

Environment in the European Union at the turn of the century

**Appendix to the summary
Facts and findings per environmental issue**

Cover design: Rolf Kuchling, EEA

Legal notice

The contents of this report do not necessarily reflect the official opinion of the European Communities or other European Communities institutions. Neither the European Environment Agency nor any person or company acting on the behalf of the Agency is responsible for the use that may be made of the information contained in this report.

A great deal of additional information on the European Union is available on the Internet.

It can be accessed through the Europa server (<http://europa.eu.int>)

©EEA, Copenhagen, 1999

Reproduction is authorised provided the source is acknowledged

Printed in Italy

Printed on recycled and chlorine-free bleached paper

ISBN:

European Environment Agency
Kongens Nytorv 6
DK-1050 Copenhagen K
Denmark
Tel: +45 33 36 71 00
Fax: +45 33 36 71 99
E-mail: eea@eea.eu.int

Contents

Greenhouse gases and climate change	4
Ozone depleting substances	7
Dispersion of hazardous substances	9
Transboundary air pollution	12
Water stress	15
Soil degradation	18
Waste generation and management	20
Natural and technological hazards	22
The release of genetically modified organisms to the environment	24
Biodiversity/ecosystems	26
Urban areas	29
Rural areas.....	32
Coastal and marine zones	35
Mountain areas	39

Greenhouse gases and climate change

Global and European annual mean air temperatures have increased by 0.3-0.6°C since 1900. 1998 was globally the warmest year on record. International Panel for Climate Change (IPCC) climate models predict further increases, above 1990 levels, of about 2°C by the year 2100, with higher rises in the north of Europe than the south. It is unlikely that stable, potentially sustainable, atmospheric greenhouse gas concentrations will be realised before 2050. If further temperature increases are to be limited to 1.5°C by 2100 and to 0.1°C per decade, and sea levels are to rise no more than 2 cm per decade, industrialised countries need to reduce greenhouse gas emissions by at least 35 percent between 1990 and 2010.

In the EU, carbon dioxide (CO₂) emissions fell about 1% between 1990 and 1996 (3% between 1990-1995), with

Reported (1990 and 1996) national CO₂ emissions, EU Member States. For seven Member States the latest available 1994 or 1995 estimates were used as estimates for 1996.

Member state	(million tonnes CO ₂)	
	1990	1996
Austria	62	62
Belgium	116	129
Denmark	52	60
Finland	59	66
France	392	399
Germany	1014	910
Greece	85	92
Ireland	31	35
Italy	442	448
Luxembourg	13	7
Netherlands	161	185
Portugal	47	51
Spain	226	248
Sweden	55	63
United Kingdom	615	593
EU-15	3372	3348

Source: EEA, 1999

considerable variation between the Member States – thanks to a combination of low economic growth, increases in energy efficiency and the effects of policies and measures to reduce greenhouse gas emissions. Specific circumstances in the UK (switch from coal to gas) and Germany (economic restructuring of the new Länder) also played a significant role.

The EU aims, initially, to stabilise CO₂ emissions in 2000 at the level of 1990. EU15 CO₂ emissions by 2000 are projected to be within +/-2% of the 1990 levels, suggesting that the stabilisation target could be achieved. Under the 1997 so-called ‘Kyoto agreement’ (United Nations Forum on Climate Change Convention - UNFCCC), the EU aims to reduce emissions of the main six greenhouse gases by 8% in 2008-2012 from 1990 levels. Forest carbon sinks in Europe can only achieve up to 1% of these reductions. Various new “flexibility” or “Kyoto mechanisms” introduced in the Kyoto Protocol – emissions trading and joint implementation among industrialised countries and the “clean development mechanism” between industrialised and developing countries – need to be further elaborated at the latest by 2000, by means of the UNFCCC Buenos Aires action plan.

EU15 total greenhouse gas emissions are projected to increase under the baseline scenario by 6 percent between 1990 and 2010. The increase in CO₂ emissions is appreciably less than the increase in total energy consumption – mainly due to a shift from solid to gaseous fuels. The main driving force for increasing CO₂ emissions comes from the transport sector – transport emissions are projected to increase about 40% by 2010; industrial CO₂ emissions are projected to fall by 15% by 2010, while little change is expected in the domestic/tertiary and power and heat producing sectors. EU total methane emissions are projected to fall 8%, while nitrous oxide emissions are projected to rise 9%, and fluorocarbons, currently a minor contributor to total greenhouse gas emissions, will increase 40 %.

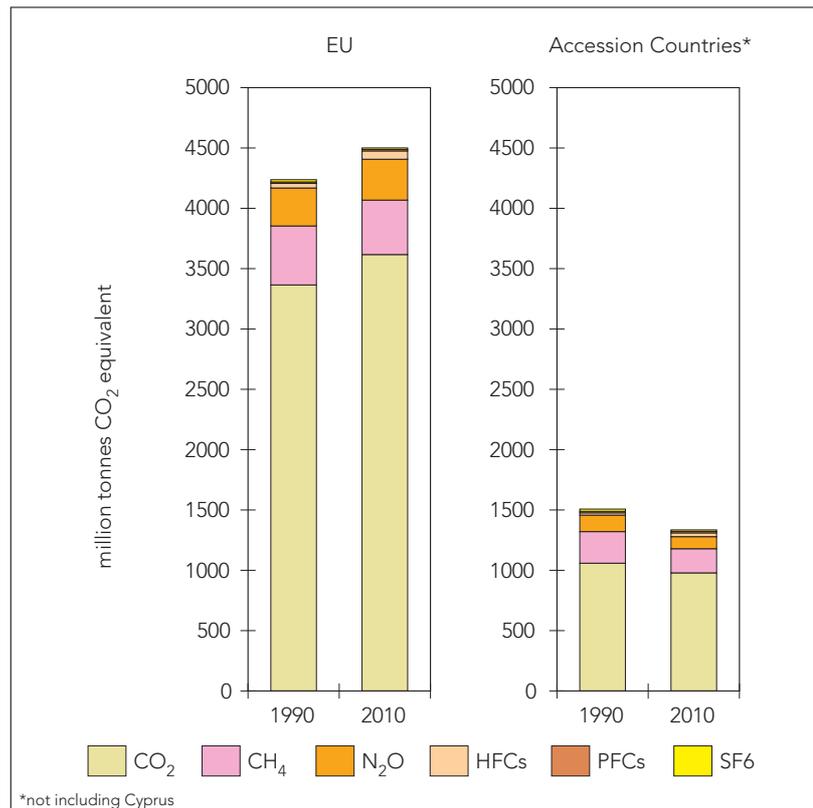
The Kyoto target requires about 600 Mtonnes (in CO₂ equivalent) reduction in emissions below the projected emissions in 2010. The total technical reduction potential for measures to reduce emissions of all six greenhouse gases, with costs below 50 EURO/tonne, is estimated to be considerably

6 Environment in the European Union at the turn of the century

more than what is needed to achieve the Kyoto target. This shows that the EU's use of "Kyoto mechanisms" could be limited. Member States have adopted various measures to reduce greenhouse gas emissions, including in some cases a CO₂ tax, although a comprehensive EU-wide energy and products tax has not been adopted.

CO₂ emissions in the Accession Countries are projected to fall 8%. Based on the limited information available, total greenhouse gas emissions of these countries in 2010 are estimated to fall 11% from 1990 levels. Combined with the projected 6% increase for the EU15, this would mean a 2% increase in emissions of a potentially enlarged EU by 2010 from 1990 levels.

Business-as-usual greenhouse gas emissions in Europe by gas (1990-2010)



Source: European Commission, 1999; Ecofys, 1998; AEA, 1998; UNFCCC, 1998; EEA, 1999.

Ozone depleting substances

In Europe the increase in ultra-violet radiation (UV) is estimated to be larger over the western parts because of large depletion in the total ozone column. UV global trends are estimated to increase by 3-4% per decade in northern hemisphere midlatitudes and 3-9% in southern hemisphere midlatitudes. The ozone layer can start recovering, but full recovery will take another 50 years – if emissions of ozone depleting substances (ODS) were zero in 1999, the earliest recovery year physically possible would be 2033.

Global production and emissions of ozone depleting substances have fallen sharply since the end of the 1980s as a direct result of international measures. In the EU, production of halons stopped in 1994, while production of chlorofluorocarbons (CFCs) was phased out in 1995. Consumption of hydrochlorofluorocarbons (HCFCs) and methyl bromides are to be phased out by 2020 and 2005 respectively, although the European Commission is drafting proposals to bring these dates forward to 2015 and 2001, and also limit the production of HCFCs and ban the production of methyl bromide.

The potential “chlorine plus bromine” concentration, a measure for the total potential depletion of the ozone layer, peaked in 1994 and is now decreasing. Effective stratospheric chlorine peaked in about 1997 and is now expected to fall (assuming full compliance of the latest Amendments of the Montreal Protocol). The atmospheric concentration of halons is still increasing, contrary to earlier expectations. There exists a relatively large potential for eliminating global halon emissions by stopping production and destroying halons used in existing equipment.

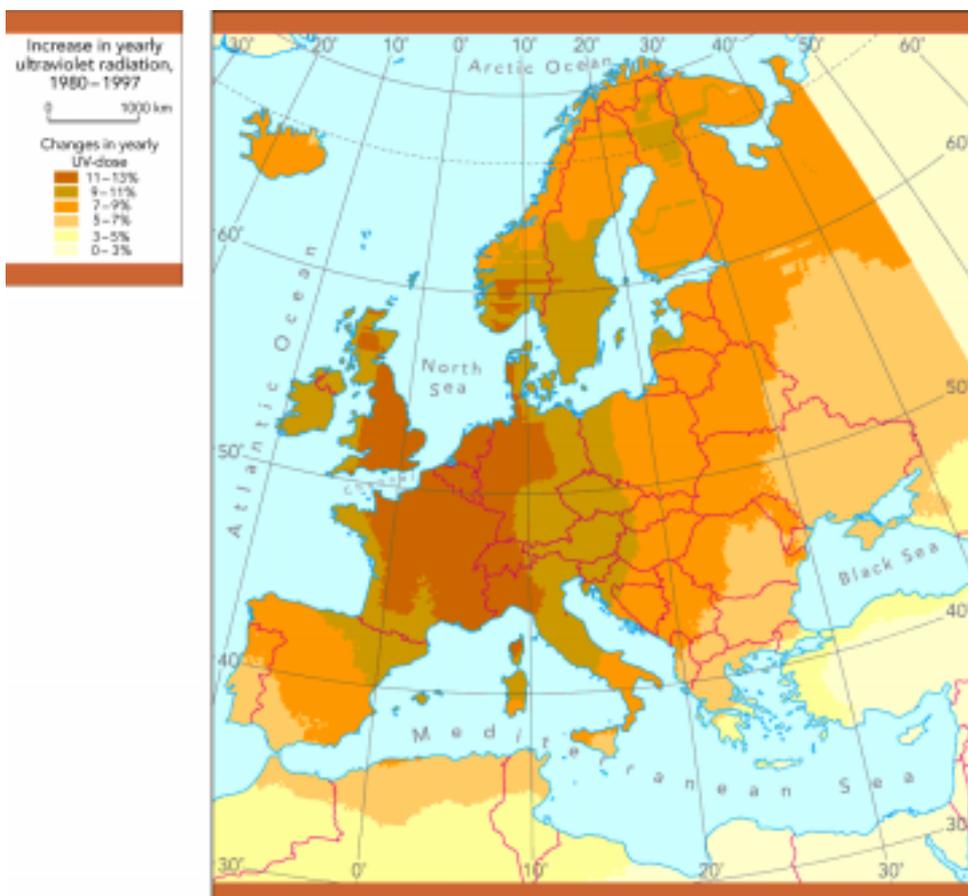
Assuming that measures currently in force are fully implemented, additional cases of skin cancer caused by ozone depletion should peak at 78 per million per year around 2055. Total additional cases from now until the end of the 21st century are estimated at 5 000 per million.

Production of CFCs is still permitted (until 2010) in developing countries and in developed countries for use by

8 Environment in the European Union at the turn of the century

developing countries. A more rapid phasing out would speed the recovery of the ozone layer. There are indications that around 10% of developing country production is imported illegally into developed countries; and continued smuggling on this scale would delay recovery.

Largest increase in ultraviolet radiation in Northwest Europe



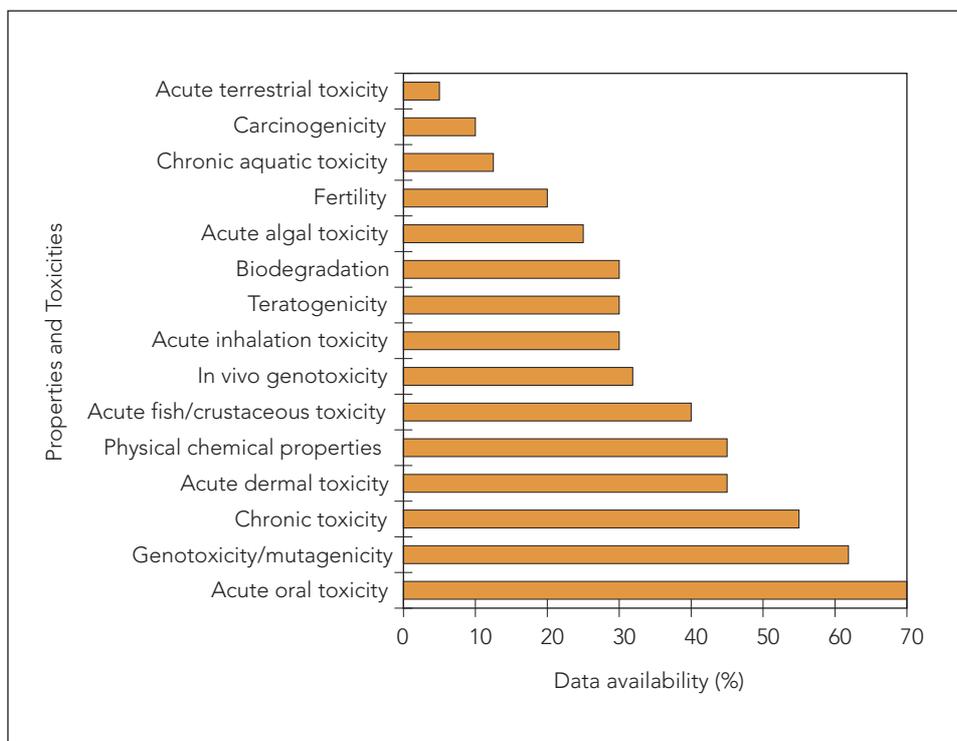
The increase (%) from 1980 to 1997 in erythemal UV radiation (causing the skin to turn red) is calculated using observed total ozone values from the TOMS satellite instruments and assuming clear sky conditions.

Source: Update from Europe's Environment: The Second Assessment (1998)

Dispersion of hazardous substances

Various control measures have reduced chemical risk and some emissions and environmental concentrations of persistent organic pollutants (POPs) and heavy metals are declining. But for 75% of the large volume chemicals on the market, there is insufficient analysis of toxicity and eco-toxicity available to support minimal risk assessment.

Availability of data on 2472 high production volume chemicals submitted to the European Chemicals Bureau



Source: adapted from Van Leeuwen et al., 1996; Joint Research Centre - European Commission n.d.

Positive trends from measures such as recycling are countered by a general increase in economic activity, including road transport and agricultural production. Consequently, *total annual emissions* of chemicals are expected to rise by 2010, following a 30-50% increase in the *output* of chemical industry.

10 Environment in the European Union at the turn of the century

Heavy metal exposure has been reduced through improved water treatment and the phasing out of leaded petrol which more than halved emissions of lead in the EU between 1990 and 1996. Cadmium and mercury emissions are expected to increase 20 to 30% between 1990 and 2010 from transport (tyres material) and industrial activities. Recent studies on the emissions of particulate matters (especially PM10) and attached heavy metals showed that the future situation could improve. The ultimate goal of bringing discharges and emissions to near background levels for heavy metals will not be achieved by 2010.

For the Accession Countries, over the next decade, significant decreases are anticipated for lead (58%), copper (31%) and mercury (12%) due to policy implementation. Emissions of cadmium are expected to increase 4% over the period as growth in traffic more than offsets improvements due to policy measures.

Overall, *pesticide* use appears to have fallen in most EU15 countries over the past 20 years; but despite reductions, even bans on the production and use of dichlorodiphenyl-trichoretane (DDT) and lindane, it will take considerable time for the reservoirs in the various environmental compartments to become depleted and stock-piles to run down. Moreover, bio-accumulation phenomena will continue as a result of redistribution processes for a long time after a substance has been banned from use. Over the next decade, slight increases in the emissions of some pesticides are expected in the EU, while others such as pentachlorophenol emissions should fall. In Accession Countries, there are expected to be large increases in the use of pesticides due to increased agricultural production. EU investment in converting biocide manufacturing plants to produce less harmful formulations in the Accession/Developing countries would help reduce exposure from long-range transboundary impacts and from traded goods.

Implementation of the Integrated Pollution Prevention and Control (IPCC) Directive and earlier measures have reduced emissions of polychlorinated biphenyls and dioxins/furans from power generation, refining, and waste incineration plants. Recycling does not always reduce overall human and

environmental exposure because higher emission factors during reprocessing might be unavoidable. While the concentration and deposition of dioxins are expected to fall in the EU between 1990-2010 with the implementation of existing and proposed policies, the concentrations of Benzo(a)pyrene and other Polycyclic Aromatic Hydrocarbons, platinum (from catalytic converters) and brominated flame retardants are expected to increase over many parts of Europe.

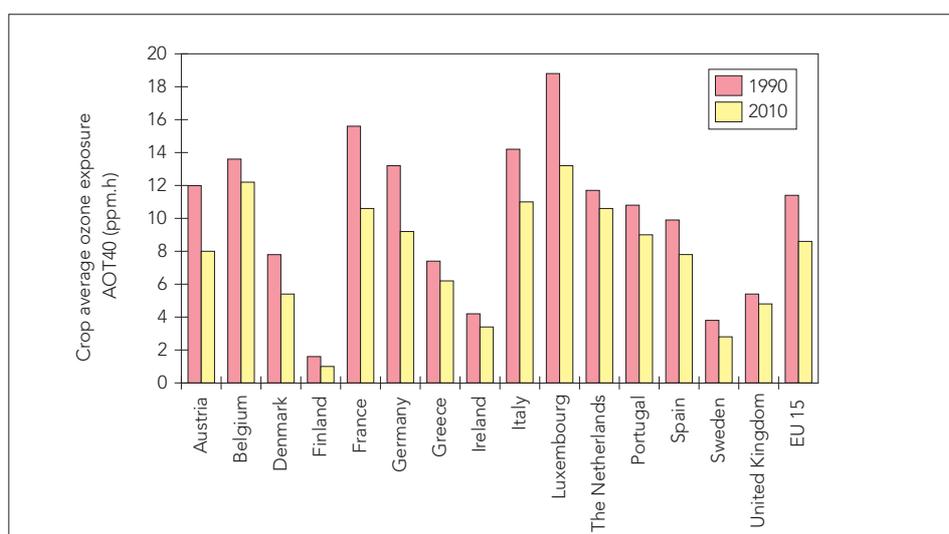
Transboundary air pollution

In the 1980s and 1990s, the achievements in abating emissions from stationary sources was almost counterbalanced by increased emissions due to more mobility, despite improvements in motor vehicle technology. Energy consumption, particularly by transport in 2010 will mean, for the EU, a 17% increase from stationary sources and a 37% rise from mobile sources. In the agricultural sector, activity levels (livestock, nitrogen fertiliser use) are likely to fall, resulting in lower emissions from agricultural sources. Integrated abatement strategies are needed – not least to address the important interaction with other major environmental problems, such as climate change.

In densely populated areas in Northwest Europe, *smog formation* is most strongly affected by volatile organic compounds (VOC) emissions. In less populated areas it is more dependent on nitrogen oxides (NO_x) emissions. All EU tropospheric ozone threshold values set under the current EU Ozone Directive have been exceeded since 1994, when the Directive came into force. During short periods of two to four days, high levels of ozone above the threshold values set for protecting people's health occur regularly over large parts of Europe. During the summer, there is a general blanket of medium to high ozone levels over Europe at least twice as high as during the 1850s. Proposals are being formulated for a new Ozone Directive, setting out target values for 2010. However, even the most realistic options for abating emissions will not bring ozone levels down enough to prevent adverse effects on human health and ecosystems by that time.

Ozone concentrations vary considerably from year to year. Model calculations indicate that the increases in tropospheric background concentrations will continue, due to growth in background levels of nitrogen oxides, carbon monoxide, and methane. The cumulative EU population exposure is expected to decrease, but large exceedance will continue to appear in 2010. Similarly, the vegetation exposure should decrease by a quarter.

Reduction in ozone exposure of crops in 2010 compared to the 1990 situation



Source: EMEP

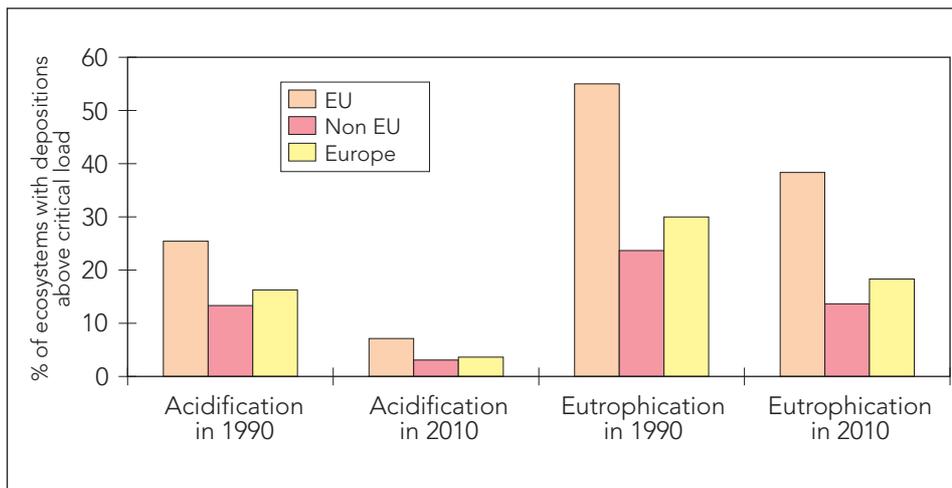
The observed decrease in emissions of *acidifying substances* should result in significantly lower deposition levels in the period 1990 to 2010. For EU15 the emissions reduction between 1990 and 2010 of sulphur dioxide (SO₂) is estimated at 70%, 45% for nitrogen dioxide (NO₂) and around 18% for ammonia (NH₃). The corresponding reductions for the Accession Countries are: almost 60%, around 27%, and only 1%. EU agreed emission targets for NO_x are 30 per cent reductions between 1990-2000, and for SO₂ a 40 per cent reduction between 1990 and 2000. The 2000 target for SO₂ will probably be achieved, while the one for NO_x is not expected to be met.

Lower emission and deposition levels should mean significant improvements for ecosystems. In the EU, ecosystems with acid deposition above their critical loads will fall from 25% in 1990 to 7% in 2010; with ecosystems in several countries virtually no longer exposed to exceedances. The corresponding figures for ecosystems with nitrogen deposition above their critical loads are 55% in 1990 and 39% in 2010. A substantial improvement in the area of ecosystems affected by acidification is forecast for Accession

14 Environment in the European Union at the turn of the century

Countries; from 44% in 1990 to 6% in 2010. With *eutrophication*, a more modest gain in protected ecosystems is forecast: from 84% in 1990 to 72% in 2010.

Ecosystems damage: fraction of ecosystems with depositions above their critical loads



Source: European Commission, 1999

The EU Acidification Strategy is targeting full protection of all ecosystems in the long term. Current interim emission targets for 2010 require reductions of 83% for SO_2 , 55% for NO_x , and 29% for NH_3 compared to 1990 levels. These will not be achieved with existing and proposed policies.

Water stress

Pressure on water resources affects habitats, particularly wetlands, and can lead to contamination and depletion of surface and groundwater, causing soil degradation, excessive salinity, and desertification. In the EU, the Accession Countries and the European Free Trade Association countries, total water resources amount to 1897 km³/year, of which 16 per cent are abstracted and 5 per cent consumed (not returned to the site of abstraction).

A previous upward trend in *water demand* has levelled off in recent years. Industry and households have increased their efficiency in using water. The prospects for water use largely depend on future trends in agricultural use, which will be affected by developments in the Common Agricultural Policy, and the extent to which water pricing is economically efficient. Agriculture consumes far more water than other uses (approximately 80% versus 20% for urban and industrial use and 5% for cooling water). The Mediterranean countries are the major water consumers in the EU – mainly for agricultural purposes, though development pressures in comparatively dry regions are also a factor. Estimations for future total abstractions in EU show very small increases.

Transboundary river flows make up a significant share of the resources in many countries. In Hungary for instance, freshwater from upstream countries accounts for as much as 95% of the total resource – in the Netherlands and Slovak Republic, this proportion is over 80%, while Germany, Greece and Portugal rely on imported water for over 40% of their resources. While there are international agreements to control the quantity and quality of imported water, tensions can arise, especially where resources (in upstream or downstream countries) are limited.

Flooding is the most common, and costly form of natural disaster in the Mediterranean region and in central Europe. It is also more frequent in recent years in the Rhine catchment area. There is a need for management of water resources to be closely integrated with flood protection and maintenance of biodiversity.

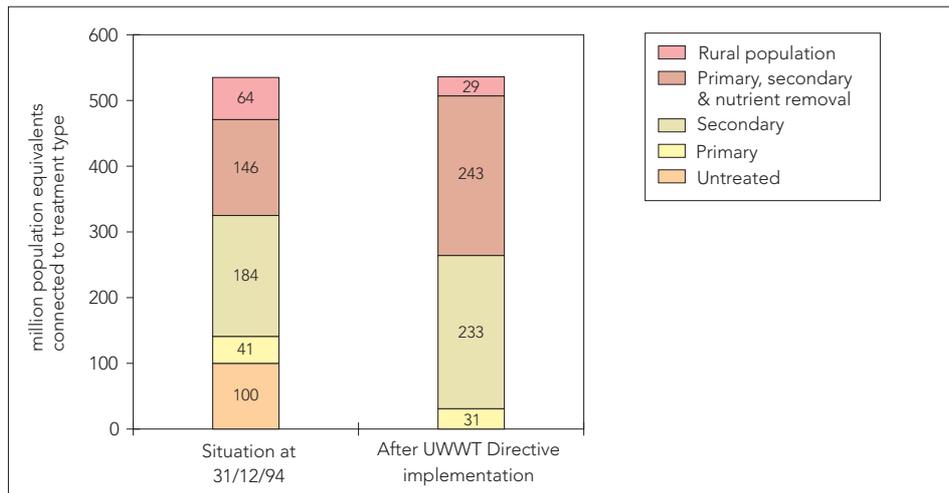
16 Environment in the European Union at the turn of the century

The number of heavily polluted rivers in the EU has declined significantly, due mainly to reductions in point source *discharges of organic matter and phosphorus*. The improvements have been less significant in southern and eastern Europe. The phosphorus level of European lakes has decreased markedly – but water quality in many lakes in large parts of Europe is still poor. Nitrate concentrations in EU rivers have shown little change since 1980 and the reduced use of nitrogen fertilisers in agriculture does not seem to have resulted in lower levels of nitrate. In some parts of EU, drinking water contaminated by nitrate is a serious problem, particularly where it is taken from relatively shallow groundwater sources with significant time lag in recovery. In the Accession Countries, agricultural activities are generally less intensive than in the EU. Nevertheless, there are some regions with high nitrate levels, where the rural population is dependent on heavily polluted shallow wells for drinking water.

Fertiliser consumption rose in the 1960s and 1970s and fell from the mid-1980s onwards. Phosphorus fertiliser consumption in most EU countries peaked around the early 1980s, and the use of nitrogen fertilisers peaked around the mid- to late 1980s. In the Accession Countries, fertiliser consumption has declined markedly, but may increase from its current low level due to increased agricultural production.

In the EU, a high proportion of *waste water* is treated before discharge: 90% of the EU population is connected to sewers and 70% to waste water treatment plants, although there are differences between the northern and southern countries. Full implementation of the urban waste water treatment Directive in the EU will decrease the discharges of organic matter and phosphorus with about two-thirds and one-third respectively. In the Accession Countries, 40% of the population is not connected to sewers and for 18% waste water is discharged untreated. The remaining 42% of the waste water is treated before being discharged into surface waters, with most waste water receiving secondary treatment to remove organic matter. Upgrading treatment plants to EU standards would considerably reduce polluting discharges; two-thirds of the organic matter and almost half of the nutrients. At the same time, the intensification of urban waste water treatment will increase the quantity of contaminated remaining sludge.

Development in the number of population equivalents connected to different types of waste water treatment, EU10 in person equivalents. EU10: DE, ES, FI, FR, GR, IT, LU, NL, PT, UK.



Source: Compiled from European Waste Water Group (1997).

The implementation of the Nitrate Directive has been unsatisfactory in the majority of Member States and proceedings have been initiated against those that have not yet complied. Implementing the Urban Waste Water Treatment Directive has been more satisfactory, and considerable investment programmes are in place in all Member States to comply with its objectives. Achieving these objectives should further improve the state of the EU waters before the end of the century. If more stringent measures are not taken to reduce emissions from agriculture, this improvement may turn out to be too small to achieve good status in Europe's water bodies. In the longer term, the proposed Water Framework Directive would promote integrated water management within river catchments, set an overall ecological objective and deal with other pressures not covered in existing legislation.

Soil degradation

Damage to Europe's soils from modern human activities is increasing and leads to irreversible losses due to soil erosion, local and diffuse contamination and the sealing of soil surfaces. Population growth coupled with urbanisation is putting soils under pressure, while agricultural intensification is making soils more prone to erosion.

Sealing of soil surfaces due to an increased urbanisation and new infrastructures is the main cause of soil degradation in the most industrialised and populated countries of western and northern Europe.

Soil loss by erosion is the main cause of soil degradation in the Mediterranean region. In some areas, soil erosion cannot be reversed, while in others nearly complete removal of soil has been observed.

Soil deterioration by contamination is an important issue in central, western and northern Europe. For 12 of EU countries, the estimated number of potentially contaminated sites adds up to 1,500,000, of which more than 300,000 have been identified. This number of sites is not expected to increase, due to national policies already in place and the commitment to the precautionary principle. But, the huge number of existing contaminated sites is an enormous challenge for the next decades and will need appropriate legal instruments, innovative remediation technologies and practical financial instruments. In the Accession countries, there is a threat that the number of contaminated sites increases, if economical growth is not combined with appropriate environmental standards.

Sustainable management of soil as a natural resource, together with air and water, is one of the environmental challenges and priorities in the 5th Environmental Action Programme. But unlike the other two media, soil is not explicitly considered when specific objectives and targets are defined. Soil protection is addressed indirectly through measures to protect air and water, or developed within sectoral policies (secondary protection). Moreover, measures developed for specific sectors without considering the possible

effects on soil may lead to its further damage. At the national level, many Member States have produced legislation, policies or guidelines to ameliorate or prevent soils from further degradation. But, in general the policy measures are primarily aimed at combating pollution in other areas, and affect soils indirectly. Statutory soil monitoring is carried out as well in a number of Member States, but rarely for the purposes of soil protection per se; and comparability at the EU level remains weak. The development of an EU policy framework which recognises the role of soil, which takes account of the problems arising from the competition among its concurrent uses (ecological and socio-economic), and which is aimed towards the maintenance of its multiple function, would have multiple benefits and achieve a consistent improvement of Europe's environment as a whole.

Potential and Identified contaminated sites in some EU countries

	Potentially contaminated sites		Contaminated sites	
	identified (screening completed)	estimated total	identified (risk assessment completed)	estimated total
Austria	28,000	~80,000	135	~1,500
Belgium (Flemish region)	5,528	~9,000	7,870	n.i.
Denmark	37,000	~40,000	3,673	~14,000
Finland	10,396	25,000	1,200	n.i.
France	n.i.	~700,000	896	n.i.
Germany	202,880	~240,000	n.i.	n.i.
Greece	n.i.	n.i.	n.i.	n.i.
Ireland	n.i.	2000	n.i.	n.i.
Italy	8,873	n.i.	1,251	n.i.
Luxembourg	616	n.i.	175	n.i.
Netherlands	n.i.	~120,000	n.i.	n.i.
Portugal	7,000	n.i.	12,000	22,000
Spain	4,902	n.i.	370	n.i.
Sweden	n.i.	n.i.	n.i.	n.i.
United Kingdom	n.i.	~100,000	n.i.	~10,000

n.i.: no information

Source: EEA-ETC/S(1998)

Waste generation and management

The reported total *waste generation* within EU and the European Free Trade Association countries increased by nearly 10% between 1990 and 1995, while economic growth was about 6.5% in constant prices. The total amount of waste (excluding agricultural waste) generated in 1995 was estimated to be 1.3 billion tonnes in 1995 or about 3.5 tonnes per capita; while the amount of hazardous waste was about 36 million tonnes. Half of the waste comes from manufacturing industry and construction and demolition activities, while municipal waste, mining waste and waste from other sources each contribute about a sixth of the total. In the Accession Countries, amounts of industrial waste per capita are higher, while volumes of municipal waste are currently lower than the EU average.

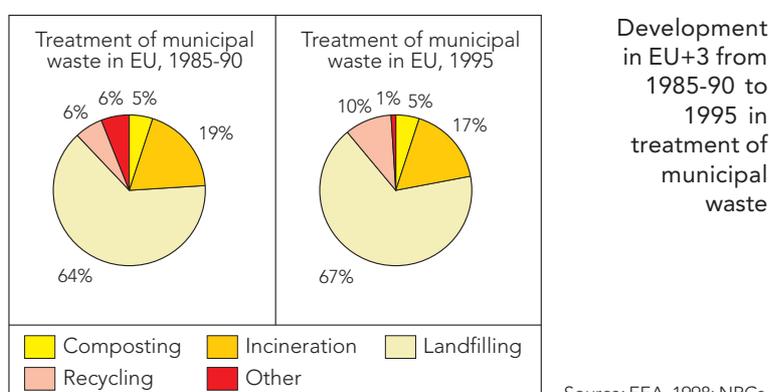
Limited current systematic and consistent data hinder the development of projections for future waste trends. Nevertheless, most waste streams will probably increase over the next decade. In 2010 the generation of paper and cardboard, glass and plastic waste will be increased by around 40 to 60% compared with 1990 levels. The number of scrapped cars will increase less, around 35% compared to 1995 levels.

Managing this waste gives rise to a number of pressures on the environment:

- leaching of nutrients, heavy metals, greenhouse gases and other toxic compounds from landfills;
- use of land for landfills;
- emission of greenhouses gases from landfills and treatment of organic waste;
- air pollution and toxic by-products from incinerators;
- air and water pollution and secondary waste streams from recycling plants although those substitute the production of primary resources;
- increased transport with heavy lorries.

Waste is also now produced as a result of society's attempt to solve other environmental problems such as water and air pollution. Some of these increasing amounts of bulk wastes give rise to new problems - examples include sewage sludge and residues from cleaning of flue gases.

In most EU countries landfilling is still the most common *treatment route* for waste and a major change is needed in order to implement the EU strategy on waste. Furthermore, as shown in the figure for municipal waste, there has been no general improvement in the trend in the nineties. This situation must first of all be explained by the fact that in nearly all EU Member States the average disposal prices for landfilling non-hazardous waste are far below those for incineration with energy recovery. This means that unless other regulations are in place, the market mechanisms act in direct opposition to the official Community strategy.



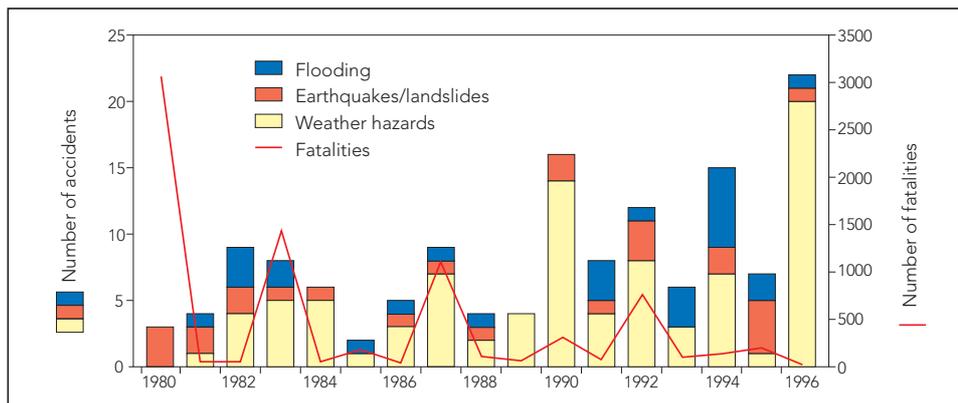
Paper and glass are some of the waste fractions where Member States have followed the Community waste strategy of increasing recycling instead of energy recovery and landfilling. However, the development has been only a partial success, because the total amount of waste paper and glass waste (container glass) generation has also increased in the same period. In the EU+Norway the recycling rate for paper and paperboard increased from 36% in 1985 to 49% in 1996, but a 3.5% per annum increase in total consumption meant that the quantity of paper waste incinerated or landfilled also rose. Similarly, while recycling for glass has increased almost 50% from 5 million to 7,4 million tonnes per year, the amount of waste glass for disposal was only reduced by 12% from 6,7 million to 5,9 million tonnes due to the increase in waste glass.

Sewage sludge and end-of-life vehicles are other waste streams where substantial increases in quantities can be expected, calling for more efficient waste management practices.

Natural and technological hazards

Since the late 1980s, *natural hazards* have had a bigger impact on the environment. Between 1990-96, economic losses due to floods and landslides were four times those in the whole of the preceding decade. As yet, there is no targeted policy to reduce natural hazards, although programmes such as EPOCH (European programme for climatology and natural hazards) have specifically addressed this source of risk. The present lack of integrated planning and management of human activities can increase their incidence and severity – particularly landslides.

Accidents in Europe involving natural hazards and the associated number of fatalities



Source: OECD Environmental Data, 1997

EU has had measures on major *industrial accidents* in force since 1984. However, in spite of all measures already adopted, major accidents continue to occur in fixed installations of the process industry and over 300 accidents have been reported since 1984 by EU Member States to the European Commission's Major Accident Reporting System (MARS) under the legal requirements of the 'Seveso Directives' (82/501 & 96/82/EEC). Since the rate of reporting major accidents to MARS is in good correspondence to the actual rate of occurrence of major accidents, the constant trend observed is an indication that many of the often seemingly trivial "lessons learned" from accidents have not yet been sufficiently evaluated and/or implemented in industry's practices and standards.

Therefore, many efforts are still necessary to further reduce the risks related to major accidents from fixed industrial installations. On the other hand, since the industrial activities which give rise to most of the major accident risks are increasing in intensity in Europe, the risks of major accidents per unit of activity seem to have a slightly falling tendency. In contrast to industrial accidents in fixed installations, major oil spills due to marine transport accidents as well as offshore installation accidents have shown a clear downward trend.

Information on the extent and location of technological hazards is generally improving, particularly as a result of the Seveso II Directive. As such, pre-arrangements can be made in emergency response plans. The problem of low frequency, high consequence events, however, remains a key issue for risk management.

Lack of sufficiently detailed, comparable information on the risks posed by certain types of nuclear establishments, including the treatment of waste, means the overall risk to the European environment from accidental *releases of radionuclides*, even if small, cannot be quantified. It is likely that the overall risk from nuclear accidents increased in the 1970s as more plants were commissioned – but has declined in the 1990s as older plants are taken out of service and building new ones has slowed. A gradual improvement in the overall risk of accidents is expected but the magnitude of the risk seems likely to remain at similar levels up to 2010. A complicating factor is the increasing deterioration of the older plants in Eastern Europe. Implementing improved safety plans for these reactors is delayed because of the lack of financial resources – despite significant outside assistance.

Public perception of various hazards and risks, and the influence of various pressure groups can be a major factor. So, sound information on current natural and technological hazards is essential. Important questions include: Which hazards are connected with chronic changes to the environment, such as global warming and sea level rise? Are human activities increasing the risk from various hazards?

The release of genetically modified organisms to the environment

The genetically modified organisms (GMOs) issue remains beset by scientific uncertainty and political controversy. Modern biotechnology offers opportunities for innovation, and could encourage Europe's international competitiveness.

As new crop plants, GMOs have been released experimentally to the environment since 1985/86, and four commercial food crops have been approved. The EU is some way behind the United States in the commercial introduction of genetically modified crops.

However, public opinion across Europe is sceptical about genetically modified foods, and there is strong support for labelling them, public consultation and more comprehensive regulation and monitoring. Apart from food safety, concerns have been expressed on genetic transfers with native species. The EU has legislation (Directives 90/220 and 97/258) to regulate the release of GMOs – deliberate and accidental – and their safety in food. Most other European countries have either followed the EU approach or adapted existing laws.

EU marketing consent for GMO products takes at least 1-2 years; and none has been approved unanimously so far. Some countries, including Austria and Denmark, have wanted to include the impacts on agriculture in their assessment of environmental harm, while the European Commission and some Member States, such as the UK and the Netherlands, have tended to define environmental harm more narrowly, restricting risk assessment to the direct effects associated with GMOs. The European Commission published proposals for new legislation in 1996, broadening the risk management strategy to include indirect effects. Safety assessments have also been criticised on the grounds that cumulative impacts are neglected and that small scale trials may not predict performance in the wider environment. These wider aspects are addressed in Norway, with a risk assessment framework which explicitly refers to the justification of 'need' and sustainable development. Concerns over the inadequacy of risk assessments has lead to

a partial moratorium on some GMO applications in the UK, to a 2 year moratorium in France against the release and placing on the market of genetically modified rapeseed and sugar beet, and to conflict between Member States and the EU over GMO approvals.

There is also a potential conflict between EU legislation and World Trade Organisation rules on free trade, which would prohibit import restrictions on genetically modified products unless there is scientific evidence of a risk to human or environmental safety.

At an international level, United Nations Environment Programme (UNEP) technical guidelines for GMO risk assessment and current EU legislation are consistent. As part of the Convention on Biological Diversity, a Biosafety Protocol is now being negotiated: this is likely to require that transboundary movement of GMOs be subject to prior informed consent, with risk assessment based on scientific parameters.

Biodiversity/ecosystems

The overall threat and changes in biodiversity at all scales (genes, species, ecosystems and habitats) are expected to remain high in the EU to 2010 and beyond. The pressure comes from many interconnected sources, principally land use change, pollution and the introduction of alien species.

The area available for natural and semi-natural habitats and indigenous species is foreseen to decrease (e.g. the ongoing relentless spread of urban development and transport infrastructure) and the threats are foreseen to continue to increase. But ongoing and some new recoveries are also foreseen for several habitats and species. The robust and generalist species as well as the invasive species are foreseen to continue to be favoured and spread, while rare, endemic and specialist species will continue to decline.

Biodiversity is changed and can be lost by the way the land is used, which results in *fragmentation* of semi-natural and natural habitats, often threatening the viability of species and function of ecosystems in a complex process. Agricultural intensification has the most heavy impact. The effects of the other extreme – abandonment of land and agriculture – will lead to adverse effects in extensively or old-type farmed areas, whereas it can have some positive effects in formerly intensively managed areas. Forest practices, relying on monospecific plantations and even-aged stands of exotic species, have not been conducive to biological diversity. The forest area is foreseen to increase slowly, while old-growth forests and forests of local tree species still will decrease in many areas. Careful planning will be needed to avoid further loss if more forest is to be planted to function as carbon sinks in response to the Kyoto Protocol on global warming.

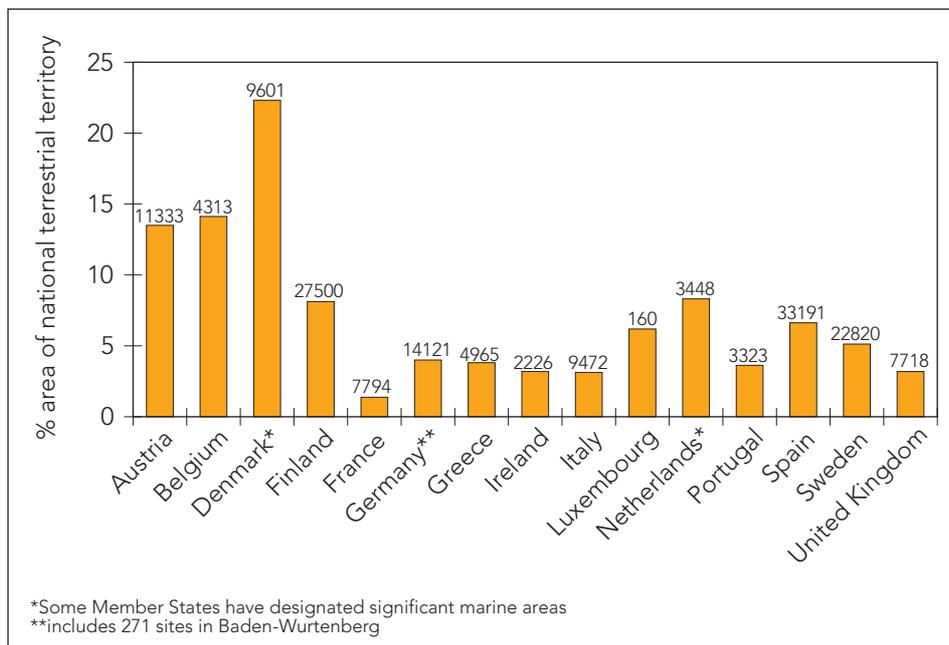
The *impact of climate change* is more subtle and difficult to predict, although some results may already be seen in changes in growing and activity seasons for some plants and animals. For example, one analysis proposes a climate-induced shift in distribution of terrestrial plant species composition of some 50% in south-western Europe between 1990 and 2050 owing to changes in local climate and water availability.

Pollution impacts are somewhat easier to identify. Over the next decade the impacts of acidification and eutrophication are foreseen to show reductions and biodiversity to show some recovery. A full return to pre-pollution conditions cannot take place, even after 2010, because of changes in competition and distribution of species.

The introduction – whether voluntary or accidental – of *species alien* to European ecosystems or to other regions of Europe represents an increasing risk, favoured by globalisation of trade, exchange and transports. Genetic transfer between non-native species, or possibly even genetically modified organisms, and indigenous species, genetic erosion and isolation of species populations are likely to intensify over the next decade.

The NATURA 2000 Network for *protection of habitats and species* is expected to become operational over the next

Proposed Special Protected Area (including marine sites) in % of national territories



Source: European Commission - DGXI, 1999

decade, with upwards of 10% of the EU territory designated for nature conservation purposes and with provisions for protecting species populations.

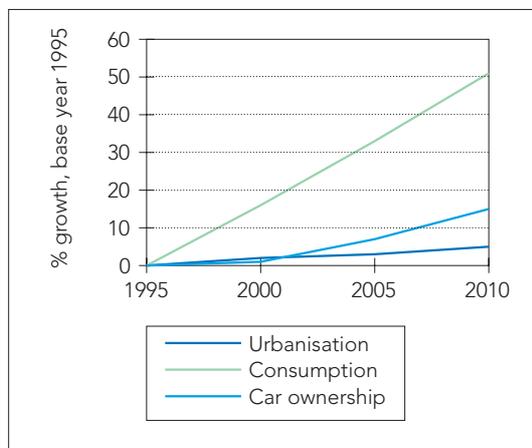
The European Community Biodiversity Strategy addresses the requirements of the Convention on Biological Diversity concerning the European Community. The Strategy which aims to complement the biodiversity initiatives of Member States, provides for a series of action plans designed to integrate biodiversity within policies and programmes for which there is a Community competence. But also other more general and widespread, important instruments aim at integrating biodiversity into other sectors. EU Agenda 2000 represents possibilities to consider new interrelationships between rural areas and biodiversity : agri-environmental measures, structural funds, Less Favoured Areas, afforestation measures. The work towards a European Forestry Strategy targets more sustainable forest practices. Several EU initiatives relate to conservation of genetic resources.

Urban areas

The problems of urban development and its impact on the environment have been difficult ones for European policy-makers. Some 600 local authorities in Europe have taken initiatives to implement a Local Agenda 21 and about 300 European local governments have adopted the Charter of European Cities and Towns, which emphasises integrated approaches towards sustainability and the need for better networking and collaboration between European cities in this effort.

Urban settlements are increasing steadily in Europe – with cities continuing to sprawl, causing land use stresses and social inequities. The population living in ‘urban agglomerations’ will increase by more than 4% over the next 15 years.

Key urban trends



Source: EEA; European Commission, 1999

Urban sprawl results in more traffic: passenger transport demand is expected to grow 40% above 1990 levels in 2010 and a 25% increase in car ownership is expected over the same period. Accession Countries will reach the lowest EU car ownership levels (336 cars per 1000 heads in Greece) by 2010, while no further growth is expected at the high end (673 cars per 1000 heads in Luxembourg) due to saturation.

Urban sprawl is geared by land use and transport patterns, and so largely influenced by current consumption trends. Today, consumption accounts for most of the pollution burden caused by households – final private consumption is growing much faster than the gross domestic product. Ultimately, this results in increased water and energy consumption, and waste generation. However, in some areas, urban sprawl can produce better living conditions in sub-urban areas.

Though most cities have *air pollution* harmful to health, policies in place are expected to improve the situation considerably. The average exposure of inhabitants of large agglomerations in the EU to concentrations above recommended levels will decrease substantially from 1990 to 2010, although exceedances of threshold concentrations still occur. The most significant exceedances to be expected in 2010 are for nitrogen dioxide (NO₂) and Benz(a)pyrene. In the Accession Countries sulphur dioxide (SO₂) and particulate matters (especially PM10) also remain serious problems.

Nearly 40 million people residing in the 115 larger European cities still experience exceedance of the World Health Organization (WHO) air quality guidelines (AQG) for at least one pollutant every year. There is though some evidence of a downward trend in nitrogen oxides and ozone levels from 1990 to 1995, but in many cities long term AQG for nitrogen oxides are still exceeded and maximum hourly ozone concentrations exceed the WHO-AQG. Ambient concentrations of SO₂, lead and PM10 have fallen over the last decade, thanks to cleaner fuels and energy sources and more efficient combustion technologies. Levels of ozone remain high in most European cities, exceeding WHO health guidelines. This is due mainly to road traffic emissions: road vehicles cause 44% of nitrogen oxides (NO_x), 56% of carbon oxide (CO) and 31% of non-methane volatile organic compounds (NMVOC) emissions in the EU – within cities, these percentages are much higher.

While there has been a mainly downward trend over the last decade in the total mass of particulates in the air, in 1995 the majority of large European cities exceeded recommended levels of the inhalable harmful fraction of particulate matters.

National and EU-level legislation aimed at reducing automobile emissions, e.g. the introduction of catalytic converters and unleaded petrol, resulted in considerably lower vehicle emission factors –although these improvements are partially offset by continuing growth in vehicle numbers. NO_x and NMVOC emissions have declined since 1990 in the EU and in the Accession Countries – for NO_x, faster in the Accession Countries as a result of the relatively more recent renewal of vehicle fleet.

In terms of *noise exposure*, it is estimated that more than 30 % of the EU population live in dwellings with significant exposure to road noise, in spite of significant reductions of noise limits from individual sources. The noise limits for cars have been reduced by 85% since 1970 and for lorries by 90%. The latest reduction to 74 dB(A) for cars and 80 dB(A) for lorries has led in particular to significant application of low noise technology. Furthermore, new vehicle standards have a noticeable effect on actual noise levels only when vehicle renewal is well advanced - and this can take up to 15 years.

It is anticipated that air traffic growth up to 2010 can be accommodated at the main airports without significant increases in noise exposure. This is mainly due to the phasing out of noisier aircraft, fleet renewal and noise optimisation of flight procedures and air strip geometry. However, there may be increased noise at regional airports where rapid growth in air traffic can be expected.

Rural areas

Rural areas, which contain the vast bulk of the EU's varied conservation and biodiversity assets, are increasingly under pressure – as the rural economy becomes less dependent on agriculture. Indeed, at least every second job in predominantly rural areas is in the service sector. And although agriculture still dominates land use and the appearance of the countryside, in most of the EU the proportion of land used for agriculture has fallen as urban and forested areas have expanded.

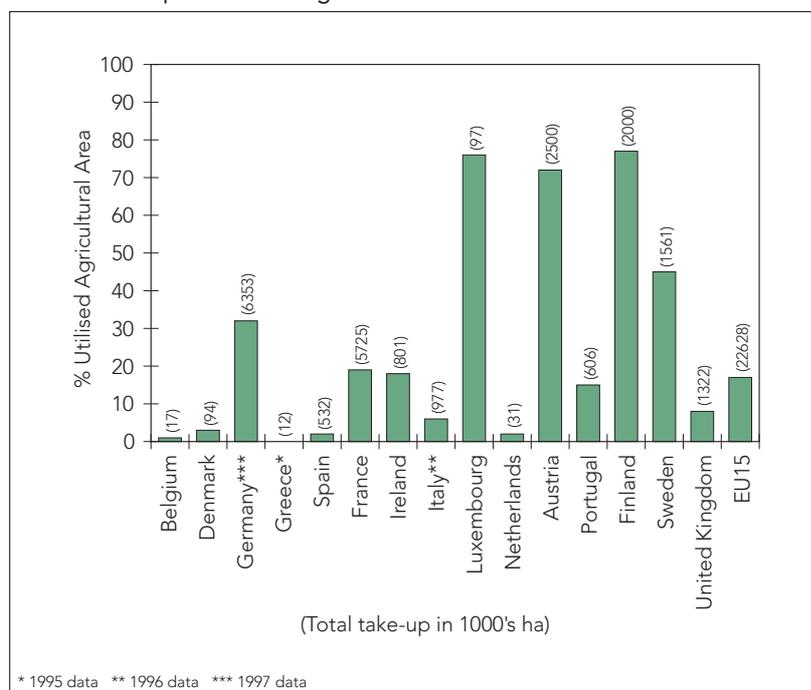
Agriculture in the EU developed –partly driven by the Common Agricultural Policy (CAP)– with huge regional unbalances. One of the most striking features is the fact that 80% of the EU's agricultural production (in terms of farm incomes) occurs in coastal areas of the North Sea and the Channel. This concentration has environmental consequences for water, soils and biodiversity. At the same time, economic pressures on marginal farms can cause land to fall into disuse, thus impacting on biodiversity. In less productive agricultural regions, agriculture has suffered social and economic decline. The more integrated approach to economic activity and the environment in rural areas, now being urged by EU institutions, is beginning to help the agricultural sector to embrace objectives of more extensive agricultural production, stable rural communities and maintenance of ecological functions.

Afforestation may play an important part in environmental protection, and generate a number of positive external effects, e.g. curbing erosion, preventing desertification, encouraging biodiversity and regulating the hydrological regime. But, where the aim is mainly to create economically viable wood-based industries, tensions can exist between the need to maximise the economic return and to protect important environmental assets. Afforestation of agricultural land appears to have made only a small impact on surplus agricultural production. This suggests that afforestation measures generally have little impact where agricultural practices are more specialised and intensive in character. At present, forests – approximately one-third of the total EU land area – still face serious threats, including air pollution,

pests, diseases, reduced species diversity and in some cases an over-emphasis on timber production.

EU environmental *policies and instruments* to address specific rural concerns focus mainly on protecting important bird and habitat areas, and water resources vulnerable to nitrate pollution. It is expected that large areas will be included within Special Areas of Conservation under the Habitats Directive – and this will call for innovative approaches to land management. These policies are supported by agri-environmental measures. The measures in place cover 20% of the utilised agricultural area of the EU. However, while some countries (notably Austria, Luxembourg and Finland) have made very substantial use of the opportunities, others have not. The main aims of the schemes are the introduction of environmentally sound production methods such as low input farming and the provision of incentives for environmental services, for instance in the field of landscapes

Current take-up of land for agri-environment measures



Source: European Commission, 1997

34 Environment in the European Union at the turn of the century

and nature protection. Their implementation has generally had positive environmental impacts, although the take-up of the schemes has been mixed, particularly with respect to set-aside land.

In the Accession Countries, despite agricultural intensification, there are still large areas of semi-natural agricultural habits such as permanent grasslands and pseudo-steppes. European environment ministers have noted the importance of the biological and landscape diversity of the Central and East European Countries, and concluded that integrated rural development strategies are needed to protect and enhance these assets. In general, the formulation of rural development policies is in an early stage within the Accession Countries focusing on agriculture and basic infrastructure.

Coastal and marine zones

Some 85% of European coasts, where about a third of Europe's population lives, are at high or moderate risk from different kinds of pressures and impacts, among which sea level rise from climate change. Remaining poor water quality, coastal erosion and the lack of integrated coastal zone management are the main problems. Coastal erosion, caused by human activities or natural causes, is a major issue in some regions in the EU with 25% of the coast length subject to erosion, 50% stable while 15% is receiving material (aggradation); for the remaining 10%, the evolution is unknown.

Among the 25 less favoured areas in EU in 1983, 23 were coastal areas. The fact that 19 remain so in 1996 shows that in spite of the high expenditure under EU financial instruments (about two-third of the EU Structural funds are allocated to coastal areas) the cohesion results have not been achieved. This lack of economic growth curbs the conditions for environmental management.

Coastal areas could provide the best example of environmental integration. To date, an integrated approach to *Coastal Zone Management* (ICZM) is still missing at national level, where a sectoral approach dominates. Key areas of action for ICZM are environmental impact assessment, coastal land planning, habitat management and pollution control. The results of the EU "Integrated Coastal Zone Management Demonstration Programme" and the initiative of the proposed Water Framework Directive should provide concrete examples on how to tackle the coastal zone management issues as they occur in the Member States.

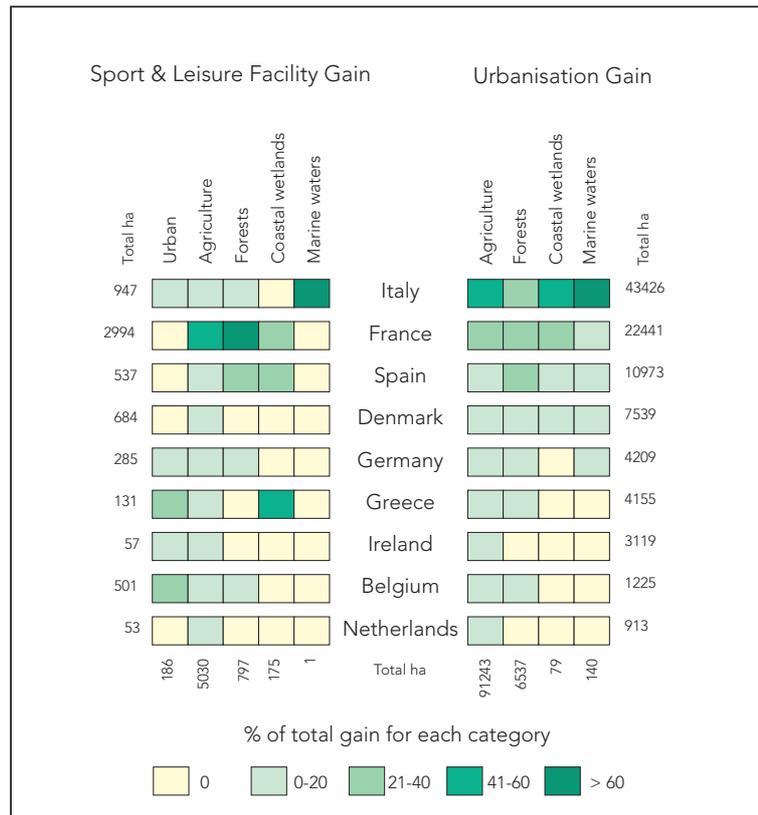
The Mediterranean is the world's leading tourist destination, accounting for 30% of international tourist arrivals and for one-third of the receipts from international *tourism*. The number of tourists in the Mediterranean coastal region is set to rise from 135 million in 1990 to 235-353 million in 2025. Tourism is also important for other coastal regions including the Baltic Sea states, the North Sea and North East Atlantic coasts. Overall, the annual growth rate for tourism in Europe is 3.7% per year. Whether this growth rate will

36 Environment in the European Union at the turn of the century

continue depends on Europe maintaining its market share in competition with other tourism destinations.

Urbanisation, in general, has increased from 1975 to 1990 in the coastal zones in the EU Member States. Agriculture, although being a declining source of employment, remains a major economic activity there. Recent reforms of the Common Agricultural Policy (CAP) have had an effect – for instance, set-aside is expected to lead to a decline of at least 10% in the area of arable land under cultivation on the North Sea coasts, while a further 4-5% of arable land will be farmed less intensively, chiefly because of stricter environmental controls.

Changes in EU agriculture areas in relation to urbanisation – 1975-1990s



Source: LACOAST Project, JRC

All EU *regional seas* are covered by Conventions which share the aim of protecting the marine environment. The Conventions are relatively complete (by means of appropriate scientific and management tools) but they still need to be enforced and above all co-ordinated to provide comparable information.

The **North Sea** catchment area and coasts are densely populated with considerable industrial development, and the offshore oil and gas industry as a major economic activity. Large areas such as the industrialised estuaries have concentrations of contaminants clearly above the North Atlantic background level. Synthetic organic compounds could be found in the North Sea although higher concentrations are clearly identifiable in some areas; known distributions are strongly influenced by sampling distribution. Contaminants come from major rivers – Elbe, Weser, Rhine, Meuse, Scheldt, Seine, Thames, Humber – and also from dredged material and atmospheric inputs. Nutrient levels are high, especially in the southern part of the North sea.

Areas surrounding the **European Arctic** seas are sparsely populated, with little industry. The major sources of pollutants and radionuclides are atmospheric long-range transport, Russian rivers, ice-drift and ocean currents. High levels of persistent organic pollutants are found in some top predators.

In the **Baltic Sea**, maritime traffic is intense. There is considerable transport of oil, which is likely to increase. There have been improvements in the marine environment: discharges of organo-halogen compounds from pulp industry have been reduced by nearly 90% since 1987, and concentrations of polychlorinated biphenyl (PCBs), dychlorodiphenyltrichloroethane (DDT), hexachlorocyclohexane (HCH) and hexachlorobenzene (HCB) have also declined – although they are still several times higher than in the open North Sea and the Atlantic Ocean. Eutrophication is a serious problem due to a combination of excessive nutrients, topography, and the physical and chemical nature of the Baltic Sea. The Baltic Sea states decided in 1988 to reduce nutrients, heavy metals

38 Environment in the European Union at the turn of the century

and persistent organic pollutants by 50% by 1995 but this common objective is not yet reached by all countries.

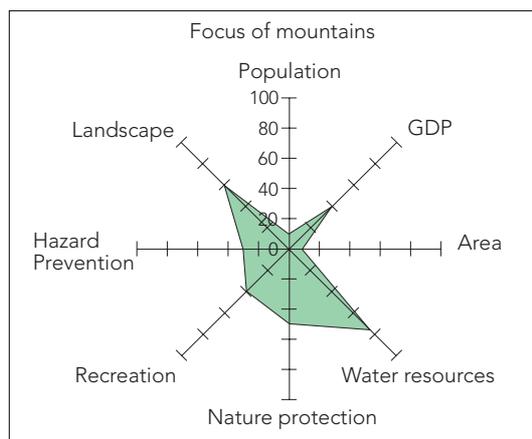
In the **Mediterranean**, there are serious problems with increasing concentrations of hydrocarbons, which contaminate water and beaches. Heavy metals and PCBs, while present, are not a major environmental threat. Eutrophication is a problem in places, and while the situation has been mitigated by the installation of urban waste-water treatment plants, much of the municipal sewage in the Mediterranean is still untreated.

In the last 30 years the **Black Sea** has increasingly attracted the attention of scientists, governments and the public as a region suffering ecological deterioration. In the 1973-1990 period, 60 million tonnes of bottom living animals were found dead (including 5 000 tonnes of fish). These phenomena may be linked to the increase in mineral and nutrients river discharge.

Mountain areas

Mountain areas have seen considerable demographic change – with workers leaving, and retired people moving in. At the same time, tourism and purchases of second homes lead to significant seasonal variation in the population make-up. Tourism, promoted as a means of economic development for remote areas, has imposed environmental pressures in some vulnerable mountain regions; a Protocol to manage this issue exists for the Alps under the Alpine Convention. While ‘green tourism’ is developing as a new market, offering environmental benefits, there is continuing growth in intensive, environmentally threatening tourism in less developed regions.

Several mountain ranges are “trans-national areas” requiring special attention in a European spatial policy in terms of watershed management, risk prevention, preservation of biological and landscape diversity, and recreation. Gradients and exposure make mountain areas highly suitable for renewable energy generation such as wind and hydroelectric energy. These could offer additional, sustainable revenues for mountain economies, but the environmental benefits and costs need to be assessed carefully. Many EU areas depend on the water resources of mountains – for high-quality freshwater, irrigation water for food production, hydropower generation, and for supplies for natural wetlands in plains. There is increasing demand



Mountain issues illustrated by an estimation of their multi-functionality within Europe

Source: EEA

for water, mainly in eastern and southern European countries, at the same time as water resources are threatened by deterioration in quantity and quality, and also by the prospect of climate change.

Over the next 20 years, long-distance freight *traffic* across the Alps is expected to double, and passenger transport to increase by 50 percent. Where much of the traffic is in transit, the mountain areas enjoy little benefit, but can suffer serious environmental and social impacts. Traffic network impacts are concentrated in valleys where people live: thus in the Alpine region there are severe impacts from traffic noise and pollution, particularly from ozone and lead. Potential conflict between transport requirements and the protection of the mountain environment is shown by the experience of Austria, where reducing road infrastructure charges to comply with EU legislation was followed by an increase in freight traffic. In contrast, the Alpine Convention's traffic protocol has helped Switzerland to achieve a 70% share for rail of goods in transit, while the maximum weight for road transport is limited to 28 tonnes per truck (lower than in other Alpine countries).

Worsening economic conditions for *agriculture* threaten cultural landscapes. Soils in mountains are more sensitive to degradation and require specifically adapted land use patterns. However, in the valleys and on good accessible slopes, farming has tended to shift from extensive meadows to intensively grazed pastures, with increased irrigation and use of fertilisers. In other areas, there has been abandonment and afforestation of land, the negative effects of which are partly mitigated by agri-environment measures. Both of these changes cause a significant decline of biodiversity and root density. Unlike intensification, abandonment will cause increasing soil erosion and snow gliding, changes in water storage capacity and water transport in soils, the beginning of podzolisation of soils and might result in more natural hazards.

In the Accession Countries, the main changes are driven by the transition towards a private economy. Pastures are enlarged by cutting subalpine forests and shrubs, while hunting tourism causes the overgrazing of some forests by growing deer stocks.

**Order form for:
Environment in the European Union at the turn of the century**

Please send me ___ copies of: *Environment in the European Union at the turn of the century*,
EEA 1999 , 446 pp, ISBN 92-9157-202-0,
Catalogue number: GH-18-98-784-EN-C, Price in Luxembourg 21 euro.

Please fill in this form in CAPITAL LETTERS and send it to your bookseller or to one of the sales agents of the EU publications office listed overleaf

Name: _____ Date: _____
Address: _____

Phone: _____ Signature: _____

Ordering executive summaries

Executive summaries of *Environment in the European Union at the turn of the century* are delivered free of charge from the EEA, and are also available on the EEA web-site: <http://www.eea.eu.int>. For a personal copy, please e-mail: informationcentre@eea.eu.int indicating language version, number of copies and your contact information. If e-mail is not available, please fill in the order form below and send it to the EEA by mail or fax: EEA, Information Centre, Kongens Nytorv 6, 1050 Copenhagen K, Denmark, Fax: +45 33 36 71 99, Phone: +45 33 36 71 00.

Order form for summary

Please send me free of charge the summary of
Environment in the European Union at the turn of the century, in (please indicate language version and number of copies):

No of copies	Language	No of copies	Language
_____	English	_____	Dutch
_____	French	_____	Swedish
_____	German	_____	Finnish
_____	Spanish	_____	Danish
_____	Italian	_____	Norwegian
_____	Portuguese	_____	Icelandic
_____	Greek		

Name: _____ Date: _____
Address: _____

Sales Agents Liste

European Environment Agency

Environment in the European Union at the turn of the century

Luxembourg: Office for Official Publications of the European Communities

1999 - 44 pp. - 14,8 x 21 cm

ISBN