consumers with more sustainable consumption choices; and

- demanded by consumer associations (eg, product labelling, codes of conduct for industry, recycling systems; the development of the German Green Dot system is largely attributed to the success of an informal consumer scheme which encouraged shoppers to leave packaging in shops).

5.2 Environmental costs and expenditures

Introduction

Any consideration of the costs of implementing environmental policy measures is underpinned by the notion that the environment, as a resource, is to be valued for the benefits that are derived directly and indirectly from its existence and use.

To evaluate the effectiveness of environmental policies requires an indication of the value of the environmental and social benefits (including costs avoided, such as clean-up costs), which flow from the implementation of the identified measures and the associated cost streams. This will enable the economic implications of environmental protection across all policy fields to be analysed. For example, the external cost of current transportation systems in the EU is assumed to amounts to about 4% of GDP (DRI et al., 1994).The external cost includes environmental pollution, accidents, traffic jams, etc.

The costs of implementing policy can be incurred by governments and the private sector including agriculture, industry and households. The polluter pays principle aims to apportion the cost of improving or stabilising the quality of the environment to those responsible for its degradation. The integration of environmental policy and the polluter pays principle into other sectors of economic activity should lead to a more equitable distribution of environmental expenditure between the public and private sectors.

The benefits of taking action via environmental policies should be set against the costs in order to provide a link between environmental and economic information. The direct benefits can be classified as follows (and described as costs of inaction):

- improvement in environmental quality;
- reduction in environmental degradation; and
- restoration of environmental quality (eg, through clean up of contaminated land).

These direct benefits will lead to further social and economic development by creating further spin-offs such as increased quality of life, health improvements, the protection of species and habitats, job creation, etc.

Data on environmental expenditure

Statistics on environmental expenditure have been collected by the sources listed below.

- OECD has gathered statistics through questionnaires sent to member countries in 1992 and 1994, which were designed to gather data on pollution abatement and control expenditure. Costs are presented based on expenditure by the public sector, the private sector and private households; costs are divided by three environmental media (air, water and waste).

- A study has been carried out for the Commission (ERECO, 1993) which examines expenditures by sectors involved in the recycling and emissions abatement industries. This includes measures aimed at protecting the natural environment. The expenditure data is based on estimates from various sources within most Member States and gives a general idea of expenditure levels that need to be further explored by detailed surveys.

- Eurostat are developing the European System for the Collection of Economic Data on the Environment (SERIEE), which currently focus on establishing an Environmental Protection Expenditure Account (EPEA). This will compile expenditure data by theme (ambient air and climate protection, waste management, protection of soil and groundwater, noise and vibration abatement, protection of biodiversity and landscape, and other environmental protection activities) and by sector (government, industry, households). Data collection for the government and industry sectors is currently in progress; the results will be published when sufficient data have been supplied by Member States.

A number of issues have arisen in relation to the methodology for collecting and comparing statistics on environmental expenditure across countries; the main points are summarised below.

- *Definition of environmental expenditure*: It is generally agreed that the definition should include all activities aimed at the prevention, reduction and elimination of pollution and other degradations of the environment. Excluded from the definition are activities which result in environmental protection but did not have this as their main objective. For example, activities undertaken primarily to comply with health and safety legislation but which result in an improvement in the environmental performance of a process, or where investment is under-taken for profit-maximisation with environmental spin-offs.

- *Integrated techniques*: Where expenditure involves the installation of end-of-pipe abatement measures this is a straightforward addition. However,difficulties arise where environmental protection is achieved by means of process change (ie,integrated or clean' technologies). This will require the identification of the proportion of the capital expenditure that relates directly to environmental protection. The resolution of this issue will become increasingly important as environmental policy moves to focusing primarily on the prevention of pollution from occurring. The proportion of expenditure on clean technologies will increase in the future; this will lead to a reduction in the need for end-of-pipe expenditure.

- *Transfer payments*: Payments for financing or compensating for activities aimed at environmental protection are included (eg, payments to farmers to compensate for setting land aside to reduce the environmental impacts of intensive agricultural practices). Taxes and charges levied for the purpose of environmental protection are also included. By including these, steps need to be taken to ensure double counting of costs does not take place.

Environmental expenditure in the EU

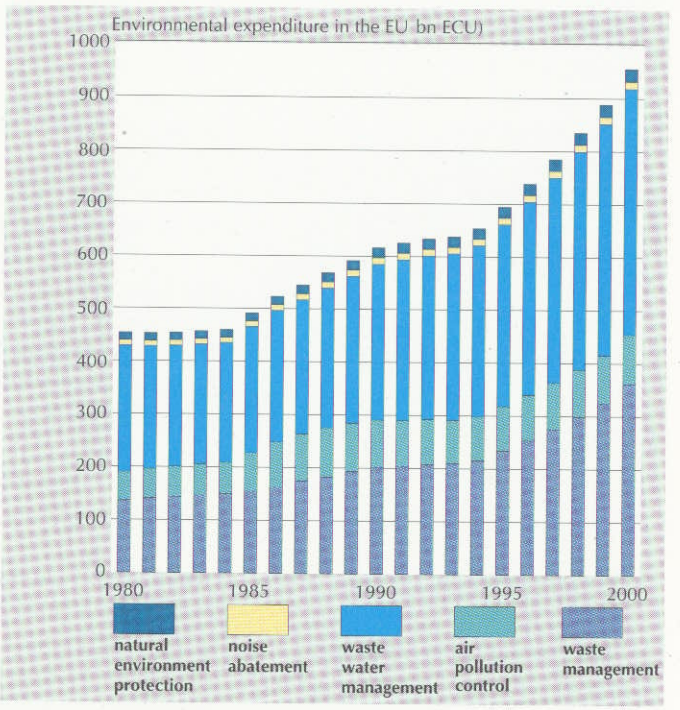
Total environmental expenditure in the EU12 has been estimated at about 63 bn ECU in 1992*[16]. From 1980 to 1985, the level of environmental expenditure remained relatively stable. Expenditure on environmental protection has been increasing steadily since 1985 at about 4% per annum, although since 1990 growth has been slower at 1% per annum *(Figure 5.2.1)*.

Environmental expenditure by theme

Environmental expenditure as a percentage of GDP varies by theme from an average of 0.5% for waste water treatment to less than 0.2% for air quality. In general, the northern Member States have so far spent a larger proportion of GDP on environmental measures than the southern Member States.

*16 The ERECO study excluded the following activities: energy management, drinking water supply, improvements to the human habitat, expenditure on R&D.

Figur 5.2.1: Development environmental expenditures in EU12
Source: ERECO, 1993



Note: 1992–2000 is estimated

Expenditure on waste water treatment measures accounts for the largest share of total environmental expenditure. This theme has traditionally accounted for a significant share of total expenditure mainly as a result of legislation on surface and bathing water quality and, more recently, the Urban Waste Water Directive, requiring increased or upgraded treatment capacity. The EC has estimated that the provision of support for urban waste water treatment and renovation of water supply distribution systems will be in the order of 280 bn ECU over the next 12 years (EC, 1993).

OECD surveys similarly show the protection of water resources accounting for the largest share of expenditure on pollution abatement activities (OECD, 1993). Waste management is the next most significant area of environmental spending, accounting for 33% of total expenditure in the EU12. As with water resources, the public sector accounts for a greater share of total spending than the private sector. Spending on air pollution control, noise abatement and the proctection of natural resources together account for 17% of total expenditure in 1992. The majority of spending in air pollution and noise abatement was carried out by the private sector.

In Sweden and Austria the situation is similar, with the majority of spending incurred by the public

Table 5.2.1 Costs of environmental protection by theme

Theme	Costs of protection
Air pollution: climate change, ozone depletion, acidification, other air pollution	As a result of policy measures to control SO_2 and NO_x emissions, control costs will increase dramatically. The installation of SO_2 and NO_x control technologies at coal fired power stations is expected to increase electricity generating costs throughout the EU by 15-30%. In Germany, the costs for NO_x control were 3.6 mio DM in 1990 rising to 25 mio DM in 2000; for SO_2, the costs are expected to increase from 6.5mio DM in 1990 to15 mio DM in 2000 The costs of complying with the proposed Solvents Directive, aimed at reducing VOC emissions from industry, were estimated for 16 of the 20 sectors affected by the legislation. This placed the total EU costs at about 3.5 bn ECU per annum. Costs varied by industry sector from net savings expected for vehicle refinishers to total sector costs of about 600 mio ECU per annum for surface cleaning activities Compliance with the requirements of the proposal on the sulphur content of liquid fuels is expected to cost the refinery industry an additional 2bn ECU per year
Water resources	About 70% of expenditure on waste water management is spent on the national networks of sewage and urban waste water treatment. The required level of spending is expected to have risen considerably by 1995; for instance in the UK alone the privatised water companies estimate that meeting the EU Water Quality Standards will cost 45-50 bn ECU, while France has reported the costs of a 10 year action programme to meet the Nitrates Directive and bring agriculture into compliance of 12 bn ECU.
Noise: urban areas	Technology to reduce noise from the use of vehicles is expected to lead to a 2-10% increase in the price of vehicles. In some areas of Germany, subsidies of up to 2,000 DM can be paid for vehicles defined as 'low noise' (Eurostat SERIEE 1994 Version).
Protection of natural environment: soils	Based on 1993 figures, the estimated cost of remediating soil and groundwater at the most critical sites in the EU12 is approximately 27 bn ECU for a 15 year long-term plan *(see Section 4.10)*. Remediation of all contaminated sites (including both landfill and industrial sites) is estimated at over 100 bn ECU. ADEME, in France, has estimated that the total elimination of unauthorised dumping would require an investment of 6bn ECU over a ten year period. Germany has planned to spend 15 bn DM over five years for the decontamination of sites in the new Lander (1.5 bn DM of this was allocated to the clean-up of open-pit coal mines).

sector in the areas of water resource and waste management.

Although official environmental expenditure statistics are available for the broad environmental themes described above, they do not fall into the same categories of environmental theme defined in the 5EAP. In order to give an indication of the level of spending required to meet existing policy measures or the estimated cost of meeting proposed policy measures, *Table 5.2.1* summarises available information on each of the 5EAP themes in terms of environmental protection spending at EU12 or country level.

Forecasts of environmental expenditure in the EU12 over the period 1995 to 2000 show the greatest increases in the area of waste management (8.5%) and waste water (6.2%) (see *Figure 5.2.1*). Expenditure on the protection of the natural environment will also increase significantly (3%) although this will be from a much smaller 1990 level of expenditure. Expenditure on environmental protection

is expected to increase as a result of stricter environmental policies but also due to general economic growth.

Forecasts of environmental expenditure are also available for The Netherlands to the year 2000; these are based on a long term economic scenario which incorporates assumptions about developments in Central and Eastern Europe and the volume of world trade (RIVM, 1994). These forecasts show a slightly different pattern with the greatest spending increases expected in air pollution control, noise abatement and waste management respectively. Most of the increased expenditure in air pollution control is expected to be incurred through increased operating costs in the private sector.

Environmental expenditure by sector

Data collection currently in progress for the SERIEE EPEA will provide a central and consistent set of data on environmental expenditure by sector. Presently available data for some countries and approximate estimates from studies support some general observations on this subject.

In 1992, the public sector incurred 60% of total environmental expenditure across the EU12. This shows a falling share of expenditure borne by the public sector from 68% in 1980 and 65% in 1985. A breakdown of environmental expenditure by the public and private sectors in the main environmental themes is shown in *Table 5.2.2.*

Overall expenditure is expected to more than double between 1990 and 2000 as a result of environmental policy measures. The distribution of costs across sectors will change slightly; costs will fall more on the individual sectors, hence lowering the overall proportion of environmental expenditure incurred through public spending. An outlook for The Netherlands forecasts a reduction in public environmental expenditure from 56% in 1990 to 42% in the year 2000 (RIVM, 1994). Similar trends are expected in other EU Member States due to current environmental policy ('shared responsibility') and the development of the polluter pays principle

The Netherlands also has data on environmental expenditure by economic sector incurred in 1990 and forecasts for the year 2000. Costs in the agricultural sector are expected to increase quite significantly from 2% to 8% of total expenditure (due to manure and ammonia measures). The share of spending in the transport, industry and energy sectors and households will all increase slightly. The share of costs falling on each sector will vary by Member State for many reasons including: the level of economic activity by sector, rate of growth of each sector, the degree of implementation of environmental policy measures and the baseline quality of the environment.

Impact on the economy

The past focus of environmental protection has been directed towards regulation; there has been considerable concern that this 'command and control' approach imposes a significant cost burden to certain sectors, and results in trade distortions and reduced inter-national competitiveness.

The present emphasis of environmental policy is to encourage the shift towards the sustainable management of environmental resources and behaviour. This

Table 5.2.2: Environmental expenditure by theme and sector in the EU12 in 1992 (mio ECU) Source: ERECO, 1993

Theme	Public sector	Private sector	Total	% of total spent
Waste management	14,925	5,811	20,736	33
Air pollution	457	7,993	8,450	13
Waste water treatment	19,815	11,140	30,955	49
Noise	512	730	1,242	2
Protection of natural environment	1,928	29	1,957	3
Total	*37,637*	*25,703*	*63,340*	*100*

hinges on the recognition that environmental protection, and economic growth and employment are not mutually exclusive objectives but are very much dependent. The Delors White Paper, *Growth, Competitiveness, Employment,* recognises the structural links between environment and employment and the unsustainable nature of development in the past which has led to the overuse of environmental resources. Developments aimed at valuing and accounting for these resources is integral to the move towards clean technologies, resource conservation and improved quality of life.

A number of studies have considered the impact of environmental policies on economic development and conclude the overall effect to be minimal. An OECD conference on trade and the environment in 1993 came to the following conclusion: "Empirical studies show that the costs of pollution control are a small part of total costs in most sectors and that nearly all the OECD countries have introduced similar environmental measures at roughly the same time. Environmental measures have not been the source of significant cost differentials among the major competitors and have had minimal effects on overall trade between OECD and non-OECD countries" (OECD, 1993b).

Some sectors are affected more significantly than others. In particular, concern has been raised about the economic feasibility of adopting certain measures by the SME sector (small to medium sized enterprises); the EU recommends national programmes of assistance to strengthen the competitiveness of SMEs such as access to finance, technology transfer, training and information sources. SMEs are less able to pass on increased costs to end users as overall they have less influence on the market.

Environmental regulation, combined with increased levels of awareness and incentives to protect the environment, has enabled the growth of the environment industry (the provision of goods and service for environmental protection activities), which was estimated by ERECO to be worth about 85 bn ECU in 1991 and is forecast to grow at a rate of 5% per annum (European GDP is forecast to grow at 2.5% per annum). In addition, the expansion of this industry has resulted in a direct value-added of about 50 bn ECU.

The growth of the environment industry also has an associated job creation potential. Public expenditure associated with EC programmes in Objective 1 regions (the least favoured regions), estimated to average 2.5 bn ECU per annum over the period 1993-2000, could create 100,000 permanent jobs and 200,000 related jobs in the environment sector over the same period. The OECD estimated 10 jobs per USD million in environmental expenditure in 1990 (cited in Repetto, 1995). An analysis of job creation from sector growth must be considered in the context of the overall job market and the opportunity cost of employment in other sectors. The economic impact ofenvironmental policies may lead to a change in the overall mix of industries by encouraging the adoption of clean technologies in traditionally 'dirty' industries and reducing their environmental impact. The associated job creation will depend to some extent on the relative labour intensities of different mixes of industrial development.

The implementation of clean technologies can also lead to financial savings (eg, energy conservation measures as part of the climate change programme or waste management to reduce the quantity of waste produced and encourage recycling). Research and development in these areas may also confer opportunities to some sectors in terms of, first mover advantages'. In addition, as stricter environmental requirements are imposed elsewhere, the adoption of clean technologies may become a condition for access to certain markets. Environmental taxes to encourage more sustainable, less polluting forms of behaviour across sectors will raise revenue, and there may be possibilities for ear-marking this revenue for further environmental improvements.

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ACRONYMS AND ABBREVIATIONS

ALTENER	Pilot projects for promotion of renewable energy (EC programme)
AQG	Air Quality Guidelines (WHO)
BAT	best available technology
BATNEEC	best available technology not entailing excessive costs
bbl	barrel
BEP	Best Enviromental Practice
bn	billion (10^9)
BOD	biochemichal oxygen demand
BSS	Basic Safety Standards Directive
CAP	Common Agricultural Policy (EU)
CCE	UNECE Coordination Centre for Effects (at RIVM)
Cd	cadmium
CDIAC	Carbon Dioxide Information and Analysis Center (USA)
CEC	Commission of the European Communities (now known as European Commission)
CEN	European Committee for Standardisation
CFC	chlorofluorocarbons
CH_4	methane
CHP	combined heat and power
CIPRA	Commission for the Protection of the Alps
CITES	Convention on International Trade in Endangered Species
cm	centimetre
CO	carbon monoxide
CO_2	carbon dioxide
CORINE	CO-oRdination of INformation on the Environment (EC)
CRP	Current Reduction Plans
CZM	Coastal Zone Management
dB (A)	desibel
DGXI	EC Directorate-Generale XI (Environment, Nuclear Safety and Civil Protection)
DHV	DHV Milieu & Infrastructure BV (The Netherlands)
EAP	Environmental Action Programme
EBRD	European Bank for Reconstruction and Development
EC	European Commission (sometimes European Community)
ECU	European Currency Unit
EEA	European Environment Agency
EFTA	European Free Trade Association
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EINECS	European Inventory of Existing Chemical Substances (EC)
EIONET	European Information and Observation Network (EEA)
ELINCS	European List of Chemical Substances
EMAS	Eco-Management and Audit Scheme
EMEP	European Monitoring and Evaluation Programme
EPEA	Environmental Protection Expenditure Account
EPOCH	European Programmme On Climate and Natural Hazards (EC)
ERECO	European Economic Research and Advisory Consortium
ERDF	European Regional Development Fund (EC)
ERM	Environmental Resources Management (United Kingdom)
ETC/AE	European Topic Centre on Air Emissions (EEA)
ETC/AQ	European Topic Centre on Air Quality (EEA)
ETC/IW	European Topic Centre on Inland Waters (EEA)
ETC/NC	European Topic Centre on Nature Conservation (EEA)
EU	European Union
EU12	the twelve Member States of the EU (upto end 1994: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Portugal, Spain, The Netherlands, United Kingdom)
EU15	EU12 plus the three new Member States (since 1995: Austria, Finland and Sweden)

Eurostat	Stastistical Office of the European Union (European Commission, Luxembourg)
FCCC	Framework Convention on Climate Change (UN)
FEE	Federation for Environmental Education
FGD	flue-gas desulphurisation
f.o.b.	free on board
FEOGA	European Agricultural Guidance and Guarantee Fund (EC)
GDP	gross domestic product
GDR	(former) German Democratic Republic
GESAMP	Group of Experts on the Scientific Aspects of Marine Pollution
GHG	green house gases
GMO	genetically modified organisms
GNP	gross national product
h	hour
ha	hectare
HCFC	hydrochlorofluorocarbone
HELCOM	Helsinki Commission
Hg	mercury
HGV	heavy goods vehicle
HYV	high-yealding-variety
IATA	International Air Transportation Association
ICRP	International Commission on Radiological Protection
IEEP	Institute for European Environmental Policy (United Kingdom)
IIASA	International Institute for Applied Systems Analysis
IMO	International Maritime Organisation
IPC	Integrated Pollution Control
IPCC	Intergovernmental Panel on Climate Change
IPPC	Integrated Pollution Prevention and Control (now known as IPC)
IRPTC	International Register of Potentially Toxic Chemicals
ISO	International Standard Organisation
IUCN	International Union for Conservation of Nature
JOULE	new energy technology and promotion programme (EC)
kg	kilogramme
km	kilometre
km^2	square kilometre
kt	kilotonne (1000 tonnes)
l	litre
LCPD	Large Combustion Plants Directive
Leq	Equivalent sound pressure level
LEADER	Links between actions for the development of the rural economy (EC programme)
LIFE	The Financial Instruments for the Environment (EC programme)
LRTAP	Long-Range Transboundary of Air Pollution (UNECE Convention)
LU	livestock units
m	metre
m^3	cubic meter
MARPOL	Marine Pollution Convention
MARS	Major Accident Reporting System (EC)
mg	milligramme
mio	million (10^6)
mn	minute
Mt	megatonne
Mwh	megawatt hour
N	nitrogen
N_2O	nitrous oxide
NERI	National Environmental Research Institute (Denmark)
NH_3	ammonia
NGO	non-governmental organisation
NO_2	nitrogen oxides
NO_3	nitrate
NO_3-N	N content of NO_3 (1mg NO_3-N = 4.43 mg NO_3)
NPK	nitrogen, phosphate and potassium
NVZ	Nitrate Vulnerable Zone
O_3	ozone
ODP	ozone depleting potential
OECD	Organization for Economic Cooperation and Development
P	phosphorus
pa	per annum
PACE	energy efficiency programme (EC)
Pb	lead

pc	per capita
PCB	polychlorinated biphenyl
PHARE	Poland, Hungary - EU Assistance for the reforms of the economies (now entended to all eastern countries)
PM	particulate matter
ppb	percentage per billion
ppm	percentage per million
RIVM	National Institute of Public Health and Environmental Protection (The Netherlands)
RTD	Research and technological development
SAC	Special Area of Conservation
SAVE	energy saving programme (EC)
SERIEE	European System for the Collection of Economic Information on the Environment (Eurostat)
SME	small to medium sized enterprises
SO_2	sulphur dioxide
t	tonne
t-km	tonnes-kilometres
TACIS	Technical assistance for the CIS Countries (EC programme)
TGV	"Trains à Grande Vitesse"
THERMIE	new energy technology and promotion programme (EC)
TiO_2	titanium dioxide
toe	tonne of oil equivalent
TP	total phosphorus
tpa	tonne per annum
TPE	tonne petrol equivalent
TSP	total suspended particulates
UK	United Kingdom
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organisation
UWWT	urban waste water treatment
VAT	value added tax
VOC	volatile organic compound
WCMC	World Conservation Monitoring Centre
WHO	World Health Organisation
WRI	World Resources Institute
WTO	World Tourism Organisation
%	percentage
μ	micro
-	nil (zero)

APPENDIX 1: KEY EXISTING EU ENVIRONMENTAL ACTIONS ADDRESSING THEMES AND TARGETS IN THE 5EAP

Themes and Targets of the Programme	Key EU Environmental Measures Addressing Each Theme or Target		Action Required of Target Sectors Identified in the Programme					Other[4]
	Subject	Ref No[1]	Industry	Energy	Transport	Agriculture	Tourism	
Climate Change	Monitoring and limiting greenhouse gases	D93/389	✔	✔	✔	✔		✔
	Renewable energy - ALTENER	D93/500		✔				✔
	Energy efficiency - SAVE	D91/565	✔	✔	✔			✔
	Energy labelling	92/75	✔					
	Energy standards for traded products	92/42	✔					
Acidification and Air Quality	Emissions from vehicles: Passenger cars Commercial vehicles Diesel engines for tractors Vehicle emission tests	 70/220 (A)[2] 88/77 (A) 77/537 92/55			✔ ✔ ✔ ✔			
	Large combustion plants	88/609 (A)	✔	✔				
	Volatile organic compounds	94/63	✔		✔			
	Municipal waste incinerators	89/369 89/429	✔ ✔					✔ ✔
	Air Quality - nitrogen dioxide	85/203	✔	✔	✔			✔
	Air Quality - smoke and sulphur dioxide	80/779	✔					✔
	Ozone layer	R3093/94	✔					
	Air quality - ozone	92/72			✔			✔
	Air Quality - lead	82/884	✔		✔			✔
	Emissions from industrial plants	84/360	✔					
	Lead in petrol	85/210 87/416	✔ ✔		✔ ✔			✔ ✔
	Hazardous waste incineration	94/67	✔					
	Eco-management and audit	R1836/93	✔	✔			✔	✔
Protection of Nature and Biodiversity	Birds and their habitats	79/409 (A)	✔	✔	✔	✔	✔	✔
	Trade in endangered species	R3626/82 (A)	✔				✔	✔
	Environmentally sensitive farming	R2328/91 R2078/92				✔		
	Habitats and species conservation	92/43	✔	✔	✔	✔	✔	✔
	LIFE - Finance	R1973/92	✔	✔	✔	✔	✔	✔

Themes and Targets of the Programme	Key EU Environmental Measures Addressing Each Theme or Target		Action Required of Target Sectors Identified in the Programme					Other[4]
	Subject	Ref No[1]	Industry	Energy	Transport	Agriculture	Tourism	
Management of Water Resources	Surface water for drinking	75/440 79/869	✔ ✔			✔ ✔		✔ ✔
	Drinking water	80/778	✔			✔		✔
	Bathing water	76/160	✔				✔	✔
	Urban waste water treatment	91/271	✔				✔	✔
	Groundwater	80/68	✔			✔		✔
	Dangerous substances in water	76/464 (D)3	✔			✔		
	Water standards for freshwater fish	78/659	✔			✔		✔
	Shellfish waters	79/923				✔		✔
	Nitrates from agricultural sources	91/676				✔		✔
	Eco-management and audit	R1836/93	✔	✔			✔	✔
	LIFE - Finance	R1973/92	✔	✔	✔	✔	✔	✔
The Urban[5] Environment	Urban waste water treatment	91/271	✔				✔	✔
	Air Quality - smoke and sulphur dioxide	80/779	✔					
	Air Quality - nitrogen dioxide	85/203	✔	✔	✔			✔
	Air Quality - lead	82/884	✔		✔			✔
	Emissions from vehicles: Passenger cars Commercial vehicles Diesel engines for tractors Vehicle emission tests	 70/220 (A) 88/77 (A) 77/537 92/55			✔ ✔ ✔ ✔			
	Air quality - ozone	92/72			✔			✔
	Noise - cars, buses and lorries	70/157 (A)	✔		✔			
	Environmental impact assessment	85/337	✔	✔	✔	✔	✔	✔
	LIFE - Finance	R1973/92	✔		✔	✔	✔	✔
	URBAN Initiative - Structural Funds	R2082/93	✔		✔		✔	✔
	Article 10 ERDF Regulation - Structural Funds	R2083/93	✔		✔		✔	✔
Coastal Zones[5]	Birds and their habitats	79/409 (A)	✔		✔	✔	✔	✔
	Habitats and species conservation	92/43	✔	✔	✔	✔	✔	✔
	Environmental impact assessment	85/337	✔	✔	✔		✔	✔
	Bathing water	76/160	✔			✔	✔	✔
	LIFE - Finance	R1973/92	✔		✔	✔	✔	✔
	ENVIREG (discontinued)		✔		✔		✔	
	Urban waste water treatment	91/271	✔				✔	✔

Themes and Targets of the Programme	Key EU Environmental Measures Addressing Each Theme or Target		Action Required of Target Sectors Identified in the Programme					Other[4]
	Subject	Ref No[1]	Industry	Energy	Transport	Agriculture	Tourism	
Waste Management	Waste - framework Directive	75/442 (A)	✔					✔
	Hazardous waste	91/689 (A)	✔					
	Shipment of waste	R259/93	✔		✔			✔
	Disposal of PCBs	76/403	✔	✔				✔
	Waste oils	75/439 (A)	✔	✔				
	Packaging	94/62	✔					✔
	Municipal waste incinerators	89/369 89/429	✔ ✔	✔ ✔				
	LIFE - Finance	R1973/92	✔	✔	✔	✔	✔	✔
	Eco-management and audit	R1836/93	✔	✔			✔	✔
	Hazardous waste incineration	94/67	✔					

Notes:

1 All items are Directives unless marked with an R (Regulation) or D (Decision)
2 (A) indicates that the measure has been amended
3 (D) indicates that 'daughter' Directives have been made under the main measure listed
4 A number of the measures are directed at the Member States or public authorities rather than target sectors so a tick in this column indicates that prior action is required from the Member States. This might involve, for example, the development of programmes for pollution reduction etc, which would subsequently involve action by other sectors.
5 The urban environment and coastal zones are 'cross cutting' themes. There are no items of EU environmental legislation which are exclusively and explicitly directed towards these themes. However, a number of measures are relevant and some of the most obvious examples are given below:

APPENDIX 2

SOME ENVIRONMENTAL DATA BY COUNTRY

Climate change

Table 2.1: CO_2 emissions by country (total without bunker but including final non-energy-consumption)
Source: Eurostat, 1995

Country (mio t. CO_2)	**1985**	**1990**
EU12	3193	3254
EU15 3364 3428		
Belgium	113	121
Denmark	63	53
France	414	408
Germany[a]	1136	1047
Greece	60	74
Ireland	27	32
Italy	377	432
Luxembourg	12	13
Netherlands	177	184
Portugal	29	46
Spain	201	227
United Kingdom	592	616
Austria	55[b]	61
Finland	49[b]	58
Sweden	67[b]	56

[a] Data from Germany include the former German Democratic Republic (which is 348 mio t.)
[b] Data from UNECE/LRTAP, 1995

Ozone depletion

Table 2.2a: EU12 production and sales of Ozone Depleting Substances (CFCs, HCFC, halons, carbon tetrachloride and 1,1,1-trichlorethane)
Source: Commission of European Community

(1000 t ODP)	**1986**	**1990**
Production		
Total ODP	583	391
CFC's	447	284
Halons[a]	13.8	11.6
Sales		
Total ODP	364	232
CFC's	311	184
Halons[a]	7.0	4.8

[a] 1000 t halons

Table 2.2b: Consumptions of total CFCs and halons country
Source: Eurostat, 1995

Country (1000 t. ODP)	**1986**	**1990**
Belgium		
Denmark	7.0	3.3
France	105.5	62.8
Germany	150.8	94.4
Greece		
Ireland		
Italy		
Luxembourg	0.1	0.1
Netherlands	42.3	17.6
Portugal		
Spain	20.4	23.6
United Kingdom 118.5 73.1		
Austria	9.4	1.9
Finland	3.9	2.4
Sweden	6.8	2.2

Acidification

Table 2.3a: SO_2 emissions by country
Source: UNECE, 1995

Country	(1000 t SO_2) 1985	1990
EU12	19238	16962
EU15	20083	17442
Belgium	400	317
Denmark	339	180
France	1470	1298
Germany[3]	7754	5633
Greece	500	510
Ireland	140	178
Italy	2244	2251
Luxembourg	16	
Netherlands	261	201
Portugal	198	282
Spain	2190	2316
United Kingdom	3726	3780
Austria	195	90
Finland	383	260
Sweden	267	130

[a] Data from Germany include the former German Democratic Republic

Table 2.3 b: NO_X and NH_3 emissions by country
Source: UNECE, 1995; ETC/AE, 1995

Country	1985 (1000 t NO_2)	1990	1990 (1000 t NH_3)
EU12	11803	12630	3583
EU15	12726	13534	3985
Belgium	315	343	79
Denmark	294	269	126
France	1615	1584	700
Germany[a]	3474	3033	739
Greece	306		471
Ireland	91	115	126
Italy	1741	2053	383
Luxembourg	19		7
Netherlands	573	570	204
Portugal	96	221	93
Spain	839	1257	331
United Kingdom	2438	2860	516
Austria	245	222	94
Finland	252	284	41
Sweden	426	398	74

[a] Data from Germany include the former German Democratic Republic

Air pollution and quality

Table 2.4: Non-methane-VOC emissions by country
Source: UNECE, 1995

Country (1000 t)	**1985**	**1990**
EU12	13950	14154
EU15	15171	15326
Belgium	688	395
Denmark[c]	159	165
France[c]		2402
Germany[a]	3275	3008
Greece	614	
Ireland		197
Italy	1771[b]	2554
Luxembourg		
Netherlands[d]	500	451
Portugal		644
Spain[c]	1265	1112
United Kingdom	2435	2612
Austria	412	430
Finland		209
Sweden	600[c]	533

[a] Data from Germany include the former German Democratic Republic

[b] Preliminary data;

[c] Not including nature;

[d] Including nature, CFC and CH_4 for source category

Waste management

Table 2.5a: Municipal waste generation by country
Source: Eurostat, 1995

Country (1000 t)	**1985**	**1990**
EU12[b]	112378	131340
EU15[b]	118928	139140
Belgium		3410
Denmark	2430	
France	16220	20320
Germany	19387[a]	27958
Greece	3023	3000
Ireland	1100	
Italy	15000	20033
Luxembourg	131	170
Netherlands	6307	7430
Portugal	2448	2538
Spain	10014	12546
United Kingdom	17000	20000
Austria	1400	1500
Finland	2500	3100
Sweden	2650	3200

[a] 1985 Data from Germany include the former German Democratic Republic

[b] The EU12 and EU15 estimate is based on Eurostat/OECD, 1995 and include the former GDR

Table 5.2 b: Waste recycling rates
Source: Eurostat/OECD, 1995

Country	1985	1990	1985	1990
	Paper & cardboard in %		Glass in %	
EU12[b]	37	39	25	36
Belgium	14		42	55[a]
Denmark	31	35	19	35[a]
France	34	38	26	29
Germany	40	40	36	45
Greece	25	28	15	15
Ireland	10		7	23
Italy	38	47[a]	25	48
Luxembourg				
Netherlands	50	50	49	67
Portugal	37	45	10	27
Spain	57	51	13	27
United Kingdom	28	32	12	21
Austria	37	78	38	60[a]
Finland	39	41	21	36
Sweden	43	43	20	44[a]

[a] 1991 data;

[b] Weigthed by population

European Environment Agency

ENVIRONMENT IN THE EUROPEAN UNION - 1995

Report for the Review of the Fifth Environmental Action Programme

Edited by Keimpe Wieringa

Luxembourg: Office for Official Publications of the European Communities

1995 - ix,151 pp. num. tab., fig., map.,- 21.1 x 27.7 cm

ISBN 92-827-5263-1

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ISBN 92-827-5263-1