THE EUROPEAN ENVIRONMENT

STATE AND OUTLOOK 2010

SYNTHESIS

European Environment Agency

SOER 2010

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Key messages

Environmental policy in the European Union and its neighbours has delivered substantial improvements to the state of the environment. However, major environmental challenges remain which will have significant consequences for Europe if left unaddressed.

What differs in 2010, compared to previous EEA European environment — State and outlook reports, is an enhanced understanding of the links between environmental challenges combined with unprecedented global megatrends. This has allowed a deeper appreciation of the human made systemic risks and vulnerabilities which threaten ecosystem security, and insight into the shortcomings of governance.

The prospects for Europe's environment are mixed but there are opportunities to make the environment more resilient to future risks and changes. These include unprecedented investments of information resources and technologies, ready-to-deploy resource accounting methods and a renewed commitment to the established principles of precaution and prevention, rectifying damage at source and polluter pays. These overarching findings are supported by the following 10 key messages:

- **Continuing depletion of Europe's stocks of natural capital and flows of ecosystem services will ultimately undermine Europe's economy and erode social cohesion. Most of the negative changes are driven by growing use of natural resources to satisfy production and consumption patterns. The result is a significant environmental footprint in Europe and elsewhere.**

- **Climate change — The EU has reduced its greenhouse gas emissions and is on track to meet its Kyoto Protocol commitments. However, global and European cuts in greenhouse gas emissions are far from sufficient to keep the average world temperature increase below 2 °C. Greater efforts are needed to mitigate the effects of climate change and put in place adaptation measures to increase Europe's resilience.**

- **Nature and biodiversity — Europe has established an extensive network of protected areas and programmes to reverse the loss of endangered species. However, widespread alteration of landscapes, degradation of ecosystems and loss of natural capital mean that the EU will not meet its target of halting biodiversity loss by 2010. To improve the situation we must prioritise biodiversity and ecosystem in policymaking at all scales, particularly addressing agriculture, fisheries, regional development, cohesion and spatial planning.**

- **Natural resources and waste — Environmental regulation and eco-innovation have increased resource efficiency through a relative decoupling of resource use, emissions and waste generation from economic growth in some areas. However, absolute decoupling remains a challenge, especially for households. This indicates scope not only to improve production processes further, but also to alter consumption patterns to reduce environmental pressures.**

- **Environment, health and quality of life — Water and air pollution have declined but not enough to achieve good ecological quality in all water bodies or to ensure good air quality in all urban areas. Widespread exposure to multiple pollutants and chemicals and concerns about long-term damage to human health together imply the need for more integrated pollution prevention programmes and the use of precautionary approaches.**

- **Links between the state of Europe's environment and various global megatrends imply increasing systemic risks. Many key drivers of change are highly interdependent and likely to unfold over decades rather than years. These interdependent trends and issues, many of them outside Europe's direct influence, will have significant consequences and potential risks for the resilience and sustainable development of the European economy and society. Better knowledge of the linkages and associated uncertainties will be essential.**

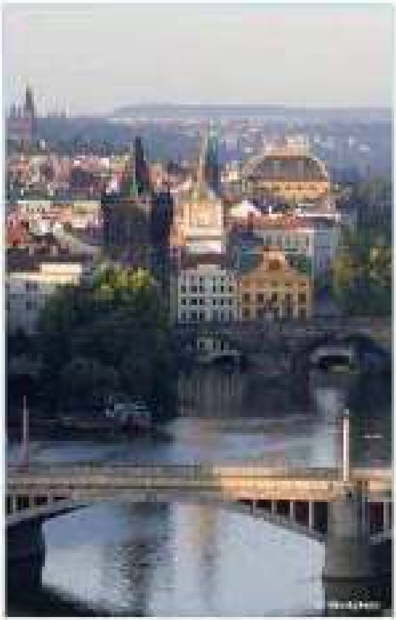
- **The notion of balanced management of natural capital and ecosystem services is a compelling integrating concept for dealing with environmental pressures from multiple sectors. Spatial planning, resource accounting and coherence among sectoral policies implemented at all scales can help balance demand to preserve natural capital and use it to fuel the economy. A more integrated approach of this sort would also provide a framework for monitoring progress more broadly and strengthen coherent analyses across multiple policy targets.**

- **Increased resource efficiency and security can be achieved, for example, using extended life-cycle approaches to reflect the full environmental impacts of products and activities. This can reduce Europe's dependence on resources globally and promote innovation. Pricing that takes full account of resource use impacts will be important for steering business and consumer behaviour towards enhanced resource efficiency. Continuing to tailor policies according to their resource needs and environmental pressures would improve coherence, address shared challenges efficiently, maximise economic and social benefits and help avoid unintended consequences.**

- **Implementing environmental policies and strengthening environmental governance will continue to provide benefits. Better implementation of sectoral and environmental policies will help ensure that goals are achieved and provide regulatory stability for businesses. A broader commitment to environmental monitoring and up-to-date reporting of environmental pollutants and wastes, using the best available information and technologies, will make environmental governance more effective. This includes reducing long-term remediation costs through early action.**

- **Transformation towards a greener European economy will ensure the long-term environmental sustainability of the region and its neighbourhood. In this context, shifts in attitudes will be important. Together, regulators, businesses and citizens could participate more widely in managing natural capital and ecosystem services, creating new and innovative ways to use resources efficiently and designing equitable fiscal reforms. Using education and various social media, citizens can be engaged in tackling global issues such as meeting the 2 °C climate target.**

The seeds for future actions exist. Our task ahead is to help them take root and flourish.



1 The state of the environment in Europe

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Figure 1.1 Structure of The European environment — State and outlook 2010 (SOER 2010)

Note: For additional information, please visit www.eea.europa.eu/soer.

Source: EEA.

The state of the environment in Europe | Synthesis

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Table 1.1 Which countries and regions does this report address?

[illegible]	[illegible]	[illegible]	[illegible]

Note: [illegible]

trends here, the more detailed analyses that follow show that in some instances, such as waste and greenhouse gas emissions, there are substantial differences by economic sector and country.

Several key environmental issues are not shown in this summary table, either because they lack explicit targets or because it is too early to measure progress against more recently agreed targets. Such issues include, for example, noise, chemicals and hazardous substances, marine and technological hazards. They are, however, considered in subsequent chapters of this report and the results from their analyses have contributed to the conclusions of this report.

The overall emerging picture of progress towards meeting environmental targets confirms the findings of previous European state of the environment reports, namely that there have been considerable improvements in many areas, but a number of major challenges remain. This picture is also reflected in recent Annual Environment Policy Reviews by the European Commission in which up to two-thirds of the 30 environmental indicators selected show a good performance or improving trend, while the remainder point to either good performance or at least modest progress towards environmental targets ([illegible]).

1.1.4 Links between environmental pressures point to environmental systemic risks

This report describes the state of and trends in the environment in Europe as well as prospects for the future along a central thread of four environmental issues: climate change, nature and biodiversity, natural resources and waste, and environment, health and quality of life. These four issues have been chosen as entry points as they are the priorities of current European strategic policies in the EU 6th Environment Action Programme ([illegible]) and the EU Strategy for Sustainable Development ([illegible]), and thereby help to create a direct link with the European policy framework.

The analyses point to the fact that today's understanding and perception of environmental challenges are changing: no longer can they be seen as isolated, simple and specific issues. Rather, the challenges are increasingly broad-ranging and complex, part of a web

Table 1.1 Indicative summary table of progress towards meeting environmental targets or objectives, and highlights of related trends over the past 10 years ([illegible])

Environmental issue	EU-27 target/objective	EU-27 → on track?	EEA-38 → trend?
Climate change			
Global mean temperature change	To limit increase to below 2 °C globally ([illegible])	[illegible]	[illegible]
Greenhouse gas emissions	To reduce greenhouse gas emissions by 20 % by 2020 ([illegible])	[illegible]	[illegible]
Energy efficiency	To reduce primary energy use by 20 % by 2020 vs baseline projections ([illegible])	[illegible]	[illegible]
Renewable energy sources	To increase energy consumption from renewables by 20 % by 2020 ([illegible])	[illegible]	[illegible]
Nature and biodiversity			
Pressures on ecosystems (in terms of [illegible])	[illegible]	[illegible]	[illegible]
Conservation status (habitats [illegible])	To achieve favourable conservation status [illegible]	[illegible]	[illegible]
Biodiversity (terrestrial and marine species and habitats)	To halt loss of biodiversity by 2010 ([illegible])	[illegible] (terrestrial) / [illegible] (marine)	[illegible]
Soil degradation (soil organic [illegible])	To prevent further soil degradation and preserve its functions ([illegible])	[illegible]	[illegible]
Natural resources and waste			
Decoupling (resource use from economic growth)	To decouple resource use from economic growth ([illegible])	[illegible]	[illegible]
Waste generation	To substantially reduce waste generation ([illegible])	[illegible]	[illegible]
Waste management (recycling)	Targets: recycling of waste for different specific waste streams	[illegible]	[illegible]
Water stress (water exploitation)	To achieve good quantitative status of water bodies ([illegible])	[illegible]	[illegible]

Table 1.1 Indicative summary table of progress towards meeting environmental targets or objectives, and highlights of related trends over the past 10 years ([illegible]) (cont.)

Environmental issue	EU-27 target/objective	EU-27 → on track?	EEA-38 → trend?
Environment and health			
Water quality (ecological and chemical status)	To achieve good ecological and chemical status of water bodies ([illegible])	[illegible]	[illegible]
Water pollution (from point sources, and bathing water quality)	To comply with existing water quality (urban wastewater directive) ([illegible])	[illegible]	[illegible]
Transboundary air pollution (SO_2, NO_x, NH_3, [illegible])	To limit emissions of acidifying, eutrophying and ozone precursor pollutants ([illegible])	[illegible]	[illegible]
Air quality in urban areas (particulate matter and ozone)	To achieve levels of air quality that do not give rise to negative health impacts ([illegible])	[illegible]	[illegible]

Legend

Positive developments	Neutral developments	Negative developments
Decreasing trend	Stable	Decreasing trend
Increasing trend		Increasing trend
On track [illegible]	Some progress [illegible]	Not on track [illegible]

Source: EEA ([illegible]).

of linked and interdependent functions provided by different natural and social systems. This does not imply that the environmental concerns which emerged in the previous century, such as how to reduce greenhouse gas emissions or halt biodiversity loss, are no longer important. Rather, it points towards an increased degree of complexity in the way we understand and respond to environmental challenges.

This report seeks to shed light from various viewpoints on key characteristics of the complex links between environmental issues. It does so by providing a closer analysis of the links between different environmental challenges, as well as between environmental and societal trends and their respective policies. For example, reducing the rate of climate change requires not only the reduction of greenhouse gas emissions from power plants, but also the reduction of more diffuse emissions from transport and agriculture as well as changes in household consumption patterns.

Taken together, trends in Europe and globally point towards a number of systemic environmental risks, such as the potential loss or damage to an entire system rather than a single element, which can be made worse by the many interdependencies between them. Systemic risks can be triggered by sudden events or built up over time, with the impact often being large and possibly catastrophic ([illegible]).

A number of underlying developments in Europe's environment display key characteristics of systemic risk:

- many of Europe's environmental issues, such as climate change or biodiversity loss, are linked and have a complex and often global character;
- they are closely linked to other challenges, such as unsustainable resource use, that span the societal and economic spheres and undermine important ecosystem services;
- as environmental challenges have become more complex and more profoundly linked to other societal concerns, the uncertainties and risks associated with them have increased.

Table 1.1 Evolution of environmental issues and challenges

In the spotlight during	Climate change	Nature and biodiversity	Natural resources and waste	Environment and health
1970s/1980s (and today)		[illegible]	[illegible]	[illegible]
1990s (and today)	[illegible]	[illegible]	[illegible]	[illegible]
2000s (and today)	[illegible]	[illegible]	[illegible]	[illegible]

Source: EEA.

The report does not present any scenarios of imminent environmental collapse. However, it does note that some local and global thresholds are being crossed, and that negative environmental trends could lead to dramatic and irreversible damage to some of the ecosystems and services that we take for granted. In other words, the current insufficient rate of progress observed over the past few decades in addressing environmental issues may severely undermine our ability to deal with potential future negative impacts.

Looking at the state of the environment and future challenges from different perspectives

Subsequent chapters assess, in more detail, key trends in the four environmental priority issues already mentioned.

Chapters 2 to 5 provide an assessment of the state of, trends in and prospects for each of these issues.

Chapter 6 reflects on the many direct and indirect connections across issues from the perspective of natural capital and ecosystem services, focusing on land, soil and water resources.

Chapter 7 then widens this by looking out to the rest of the world in terms of key socio-economic and environmental megatrends that can be expected to affect Europe's environment.

The final chapter, Chapter 8, reflects on the findings of the previous chapters and their implications for future environmental policies. It does this through an additional series of lenses: the lens of managing natural capital and ecosystem services, the lens of a green economy, the lens of strengthened integrated policies and the lens of state of the art information systems, and concludes that:

- better implementation and further strengthening of environmental protection provides multiple benefits;
- dedicated management of natural capital and ecosystem services increases resilience;

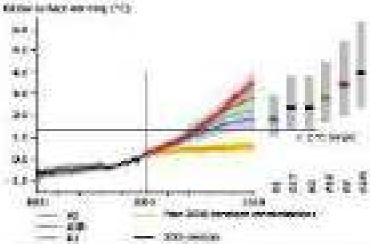
- more integrated actions across policy domains can help deliver positive environmental outcomes with co-benefits for the wider economy;
- sustainable natural capital stewardship requires a transition towards a greener, more resource-efficient economy.

2 Climate change

Climate change could lead to catastrophic impacts if unchecked

[illegible]

Figure 2.1 Past and projected global surface temperature changes (relative to 1980–1999), based on multi-model averages for selected IPCC scenarios



[illegible]

[illegible]

Europe's ambition is to limit global mean temperature increases to below 2 °C

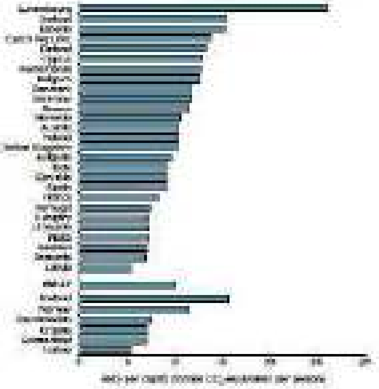
[illegible]

The EU has been reducing its greenhouse gas emissions, and will meet its Kyoto obligations

[illegible]

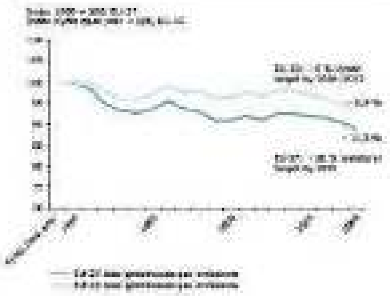
substances (ODS) under the Montreal Protocol has contributed indirectly to a very significant decrease in GHG emissions. It is estimated that ODS emissions globally by more than the reductions expected through compliance with the provisions of the Kyoto Protocol by the end of 2012 (?).

Figure 2.2 Greenhouse gas emissions in tonnes CO_2-equivalent per person by country in 2008



Source: EEA.

Figure 2.3 Domestic GHG emissions in EU-15 and EU-27 between 1990 and 2008 (?)



Source: EEA.

A closer look at key sectoral greenhouse gas emission trends reveals a mixed picture

The main sources of man-made GHG emissions globally are the burning of fossil fuels for electricity generation, transport, industry and households — which together account for about two-thirds of total global emissions. Other sources include deforestation — which contributes about a fifth — agriculture, land filling of waste, and the use of industrial fluorinated gases. Overall, in the EU, energy consumption — power and heat generation and consumption in industry, transport and households — accounts for nearly 80 % of GHG emissions (?).

Historic trends of GHG emissions in the EU over the past 20 years are the result of two sets of opposing factors (?).

On the one hand, emissions have been driven upwards by a series of factors, such as:

- increases in the production of electricity and heat by thermal plants, which has increased both in absolute terms and in comparison with other sources;
- economic growth in manufacturing industries;
- increasing transport demand for passengers and freight;
- increasing share of road transport compared with other transport modes;
- increasing number of households;
- and demographic changes over the past decades.

On the other hand, emissions have been driven downwards in the same period by factors such as:

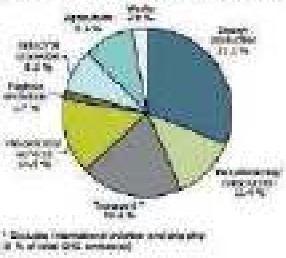
- improvements in energy efficiency, in particular by industrial end users and the energy industries;
- fuel efficiency improvements in vehicles;
- better waste management and improved landfill gas recovery (the waste sector achieved the highest relative reductions);
- decreases in emissions from agriculture (by more than 20 % since 1990);
- a shift from coal to less polluting fuels, particularly gas and biomass, for the production of electricity and heat;
- and partly due to the economic restructuring in eastern Member States in the early 1990s.

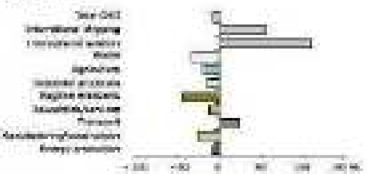
EU GHG emissions trends between 1990 and 2008 were dominated by the two largest emitters, Germany and the United Kingdom, which together were responsible for more than half of the total reduction in the EU. Significant reductions were also achieved by some EU-12 Member States, such as Bulgaria, Czech Republic, Poland and Romania. This overall decrease was partly offset by emission increases in Spain and, to a lesser extent, Italy, Greece and Portugal (?).

The overall trends are influenced by the fact that, in many cases, emissions from large point sources have been reduced, while at the same time emissions from more mobile and/or diffuse sources, especially those transport-related, have increased considerably.

In particular, transport still remains a problematic and rising sector. Transport emissions of GHGs increased by 24 % between 1990 and 2008 in the EU-27, excluding emissions from international aviation and marine transport (?). While rail freight and inland waterways saw a decline in market share, the number of cars in the EU-27 increased by 22 %, or 38 million cars, between 1995 and 2008 (?).

Figure 3.4 Greenhouse gas emissions in the EU-27 by sector in 2008, and changes between 1990 and 2008





Note: [illegible]

Source: EEA.

Box 3.1 Towards a resource-efficient transport system

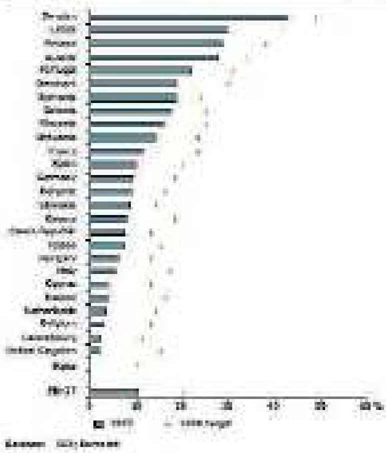
[illegible]

Source: EEA, TERM.

Looking ahead to 2020 and beyond: the EU is making some progress

[illegible]

Figure 3.5 Share of renewable energy in final energy consumption in EU-27 in 2007 and national 2020 targets



Source: EEA; Eurostat.

In the EU, significant improvements in energy efficiency occurred in all sectors due to technological developments, for example, industrial processes, car engines, space heating and electrical appliances. Also, energy efficiencies of buildings in Europe have significant potential for long-term improvements ([illegible]). On a larger scale, smart appliances and smart grids can also help improve the overall efficiency of electricity systems, enabling load/plant generation to be used less frequently through reducing peak loads.

Box 3.2 Rethinking energy systems: supergrids and smart grids

[illegible]

Source: [illegible]

Climate change impacts and vulnerabilities differ across regions, sectors and communities

Many key climate indicators are already moving beyond the patterns of natural variability within which contemporary society and economies have developed and thrived.

The main consequences of climate change expected in Europe include an increased risk of coastal and river floods, droughts, loss of biodiversity, threats to human health, and damage to economic sectors such as energy, forestry, agriculture, and tourism ([illegible]). In some sectors, new opportunities may occur especially at least for some time, such as improved agricultural production and forestry activities in northern Europe. Projections for climate change suggest that the suitability of some regions for tourism — especially in the Mediterranean — may decline during the summer months, although there may be an increase during other seasons. Similarly, opportunities for expanding tourism in northern Europe may come about. However, over a longer period and with increasing extreme events, adverse effects are likely to dominate in many parts of Europe ([illegible]).

The consequences of climate change are expected to vary considerably across Europe, with pronounced impacts expected in the Mediterranean basin, north-western Europe, the Arctic and mountainous regions. For the Mediterranean basin, in particular, increasing water temperatures and decreases in water availability are expected to exacerbate current vulnerability to drought, forest fires and heat waves. Meanwhile, in north-western Europe, low-lying coastal areas face the challenge of sea-level rise and an increased risk of associated storm surges. Temperature increases are projected to be greater than average in the Arctic, placing particular pressure on its very fragile ecosystems. Additional environmental pressures may result from easier access to oil and gas reserves, as well as new shipping routes as ice cover decreases ([illegible]).

Mountain areas face substantial challenges including reduced snow cover, potential negative impacts on winter tourism and extensive species loss. In addition, permafrost degradation in mountain regions may create infrastructural problems as roads and bridges may not be able to cope. Already today, the vast majority of glaciers in European mountains are in retreat — which also affects water resources management in downstream areas ([illegible]). In the Alps, for example, glaciers have lost approximately two-thirds of their volume since the 1850s, and acceleration of glacier retreat has been observed since the 1980s ([illegible]). Similarly coastal and river flood-prone areas across Europe are particularly vulnerable to climatic changes, as are cities and urban areas.

Map 3.1 Key past and projected impacts and effects of climate change for the main biogeographical regions of Europe

Source: EEA, JRC, WHO ([illegible]).

Climate change is projected to have major impacts on ecosystems, water resources and human health

[illegible]

intensification of the hydrological cycle — due to changes in temperature, precipitation, glaciers and snow cover. In general, annual river flows are increasing in the north and decreasing in the south, a trend that is projected to increase with future global warming. Large changes in seasonality are also projected, with lower flows in summer and higher flows in winter. As a consequence, droughts and water stress are expected to increase especially in southern Europe and particularly in summer. Flood events are projected to occur more frequently in many river basins, particularly in winter and spring, although estimates of changes in flood frequency and magnitude remain uncertain.

While information on the impacts of climate change on soil and the various related feedbacks is very limited, changes in the bio-physical nature of soil are likely due to projected rising temperatures, changing precipitation intensity and frequency and more severe droughts. Such changes can lead to a decline in soil organic carbon stocks — and a substantial increase in CO_2 emissions. Projected increased variations in rainfall patterns and intensity are likely to make soils more susceptible to erosion. Projections show significant reductions in summer soil moisture in the Mediterranean region, and increases in north-eastern Europe ([?]). Furthermore, prolonged drought periods due to climatic changes may contribute to soil degradation and increase the risk of desertification in parts of the Mediterranean and eastern Europe.

Climate change is also projected to increase health risks due to, for example, heat-waves and weather-related disasters (see Chapter 5 for further details). This highlights the need for preparedness, awareness-raising and adaptation ([?]). The related risks are very dependent on human behaviour and the quality of healthcare services. Furthermore, a number of vector-borne diseases, as well as some water- and food-borne disease outbreaks may become more frequent with rising temperatures and more frequent extreme events ([?]). In parts of Europe, there may be some benefits to health, including fewer deaths from cold. It is, however, expected that the benefits will be outweighed by the negative effects of rising temperatures ([?]).

Dedicated adaptation by Europe is urgently needed to build resilience against climate impacts

Even if European and global emission reductions and mitigation efforts over the coming decades prove successful, adaptation measures will still be necessary to deal with the unavoidable impacts of climate change. Adaptation is defined as the adjustment of natural or human systems to actual or expected climatic change or its effects in order to moderate harm or exploit beneficial opportunities ([?]).

Adaptation measures include technological solutions ('grey' measures), ecosystem-based adaptation options ('green' measures), and behavioural, managerial and policy approaches ('soft' measures). Practical examples of adaptation measures include early warning systems related to heat-waves, drought and water scarcity risk management, water demand management, crop diversification, coastal and river flood defences, disaster risk management, economic diversification, insurance, land-use management, and enhancing green infrastructure.

These need to reflect the degree to which vulnerability to climate change differs across regions and economic sectors, as well as across societal groups — especially the elderly and low-income households, both of which are more vulnerable than others. Furthermore, many adaptation initiatives should not be undertaken as stand-alone actions, but embedded within broader sectoral risk-reduction measures, including water-resource management and coastal defence strategies.

The costs of adaptation in Europe are potentially large — and may amount to billions of Euro per year in the medium and long term. However, economic assessments of the cost and benefits are subject to considerable uncertainties. Nevertheless, assessments of adaptation options have suggested that timely adaptation measures make economic, social and environmental sense, as they may reduce potential damages, save opportunities and pay off many times compared to inaction.

In general, countries are aware of the need to adapt to climate change and 11 EU Member States had adopted a national adaptation strategy by spring 2010 ([?]). At a European scale, the EU White Paper on

Table 3.x People at risk of being flooded, damage and adaptation cost at EU-27 level — without adaptation and with adaptation

	People at risk of being flooded (thousand/year)		Adaptation cost (billion EUR/year)		Residual damage cost (billion EUR/year)		Total cost (billion EUR/year)	
	Without adaptation	With adaptation	Without adaptation	With adaptation	Without adaptation	With adaptation	Without adaptation	With adaptation
A2								
2030	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2050	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B1								
2030	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2050	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: Two scenarios are analysed, based on the IPCC A2 and B1 emission scenarios.

Source: EEA, ETC Air and Climate Change ([?]).

Adaptation ([?]) is a first step towards an adaptation strategy to reduce vulnerability to the impacts of climate change and complements actions at national, regional and even local levels. Integration of adaptation into environmental and sectoral policy measures — such as those related to water, nature and biodiversity, and resource efficiency — is an important aim.

However, the EU White Paper on Adaptation recognises that limited knowledge is a key barrier and calls for a stronger knowledge base. To address related gaps, the creation of a European clearinghouse on climate change impacts, vulnerability and adaptation is foreseen. This aims to enable and encourage the sharing of information and good adaptation practices between all stakeholders.

Responding to climate change also affects other environmental challenges

Climate change is a result of one of the greatest market failures the world has seen ([?]). The issue is closely intertwined with other environmental issues, as well as broader societal and economic developments. Responding to climate change by mitigating or adapting can and should therefore not be done in isolation — as responses will also affect other environmental issues both directly and indirectly (Chapter 6).

Synergies between adaptation and mitigation measures are possible (for example in the context of land and forest management) and adaptation can help to increase resilience against other environmental challenges. Meanwhile, 'mal-adaptation' is to be avoided: this refers to measures that are either disproportionate, cost-ineffective or conflict with other policy objectives in the long term (such as additional snow making or air conditioning and its related emissions) ([?]).

Many climate change mitigation measures will deliver ancillary environmental benefits including reductions in emissions of air pollutants from fossil fuel combustion. Conversely, reduced air pollutant emissions related to climate change policies are also expected to lead to a fall in pressures on public health systems and ecosystems, for example through lower urban air pollution or decreased levels of acidification ([?]).

Climate change policies are already reducing the overall cost of pollution abatement needed to meet the objectives of the EU's Thematic Strategy on Air Pollution ([?]). It has been suggested that the inclusion of the effects of air pollution on climate change in air quality strategies can lead to benefits by reducing particulate matter and ozone precursors in addition to targeting CO_2 and other long-lived GHGs ([?]).

The implementation of measures to combat climate change is likely to lead to considerable ancillary benefits for air pollution abatement by 2030. This includes lower overall costs of controlling air pollutant emissions of the order of EUR 10 billion per year and a reduction in damage to public health and ecosystems (). Such reductions are particularly notable for oxides of nitrogen (NO_x), sulphur dioxide (SO_2), and airborne particles.

Furthermore, the reduction of emissions of black, soot and other aerosols — such as 'black carbon', carbon aerosols from fossil fuel combustion and burning of biomass — may have substantial benefits both in improving air quality and limiting the related warming effect. Black carbon emitted in Europe contributes to carbon deposition on ice and snow in the Arctic region, which may accelerate the melting of the ice caps and exacerbate climate change impacts.

However, in other areas ensuring co-benefits between tackling climate change and responding to other environmental challenges may be less straightforward.

There may be, for example, trade-offs between the large-scale deployment of different renewable energy types and the improvement of Europe's environment. Examples of this include the interplay between hydropower generation and goals of the Water Framework Directive (), the indirect land-use effects of bioenergy production which can greatly reduce or eliminate carbon benefits (), and the sensitive placement of wind turbines and barrages in order to reduce impacts on marine and bird life.

Conversely, adaptation and mitigation measures that build on an ecosystem perspective have the potential to lead to win-win situations as they both provide adequate responses to climate change challenges and also to sustain natural capital and ecosystem services in the long term (Chapters 4 and 5).

3 Nature and biodiversity

Biodiversity loss degrades natural capital and ecosystem services

'Biodiversity' includes all living organisms found in the atmosphere, on land and in water. All species have a role and provide the 'fabric of life' on which we depend: from the smallest bacteria in the soil to the largest mammal in the ocean (). The four basic building blocks of biodiversity are genes, species, habitats and ecosystems (). The preservation of biodiversity is fundamental to human well-being and sustainable provisioning of natural resources (). Furthermore it is closely interlinked with other environmental issues, such as the adaptation to climate change or protecting human health.

Europe's biodiversity is heavily influenced by human activities including agriculture, forestry and fisheries, as well as urbanisation. Roughly half of Europe's land area is farmed, most forests are exploited, and natural areas are increasingly fragmented by urban areas and infrastructural development. The marine environment is also heavily affected, not just by unsustainable fisheries, but also by other activities such as offshore extraction of oil and gas, sand and gravel extraction, shipping, and offshore wind farms.

Exploitation of natural resources typically leads to disturbance and changes in the diversity of species and habitats. Commonly moderate agricultural patterns, as seen in Europe's traditional agricultural landscapes, have contributed to a higher species diversity at a regional level if compared to what can be expected of wholly natural systems. Over-exploitation, however, can lead to degradation of natural ecosystems and ultimately to species extinctions. Examples of such ecological feedbacks are the collapse of commercial fish stocks through overfishing, the decline of pollinators due to intensive agriculture, and reduced water retention and increased flooding risks due to the destruction of moorland.

By introducing the concept of ecosystem services, the Millennium Ecosystem Assessment () framed the debate on biodiversity loss upside down. Beyond conservationist concerns, biodiversity loss has become an essential part of the debate on human well-being and the sustainability of our lifestyle, including consumption patterns.

Loss of biodiversity can thus lead to degradation of 'ecosystem services' and undermine human well-being.

Evidence is growing that ecosystem services are under great pressure globally due to the over-exploitation of natural resources in combination with human-induced climate change (). Ecosystem services are often taken for granted, but are in fact very vulnerable. The soil, for example, is a key component of ecosystems, and supports a rich variety of organisms and provides many regulating and supporting services. Yet it is only, at most, a few metres thick, and often considerably less, and subject to degradation through erosion, pollution, compaction and salinisation (Chapter 3).

Although Europe's population is expected to remain roughly stable over the next decades, the consequences for biodiversity of increasing global resource demand for food, fibres, energy and water, and lifestyle changes are expected to continue in different dimensions (see Chapter 7). Further land cover conversion and intensification of land use, both in Europe and in the rest of the world, may

Box 3.1 Ecosystem services

Ecosystems provide a number of basic services that are essential for using Earth's resources sustainably. These include:

- Provisioning services — the resources that are directly exploited by humans, such as food, fibres, water, raw materials, medicines;
- Supporting services — the processes that underpin other ecosystem services, such as primary production, pollination;
- Regulating services — the natural mechanisms regulating climate regulation, nutrient and water circulation, pest regulation, flood prevention, etc.;
- Cultural services — the benefits people gain from the natural environment for recreational, cultural and spiritual purposes.

In this framework, biodiversity is the basis for all ecosystem services.

Source: Millennium Ecosystem Assessment ().

[illegible]

Europe's ambition is to halt the loss of biodiversity and maintain ecosystem services

[illegible]

Biodiversity is still in decline

[illegible]

[illegible]

Figure 3.3 Common birds in Europe — population index

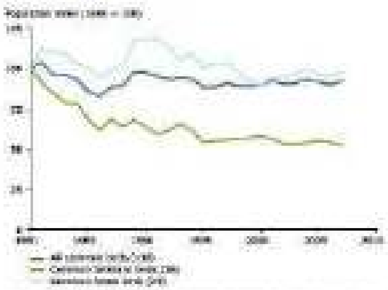
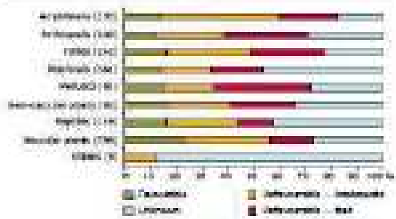
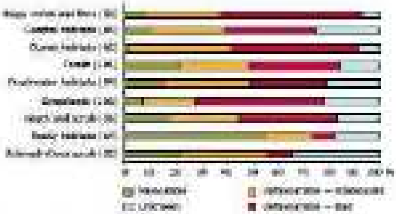
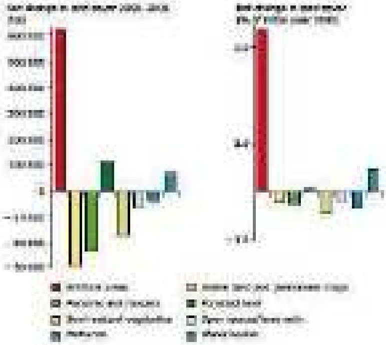
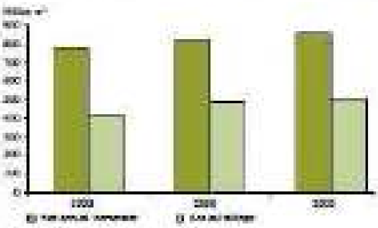


Figure 3.2 Conservation status of species (top) and habitats (bottom) of Community interest in 2008









Map 3.1 Intensity of forestry – net harvesting rate in 2005

Utilisation rate (annual fellings expressed as a percentage of the annual increment) in 2005

< 10 | 20–40 | 40–60 | 60–80 | > 80 | Not reported

Source: MCPFE, [illegible]

Farmland areas decrease but management intensifies: species-rich grasslands are in decline

The concept of ecosystem services is probably most obvious for agriculture. The prime objective is food provision, but farmland delivers many other ecosystem services. Europe's traditional agricultural landscapes are a major cultural heritage, attract tourism and other outdoor recreation opportunities. Farmland soils play a key role in nutrient and water cycling.

European agriculture is characterised by a dual trend: large-scale intensification in some regions, and land abandonment in others. Intensification is aimed at yield increase and requires investment in machinery, drainage, fertilisers and pesticides. It is also often associated with simplified crop rotations. Where socio-economic and biophysical circumstances do not allow this, agriculture remains extensive or is given up. These developments have been driven by a combination of factors including technological innovation, policy support and international market developments, as well as climate change, demographic trends and lifestyle changes. The concentration and optimisation of agricultural production has had major consequences for biodiversity, as has become apparent in the decline of farmland birds and butterflies.

Agricultural areas with high biodiversity, such as extensive grasslands, still make up about 30 % of Europe's farmland. Although its natural and cultural value is recognised in European environmental and agriculture policies, the current measures being taken within the framework of the CAP are not sufficient to prevent further decline. The vast majority of High Nature Value (HNV) farmland, about 80 %, is outside protected areas ([illegible]). The remaining 20 % is protected under the Birds and Habitats Directives. Sixty-one of the 231 habitat types of Community interest of the EU Habitats Directive are related to agricultural management, mainly grazing and mowing ([illegible]).

The assessment reports provided by EU member states under the Habitats Directive ([illegible]) indicate that the conservation status of these agricultural habitats is worse than the others. Potentially favourable measures under the rural development regulation — the second pillar of the CAP — make up less than 10 % of total CAP expenditure

Map 3.2 Approximate distribution of HNV farmland in EU-27 ([illegible])

Approximate distribution of High Nature Value (HNV) farmland across Europe

Natura 2000 sites | Prime butterfly areas (PBA) | Important bird areas (IBA)

HNV farmland %: 0 | > 0–20 | 20–50 | 50–75 | 75–100 | Outside data coverage

Note: [illegible]

Source: JRC, EEA [illegible]

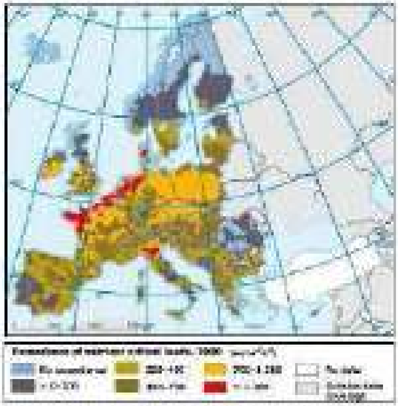
and appear mainly targeted at HNV farmland conservation. The vast majority of CAP support still benefits the most intensive productive areas and farming systems ([illegible]). Decoupling subsidies from production ([illegible]) and mandatory cross-compliance with environmental legislation can ease agricultural pressures on the environment to some extent, but this is not enough to ensure the continuing management that is needed for effective HNV farmland conservation.

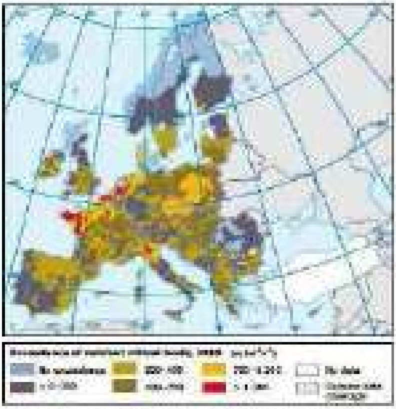
Intensification of agriculture poses threats not only to biodiversity on farmland, but also to biodiversity in farmland soil. The total weight of micro-organisms in the soil below a hectare of temperate grassland can exceed 5 tonnes — as much as a medium-sized elephant — and often exceeds the above-ground biomass. These biota are involved in most of the key soil functions. Soil conservation is therefore a major environmental concern as soil degradation processes are widespread in the EU (Chapter 4).

Increasing bioenergy production — for example, in the context of the EU target of increasing the share of renewable energy used in transport to 10 % by 2020 ([illegible]) — has also increased pressures on agricultural land resources and biodiversity. The conversion of land to certain types of biofuel crop production leads to intensification in terms of fertiliser and pesticide use, increased pollution load and further biodiversity loss. Much depends on where the conversion takes place and the extent to which European production contributes to reaching the biofuel target. The available information suggests that the trend towards concentration of agriculture in the most productive areas, as well as in further intensity and productivity increases, is likely to continue ([illegible]).

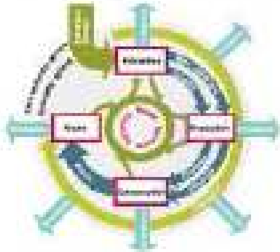
Terrestrial and freshwater ecosystems are still under pressure despite reduced pollution loads

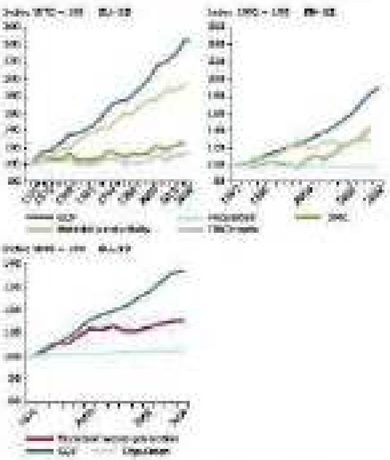
Apart from the direct effects of land conversion and exploitation, human activities such as agriculture, including waste production and transport cause indirect and cumulative effects on ecosystems — notably through air, soil and water pollution. A wide range of pollutants — including excess nutrients, pesticides, microbes, industrial chemicals, metals and pharmaceutical products — end up in the soil, in groundwater and surface water. Atmospheric deposition





4 Natural resources and waste





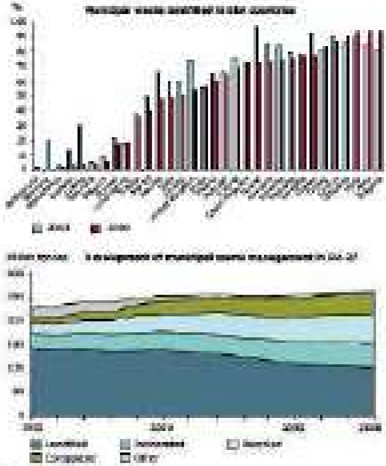
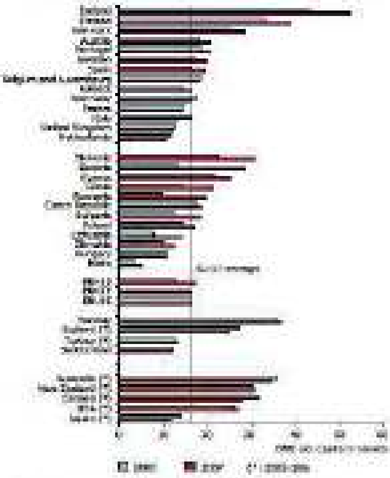


Figure 4.4 Resource use per person, by country, 2000 and 2007



Note: Domestic material consumption (DMC) is the aggregate of resources (excluding water and air) [illegible] consumed by a national economy. It includes [illegible] domestic extraction and physical imports [illegible] minus exports [illegible].

Source: [illegible]

the EU-15. This continues to have considerable environmental and economic consequences. Of 8.2 billion tonnes of materials used in the EU-27 in 2007, minerals and building materials accounted for more than half, and fossil fuels and biomass for about a quarter each.

The resource use category which increased most between 2000 and 2007 was that of minerals for construction and industrial use. Differences between individual countries are significant: the use of resources per person varies by a factor of almost ten between the highest and the lowest countries. Factors that determine resource use per person include climate, population density, infrastructure, availability of resources, level of economic development, and the structure of the economy.

Although the level of extraction of resources within Europe has remained stable, and in some cases has even decreased — [illegible] — As Europe uses up reserves that are easy to access, it will have to rely more on less concentrated ores, less accessible resources and fossil fuels with lower energy content, which are expected to cause higher environmental impacts per unit of material or energy produced.

The high use of resources to fuel economic growth increases the problems of securing supplies and sustainable yields, and managing the environmental impacts in relation to ecosystems' absorption capacities. A challenge for both policy and science is how best to measure environmental impacts that result from resource use; several current initiatives aim to better quantify the environmental impacts of resource use.

Box 4.1 Quantifying environmental pressures and the environmental impacts of resource use

[illegible]

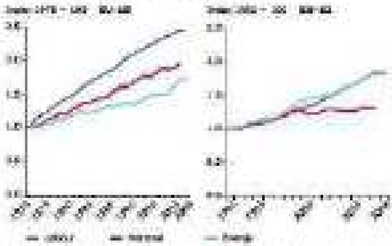
Source: EEA.

Reducing resource use in Europe also reduces environmental impacts globally

European economies are creating more and more wealth from the resources that we use. Resource efficiency in Europe has improved over the past two decades through the use of more efficient technologies, the transition to service-based economies and an increased share of imports in EU economies.

However, differences in resource efficiency across Europe are substantial, with a factor of almost ten between the most and least resource-efficient EU economies. Factors that affect resource efficiency include the technological level of production and consumption, the share of services versus heavy industry, regulatory and tax systems, and the share of imports in total resource use.

Figure 4.5 Growth in the productivity of labour, energy and materials, EU-15 and EU-12



Sources: The Conference Board [illegible] International Energy Agency energy data.

The magnitude of the differences between countries points to significant potential for improvement. For example, resource efficiency in EU-12 is only about 40 % of that in the EU-15. The ratio has changed little over the past two decades, and efficiency improvements in the EU-12 were mostly recorded before 2000.

Indeed, the growth in the productivity of resources over the past forty years has been significantly slower than that in the productivity of labour and in some cases of energy. While some of this is a result of the restructuring of economies, with a growing share of services, it also reflects the fact that labour has become relatively more costly compared with energy and materials, partly as a result of prevailing tax regimes.

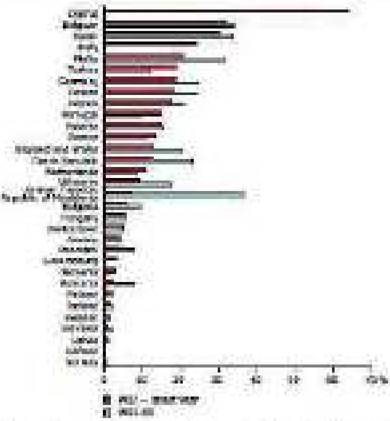
Addressing resource productivity and energy efficiency, substituting non-renewables with renewable resources, and addressing resource efficiency gaps between EU-15 and EU-12 Member States can provide opportunities for increasing European competitiveness.

Water demand management is essential for using water resources within natural limits

Water resource management differs from the management of other resources due to the unique characteristics of water: as a resource water moves through the hydrological cycle, is dependent on climatic influences, and its availability varies in time and space. It also connects different regions and other environmental media. Water is the basis for many ecosystem services — such as transport, energy production, cleaning — but can also transfer impacts from one environmental medium or one region to another. This poses explicit needs for integration and cross-border cooperation.

Human demand for water is in direct competition with the water needed for maintaining ecological functions. In many locations in Europe, water used by agriculture, industry, public water supply and tourism puts considerable stress on European water resources, and demand often exceeds local availability — and this is likely to be further exacerbated by climate change impacts.

Figure 4.8 Water exploitation index (WEI) — in late 1980s/early 1990s (WEI-90) compared to latest years available (1997 to 2007) (*)



Note: WEI: annual total water abstraction as a percentage of available long-term freshwater resources.

Source: EEA, ETC Water.

Water resources and the demand for water by different economic sectors are unevenly distributed across Europe. Even if water is abundant on a national scale, it may be scarce in individual river basins during different time periods or seasons, in particular river basins in the Mediterranean region but occasionally also some northern regions, experience over-abstraction.

The main reasons for over-abstraction include increasing demand for irrigation and tourism. In addition, considerable loss of water can occur in public distribution and supply networks prior to it reaching consumers, thus aggravating shortages in already water-scarce regions. In some countries the loss in the supply network may be up to 40 % of the total water supply in others it is below 10 % (*).

A combination of economic and natural factors results in major regional differences in water use. Water use is stable in southern Europe and decreasing in western Europe. This decrease is attributed mainly to behavioural changes, technological improvements and the prevention of water losses in distribution systems, supported by water pricing. Eastern Europe has experienced substantial decreases in water use — the average annual water use in the period 1997 to 2006 was around 40 % lower than in the early 1990s — mainly as a result of the introduction of water meters, higher water prices and the closure of some water-intensive industries (*).

In the past, European water management has largely focused on increasing supply by drilling new wells, constructing dams and reservoirs, investing in desalination and large-scale water transfer infrastructures. Increasing problems of water scarcity and drought clearly indicate the need for a more sustainable management approach. There is a particular need to invest in demand management that increases the efficiency of water use.

Greater water efficiency is possible. For example, there are large but currently unrealised potentials for water metering and the reuse of wastewater (*). Reuse of wastewater has been proven, internationally, in water-stressed regions, to be a drought-proof source of water and one of the most effective solutions to water scarcity. In Europe, wastewater is reused mainly in southern Europe. Provided that the quality is thoroughly controlled, the benefits can be substantial, including increased availability of water, reduced nutrient discharges, and reduced manufacturing costs for industry.

Nationally, land use practices and development planning could have a major impact on water scarcity, through parallel, comparable considerations of the use of groundwater and surface water. Intensive exploitation of aquifers can give rise to over-exploitation, such as that related to excessive abstraction for irrigation. The resulting short-term increase in productivity and change in land use impacts further exacerbates groundwater exploitation and can establish a cycle of unsustainable socio-economic developments — including risk of poverty, social distress, energy and food security (*).

Land use practices can also cause significant hydro-morphological alterations with potential adverse ecological consequences. For example, many important wetlands, beaches and floodplains in Europe have been drained and dammed, reservoirs and channels have been constructed to support urbanisation, agriculture, energy demand and protection from floods. The issues of water quantity and quality, integrated water demand, wastewater methods, environmental and socioeconomic aspects and risk management aspects can be better integrated in the institutional and political systems.

The Water Framework Directive (WFD) provides a framework to safeguard high environmental standards for water quality and can link other policies (*). A first look at river basin management plans, which have been set up and reported by Member States during the first round of implementation of the WFD, indicates that a significant number of water bodies have a high risk of not achieving good ecological status by 2015. In many cases, this is due to issues related to water management, particularly issues related to water quantity and irrigation, modifications of the structure of river banks and river beds, the connectivity of rivers or unsustainable flood protection measures, which have not been addressed by earlier, pollution-oriented policies.

The overall challenge within the WFD can, over time, if implemented fully, be to ensure the sustainable availability of good water quality, as well as managing inevitable trade-offs between competing uses, such as domestic use, industry, agriculture and the environment (see also Chapter 5).

Consumption patterns are key drivers of resource use and waste generation

The use of resources, water, energy and the generation of waste are all driven by our patterns of consumption and production.

Figure 4.7

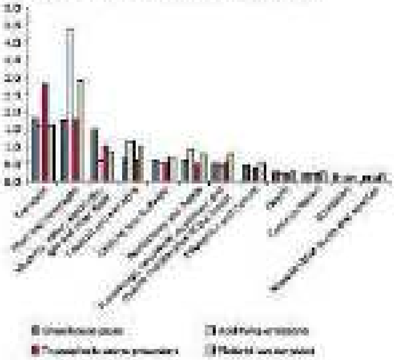
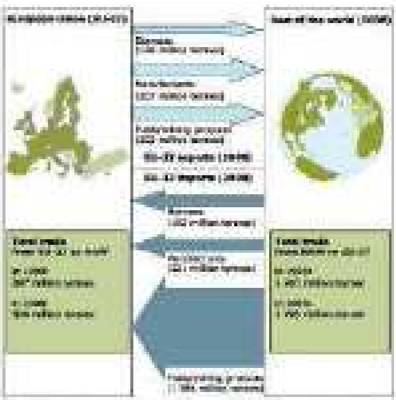


Figure 4.8



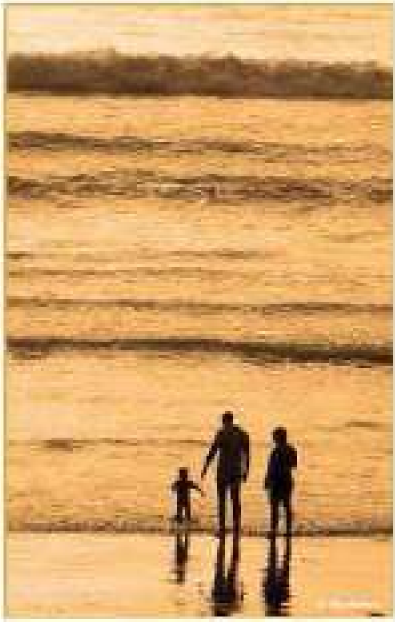
Trade-related environmental impacts may be further aggravated by lower social and environmental standards in some exporting countries, especially compared to those in the EU. However, globalisation and trade also enable [illegible] countries to export resources and raise revenues. If managed properly, for example by utilising dedicated incentives, the benefits can increase the environmental efficiency of both exports and imports by enhancing green export competitiveness and reducing embedded environmental pressures in imports.

Natural resource management is linked to other environmental and socio-economic issues

The direct environmental impacts of resource use include the degradation of fertile land, water shortages, waste generation, toxic pollution, and biodiversity loss in terrestrial and freshwater ecosystems. In addition, indirect environmental impacts, for example related to land-cover changes, may have considerable effects on ecosystem services and health.

Climate change is expected to increase environmental pressures related to resource use as changing precipitation patterns in the Mediterranean, for example, put additional pressure on water resources and influence land-cover changes.

Most environmental pressures assessed in this report are driven — directly or indirectly — by the increasing use of natural resources for production and consumption patterns that leave an environmental footprint in Europe and elsewhere in the world. Furthermore, the related depletion of our stocks of natural capital and its links to other forms of capital is putting at risk the sustainability of Europe's economy and social cohesion.



5 Environment, health and quality of life

Environment, health, life expectancy and social inequalities are linked

The environment plays a crucial role in people's physical, mental and social well-being. Despite significant improvements, major differences in environmental quality and human health remain between and within European countries. The complex relationships between environmental factors and human health, taking into account multiple pathways and interactions, should be seen in a broader spatial, socio-economic and cultural context.

In 2006, life expectancy at birth in the EU-27 was among the highest in the world — almost 76 years for men and 82 years for women ([illegible]). Most of the gain in life expectancy in recent decades has been due to improved survival of people above the age of 65, while before 1980 it was mainly due to a reduction in premature deaths (i.e. deaths before the age of 65). On average, men are expected to live almost [illegible] % of their lives free of disability and women [illegible] % ([illegible]). There are, however, differences between genders, and between Member States.

The degradation of the environment, through air pollution, noise, chemicals, poor quality water and loss of natural areas, combined with lifestyle changes, may be contributing to substantial increases in rates of obesity, diabetes, diseases of the cardiovascular and nervous systems and cancer — all of which are major public health problems for Europe's population ([illegible]). Reproductive and mental health problems are also on the rise. Asthma, allergies ([illegible]) and some types of cancer related to environmental pressures are of particular concern for children.

The World Health Organization (WHO) estimates the environmental burden of disease in the pan-European region at between [illegible] and [illegible] % of total deaths, and [illegible] to [illegible] % of disability adjusted life years (DALYs) ([illegible]), with a relatively higher burden in the eastern part of the region ([illegible]). The preliminary results of a study conducted in Belgium, Finland, France, Germany, Italy and the Netherlands, indicate that 6 to [illegible] % of the total burden of disease could be attributed to nine selected environmental factors, out of which particulate matter, noise, radon, and environmental tobacco smoke were leading. Due to many caveats, the results need to be interpreted with caution as an indicative ranking of environmental health impacts only ([illegible]).

The significant differences in the quality of the environment across Europe depend on the varying pressures related, for example, to urbanisation, pollution and natural resource use. Exposures and associated health risks, as well as the benefits of pollution reduction and of a natural environment, are not uniformly distributed within populations. Studies show that poor environmental conditions affect vulnerable groups especially ([illegible]). The evidence is scarce, but shows

Figure 5.1 The health map

Source: [illegible]

Box 5.1 Environmental burden of disease — estimating the impacts of environmental factors

[illegible]

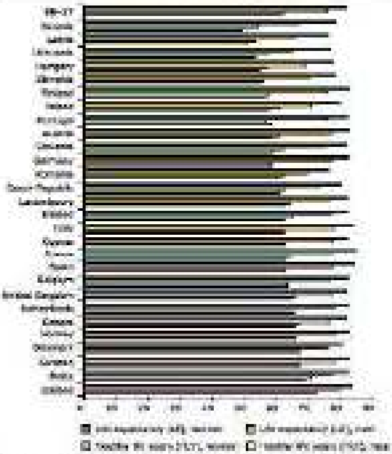
that deprived communities are more likely to be affected; for example, in Scotland, mortality rates in people aged under 75 in the 10 % most deprived areas were three times higher than those in the 10 % least deprived ([illegible]).

Better understanding of differences in the social distribution of environmental quality can be helpful for policy since specific population groups, such as those on low incomes, children, and the elderly may be more vulnerable — notably due to their health, economic and educational status, access to health care, and lifestyle factors that affect their adaptation and coping capacities ([illegible]).

Europe's ambition is to provide an environment not giving rise to harmful effects on health

The main European policies aim to provide an environment in which the level of pollution does not give rise to harmful effects on human health and the environment, and vulnerable population groups are protected. They are the 6th Environment Action Programme (6th EAP) ([illegible]), the EU Environment and Health Strategy ([illegible]) and Action Plan 2004–2010 ([illegible]), and the pan-European WHO Environment and Health process ([illegible]).

Figure 5.2 Life expectancy and healthy life years at birth in EU-25, Iceland and Norway in 2007, by gender



Note: [illegible]

Source: [illegible]

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Several areas for action have been identified, related to air and noise pollution, water protection, chemicals, including harmful substances such as pesticides, and improving the quality of life, especially in urban areas. The Environment and Health process aims at achieving a better understanding of the environmental threats to human health, reducing the disease burden caused by environmental factors, strengthening EU capacity for policymaking in this area, and identifying and preventing new environmental health threats ([illegible]).

While EU policy emphasis is on reducing pollution and the disturbance of natural services provided by the environment, there is also a growing recognition of the benefits of the natural, biologically diverse environment to human health and well-being ([illegible]).

Furthermore, it is worth noting that most health-related pollution policies are targeted to the outdoor environment. A somewhat neglected area in this regard is the indoor environment — considering that European citizens spend up to 90 % of their time indoors.

Box 5.2 Indoor environment and health

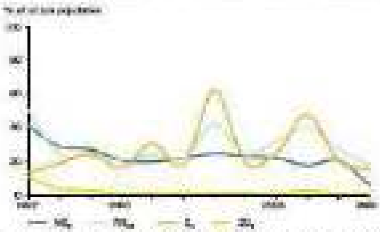
[illegible]

For some pollutants ambient air quality has improved, but major health threats remain

In Europe, there have been successful reductions in the levels of sulphur dioxide (SO_2) and carbon monoxide (CO) in ambient air, as well as marked reductions in NO_2. Also, lead ambient levels have declined considerably with the introduction of unleaded petrol. However, exposure to particulate matter (PM) and ozone (O_3) remain as major environment-related health threats, linked to a loss of life expectancy, acute and chronic respiratory and cardiovascular effects, impaired lung development in children, and reduced birth weight ([illegible]).

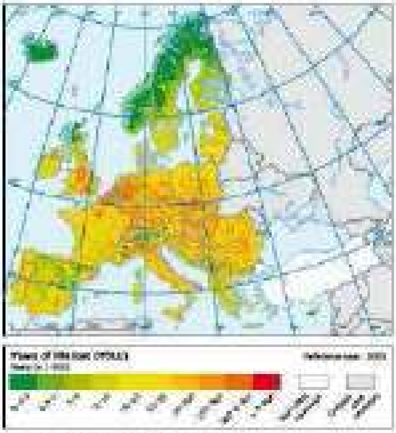
Over the past decade, ozone concentrations have frequently and widely exceeded health- and ecosystem-related target values. The

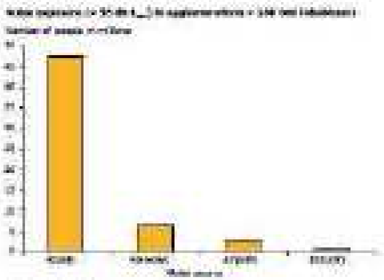
Figure 5.3 Percentage of urban population in areas where pollutant concentrations are higher than selected limit/target values, EEA member countries, 1997–2008



Note: [illegible]

Source: [illegible]





Better wastewater treatment has led to improved water quality, but complementary approaches may be needed for the future

Wastewater treatment, and the quality of both drinking and bathing water have improved significantly in Europe over the past 20 years, but continued efforts are needed to further improve the quality of water resources.

Human health can be affected through a lack of access to safe drinking water, inadequate sanitation, the consumption of contaminated [illegible] and seafood, as well as exposure to contaminated bathing water. [illegible] pregnant women [illegible].

Understanding of the relative contribution of different exposure [illegible] incomplete. The burden of water-borne disease in Europe is difficult to estimate and most likely underestimated [illegible].

The Drinking Water Directive (DWD) sets quality standards for water at the tap [illegible]. The majority of the European population receives treated drinking water from municipal supply systems. [illegible] of the water source coincides with a failure in the treatment process.

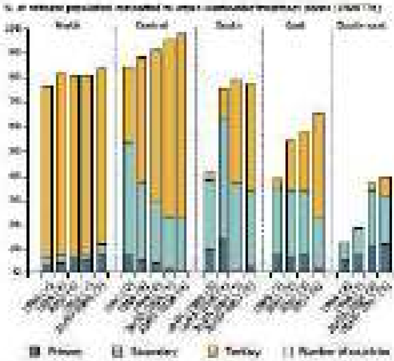
While the DWD addresses water supplies serving more than 50 people, a European data exchange and reporting system applies only to supplies for more than 5 000 people.

In a 2014 survey the compliance rate with drinking water standards in [illegible] supplies [illegible]. In 2011, [illegible] of [illegible] outbreaks of waterborne disease reported in the EU-27 were linked to the contamination of [illegible].

Implementation of the Urban Waste Water Treatment Directive (UWWTD) [illegible] remains incomplete in many countries [illegible]. However, [illegible] Member States have [illegible] transition periods for full implementation ranging up to 2018. The UWWTD addresses agglomerations with a population of 2 000 or more; thus potential

Figure 5.8 Regional variation in wastewater treatment between 1990 and 2007

% of national population connected to urban wastewater treatment plants



Note: [illegible]

North: Norway, Sweden, Finland and Iceland.

Central: [illegible]

South: [illegible]

East: [illegible]

South-east: Bulgaria, Romania and Turkey.

Source: EEA, CSI 024 [illegible]

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public health risks linked to bathing water [illegible] areas of Europe. For these areas, complementary, 'low-technology' solutions are available.

The implementation of the UWWTD has led to an increasing proportion of Europe's population being connected to a municipal treatment works. The associated improvements in wastewater treatment have resulted in a decline in the discharges of nutrients, [illegible] and some hazardous chemicals to receiving waters, and substantial improvement in the microbial quality of Europe's inland and coastal bathing waters [illegible].

While wastewater treatment has improved, both point and diffuse pollutant sources are still significant in parts of Europe and health risks remain. For example, algal blooms linked to excessive nutrient levels, particularly during extended periods of hot weather, are associated with toxin-producing cyanobacteria — which, in turn, can cause allergic reactions, skin and eye irritation and gastroenteritis in exposed people. Large populations of cyanobacteria can occur in European water bodies used for drinking water, aquaculture, recreation and tourism [illegible].

Looking ahead, major investment will be needed to maintain existing wastewater treatment infrastructures [illegible]. In addition, the discharge of some pollutants in treated effluent [illegible] concern, for example, endocrine-disrupting chemicals [illegible] or pharmaceuticals [illegible]. While wastewater treatment at municipal plants will continue to play a critical role, complementary approaches, such as tackling pollutants at source need to be explored more extensively.

New legislation related to chemicals (such as the Registration, Evaluation, Authorisation and Restriction of Chemicals regulation (REACH) [illegible] and the Environmental Quality Standards (EQS) Directive [illegible]) are likely to help drive such a source control approach. In combination with the full implementation of the Water Framework Directive [illegible], this should lead to a reduced emission of pollutants to water, leading to healthier aquatic ecosystems and reducing risks to human health.

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Pesticides in the environment have potential for unintended impacts to wildlife and humans

Pesticides disrupt essential biological processes, for example through affecting nerve transmission or mimicking hormones. Thus, human health concerns related to exposure via water, food, or close proximity to spraying have been raised [illegible]. Due to their intrinsic properties, pesticides can also be harmful to organisms in the water environment, including freshwater organisms [illegible].

Mixtures of pesticides are common both in the human food supply [illegible] and in the aquatic environment. Though assessment of mixture toxicity has been a challenge, a single-chemical approach is likely to underestimate ecological risk, including impacts of mixtures of pesticides on fish [illegible] and amphibians [illegible].

The EU Thematic Strategy on the sustainable use of pesticides [illegible] sets objectives to minimise the hazards and risks to health and the environment stemming from the use of pesticides, and to improve controls on the use and distribution of pesticides. Full implementation of the associated Pesticides Directive will be required to support the achievement of good chemical status under the Water Framework Directive [illegible].

Information on pesticides in surface and ground waters in Europe is limited, however, the reported levels, including pesticides classified as priority substances, can exceed environmental quality standards. [illegible]

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New chemical regulation may help, but the combined effects of chemicals remain an issue

Climate change and health is an emerging challenge for Europe

Natural environments provide multiple benefits to health and well-being, especially in urban areas

Map 5.2 Percentage of green urban areas in core cities ([illegible])

Percentage of green urban areas in core cities

[illegible] Outside data coverage

Source: EEA, Urban Atlas.

A broader perspective is needed to address ecosystem and health links and emerging challenges

Much progress has been achieved through dedicated approaches to improving the quality of the environment and reducing particular burdens on human health ... but many threats remain. The predominant drive for material well-being has played a major role in the biological and ecological disturbances witnessed today. Preserving and extending the benefits provided by the environment for human health and well-being will require continued effort to improve the quality of the environment. Furthermore, these efforts need to be complemented by other measures, including significant changes in lifestyle and human behaviour, as well as consumption patterns.

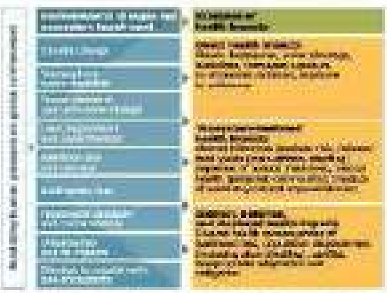
Meanwhile, new challenges are emerging with a wide range of potential, highly uncertain, ecological and human health implications. In this context, technological advancements may provide new benefits — however, history also offers many examples of adverse health impacts from new technologies ([illegible]).

Nanotechnology, for example, may allow the development of new products and services which are capable of enhancing human health, conserving natural resources or protecting the environment. However, the unique features of nanomaterials also raise concerns about potential environmental, health, occupational and general safety hazards. The understanding of nanotoxicity is in its infancy, as are methods for assessing and managing the risks inherent in the use of some materials.

Given such knowledge gaps and uncertainties, an approach to responsible development of new technologies, such as nanotechnologies, could be achieved through inclusive governance based on broad stakeholder involvement and early public intervention in research and development ([illegible]). The European Commission has, for example, consulted experts and the public regarding the benefits, risks, concerns and awareness of nanotechnologies to support the preparation of a new action plan for 2010 to 2015 ([illegible]).

The increasing recognition of health causality, complexity, and uncertainties also means that the EU Treaty principles of precaution and prevention are even more relevant than before. More emphasis on the timely and wise use of early warnings to prevent harm is called for, as is the need to act on reasonable, rather than overwhelming, evidence of the potential harms to health, given the pros and cons of action versus inaction.

Figure 5.8 Harmful effects of ecosystem changes on human health



Note: Not all ecosystem changes are included. Some changes can have positive effects (e.g. food production).

Source: Millennium Ecosystem Assessment ([illegible]).

6 Links between environmental challenges

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Table 6.1 [illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

Source: EEA.

[illegible]

[illegible]

[illegible]

[illegible]

Table 6.2 [illegible]

[illegible]	Climate change	Nature and biodiversity	[illegible]	Environment and health
Climate change		Direct links [illegible] Indirect links [illegible]	Direct links [illegible] Indirect links [illegible]	Direct links [illegible] Indirect links [illegible]
Nature and biodiversity	Direct links [illegible] Indirect links [illegible]		Direct links [illegible] Indirect links [illegible]	Direct links [illegible] Indirect links [illegible]
[illegible]	Direct links [illegible] Indirect links [illegible]	Direct links [illegible] Indirect links [illegible]		Direct links [illegible] Indirect links [illegible]

Source: EEA.

[illegible]

[illegible]

[illegible]

Box 6.1 [illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]

[illegible]

[illegible]

Source: EEA.

water management, terrestrial carbon fluxes, land-based natural greenhouse gas production and absorption to nutrient cycles. Thus, we and our economy depend on a multitude of soil functions.

For example, soil resources play a major role as a terrestrial sink of carbon and can contribute to climate change mitigation and adaptation. However, around 45 % of the mineral soils in Europe have low or very low organic matter content (0 to 2 % organic carbon) and 45 % have a medium content (2 to 6 % organic carbon) and soil organic matter in Europe is currently diminishing. Several factors are responsible for the decline in soil organic matter and many of these relate to human activity. These factors include conversion of grassland, forests and natural vegetation to arable land; deep ploughing of arable soils; drainage; liming; nitrogen fertiliser use; tillage of peat soils; crop rotations with reduced proportion of grasses.

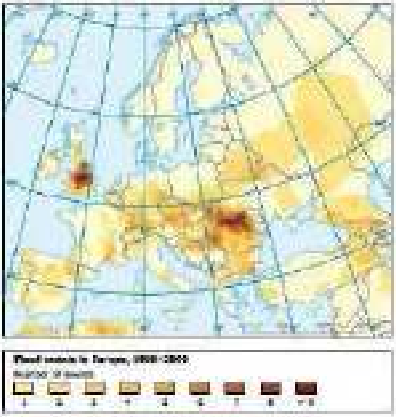
Sustainable water management requires striking a balance between different uses

Water is an ecological and economic resource, renewable but finite. It is vital to support healthy ecosystems (Chapter 3), while access to clean water is essential for human health (Chapter 5). Furthermore, water is a key natural resource linked with agricultural, forestry and industrial production, household consumption, and energy production (Chapter 4).

Environmental pressures on European water systems are closely related to land-use patterns and related human activities in the river basins. The main pressures are diffuse pollution, water abstraction, and hydromorphological changes in connection with hydropower generation, drainage and canalisation. Soil issues highlighted in the previous section, notably erosion and loss of water retention capacity, are also relevant to how we manage water resources.

Large areas of Europe are affected by water scarcity and droughts, while other regions are increasingly exposed to serious floods. Over the past ten years, Europe has experienced more than 165 major floods, causing deaths, displacement of people and large economic losses. Future climate change is expected to make matters worse.

Map 6.2 Occurrence of floods in Europe, 1998–2009



Source: EEA.

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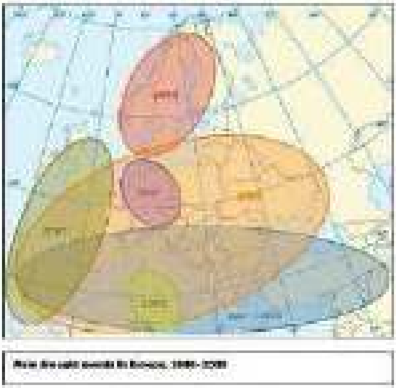
Map 6.3 Major drought events in Europe, 1990–2009



Source: EEA, ETC Land Use and Spatial Information.

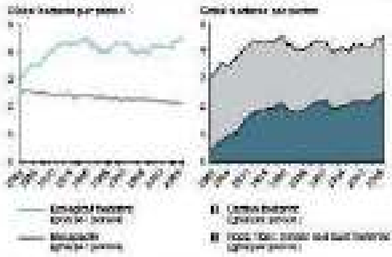
The Water Framework Directive (WFD) (4) is the key policy approach aimed at tackling these challenges. It sets ecological limits to human water use and management. Furthermore, it obliges EU Member States and regional authorities to take coordinated measures regarding, for example, agriculture, energy, transport and housing, within the context of rural and urban spatial planning, while also taking biodiversity conservation concerns into account. As noted already (Chapters 3 and 5), a first look at river basin management plans shows that strong efforts are needed in the coming years to achieve good ecological status by 2015.

For the WFD to be successful, integrated management of river basins is crucial, involving coherent multi-level efforts in identifying and implementing spatially differentiated measures that often involve trade-offs between different interests. The management of flood risks, in particular the relocation of dykes and restoration of flood plains, requires integrated urban and landscape planning.

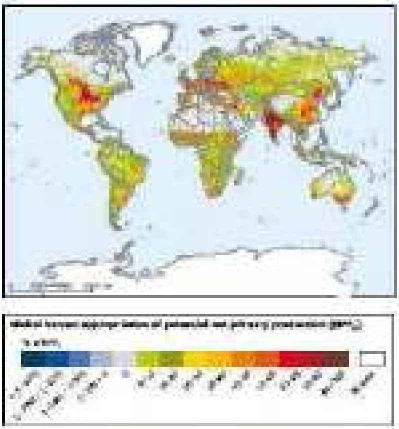
Box 6.2 Linked yet competing issues: water-energy-food-climate

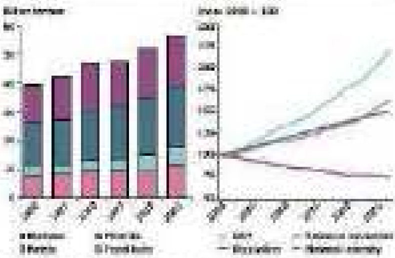
[illegible]

Source: EEA.



7 Environmental challenges in a global context





indicates does not, however, reveal information on specific resource developments. Global food, energy and water systems appear to be more vulnerable and fragile than thought a few years ago, the balance [illegible] rising increased demand, decreased supply and supply instabilities. Over-exploitation, degradation and loss of soils are relevant concerns in this regard ([illegible]) ([illegible]) ([illegible]). With global competition and increased geographic and corporate concentrations of supplies for some resources, Europe faces increasing supply risks ([illegible]).

In spite of general progress in the area of environment and health in Europe, the global burden of environmental health impacts remains deeply worrying. Unsafe water, poor sanitation and hygiene conditions, urban outdoor air pollution, indoor smoke from solid fuels and lead exposure and global climate change account for nearly a tenth of deaths and disease burden globally and around one quarter of deaths and disease burden in children under 5 years of age ([illegible]). It is again poor populations in low latitudes that are affected most heavily.

Table 7.2 Deaths and DALYs (disability-adjusted life years) ([illegible]) attributable to five environmental risks, by region, 2004

Risk	World	Low and middle income	High income
Percentage of deaths			
Indoor smoke from solid fuels	3.3	3.9	0.0
Unsafe water, sanitation, hygiene	3.2	3.8	0.1
Urban outdoor air pollution	2.0	1.9	2.5
Global climate change	0.2	0.3	0.0
Lead exposure	0.2	0.3	0.0
All five risks	8.7	9.8	2.6
Percentage of DALYs			
Indoor smoke from solid fuels	2.7	2.9	0.0
Unsafe water, sanitation, hygiene	4.2	4.6	0.3
Urban outdoor air pollution	0.6	0.6	0.3
Global climate change	0.4	0.5	0.0
Lead exposure	0.6	0.7	0.1
All five risks	8.6	9.3	0.7

Source: World Health Organization ([illegible]).

Many low- and middle-income countries now face a growing burden from new risks to health, while still fighting an unfinished battle with the traditional risks to health. The World Health Organization (WHO) forecasts that between 2005 and 2015, deaths from non-communicable diseases could increase worldwide by 17 %. The greatest increase is projected for the African region (24 %), followed by the Eastern Mediterranean region (23 %) ([illegible]). Europe is likely to be faced with the increased problem of emerging or re-emerging infectious diseases that are currently influenced by changes in temperature or precipitation, habitat loss and ecological destruction ([illegible]) ([illegible]). In an increasingly urbanised world, which is tightly linked by long-distance transport, the incidence and distribution of infectious diseases affecting humans is likely to increase ([illegible]).

Links between environmental challenges are particularly apparent in Europe's direct neighbourhood

Europe's direct neighbourhood — the Arctic, the Mediterranean and the eastern neighbours — deserve particular attention here due to the strong socio-economic and environmental links and the importance of these regions in EU external policy. Furthermore, some of the world's largest reserves of natural resources are in these regions, which is of immediate relevance to a resource-scarce Europe.

These regions are also home to some of the world's richest and yet most fragile natural environments which are facing multiple threats. At the same time, concerns remain related to many transboundary issues like water management and air pollution deposition shared between Europe and its neighbours. Some of the main environmental challenges in these regions include:

- **The Arctic** — European activities, such as those resulting in long-range emissions of air pollution, black carbon and greenhouse gas emissions, have a considerable footprint in the Arctic. At the same time what happens in the Arctic also influences Europe's environment because the Arctic plays a key role, for example, in the context of climate change and related sea level rise projections. For instance, multiple pressures on Arctic ecosystems have resulted in biodiversity loss across the region. Such changes have global repercussions because of the loss of key ecosystem

functions and are creating additional challenges for the people living in the Arctic as changing seasonal patterns affect hunting and food provision ([illegible]).

- **Eastern neighbours** — EU neighbours to the east face many environmental challenges affecting human health and ecosystems. The EEA's fourth assessment report of Europe's environment ([illegible]) summarises key environmental issues across the pan-European region, including countries in eastern Europe, the Caucasus and Central Asia. It focuses on the challenges posed by air and water pollution, climate change, biodiversity loss, pressures on the marine and coastal environment, consumption and production patterns, and socio-economic sectoral developments that drive environmental change across the region.

- **The Mediterranean** — Located at the crossroad of three continents, this is one of the richest bio-regions and yet one of the most vulnerable natural environments in the world. The recent report on the *State of the Environment and Development in the Mediterranean* ([illegible]) presents the major impacts of climate change, the characteristics of the natural resources and environment in the region, and the challenges linked to their conservation. In particular, some of the main pressures from human activities are identified (such as tourism, transport, and industry) and their impacts on coastal and marine ecosystems are assessed, together with considerations about their environmental sustainability.

Box 7.3 The European Neighbourhood Policy

[illegible]

Source: EEA.

While Europe is contributing directly and indirectly to some of the environmental pressures in these regions, it is also in an unique position to cooperate to improve their environmental conditions, particularly through fostering technology transfer and helping to build institutional capacity. These dimensions are increasingly reflected in European neighbourhood policy priorities ([illegible]).

Environmental challenges are closely connected with global drivers of change

A range of unfolding trends are shaping the future European and global context, and many of these are outside the realm of Europe's direct influence. Ensuing global megatrends cut across social, technological, economic, political and even environmental dimensions. Key developments include changing demographic patterns or accelerating rates of urbanisation, ever faster technological changes, deepening market integration, evolving economic power shifts or the changing climate.

In 1960, the world's population was 3 billion. Today, it is about 6.8 billion. The United Nations Population Division expects this growth to continue and that the global population will exceed

Figure 3.2 A selection of global drivers of change relevant for the European environment

Table 3.2 Population of the world and different regions, 1950, 1990, 2005 and 2050 according to different growth variants

Figure 3.3 Growth of GDP per capita in the EU-27, USA, China, India and Japan, 1980 to 2008

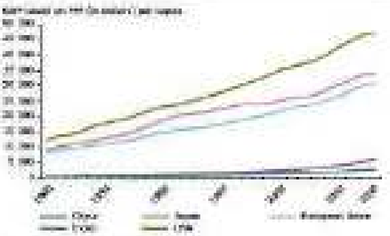
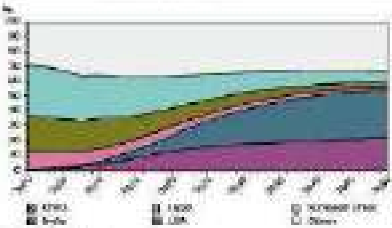
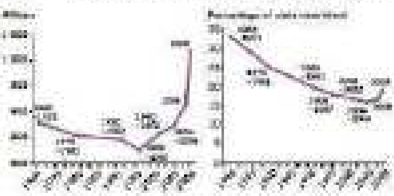
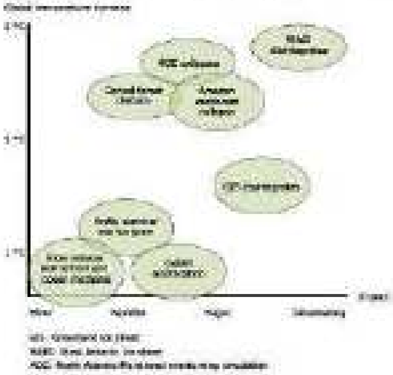
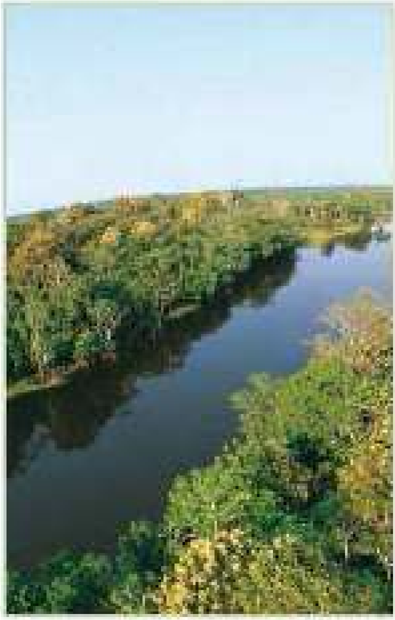


Figure 3.4 Projected shares of global middle-income class consumption, 2000 to 2050









8 Future environmental priorities: some reflections

Against this back drop, this final chapter reflects on some emerging future environmental priorities:

- **[illegible] implementation and further strengthening of current environmental priorities** in climate change, nature and biodiversity, natural resource use and waste, environment, health and quality of life. Whilst these remain important priorities, managing the links between them will be paramount. Improving [illegible] and enforcement of sectoral and environmental policies will ensure that environmental outcomes are achieved, give regulatory stability and support more effective governance.
- **[illegible] management of natural capital and ecosystem services.** Increasing resource efficiency and resilience emerge as key integrating concepts for dealing with environmental priorities, and for the many sectoral interests that depend on them.
- **Coherent integration of environmental considerations across** the many sectoral policy domains can help increase the efficiency with which natural resources are used and thus help greening the economy by reducing common pressures on the environment that originate from multiple sources and economic activities. Coherence will also lead to broad measures of progress rather than just against individual targets.
- Transformation to a green economy that addresses the long-term viability of natural capital within Europe and reduced dependency on it outside Europe.

The ongoing study on The Economics of Ecosystems and Biodiversity (TEEB) aligns with these ideas from the perspective of biodiversity and the ways in which investment in natural capital can be encouraged ([illegible]). Recommendations to policymakers include broad actions such as investing in green infrastructure to increase resilience, introducing payments for ecosystem services, removing harmful subsidies, establishing new regimes for natural capital accounting and cost-benefit analysis, and initiating specific actions to address the degradation of forests, coral reefs and fisheries as well as the links between ecosystem degradation and poverty.

Natural capital and ecosystem services provide an integrating starting point for managing many of these interconnected issues, the systemic risks inherent in them, and the transformation to a new, greener, more resource efficient economy. There is no single quick fix for all the challenges that Europe faces. Rather, as this report shows, there is a clear case for long-term, interconnected approaches to deal with them.

What this report also provides is evidence that existing European environmental policies present a robust basis on which to build new approaches that balance economic, social and environmental considerations. Future actions can draw on a set of key principles that have been established at European level: the integration of environmental considerations into other measures; precaution and prevention; rectification of damage at source; and the polluter-pays principle.

Implementing and strengthening environmental protection provides multiple benefits

Full implementation of environmental policies in Europe remains paramount as key targets are still to be met (Chapter [illegible]). However, it is clear that targets in one area can inadvertently, through unintended consequences, disrupt or counteract a target in another. Synergies and co-benefits thus need to be sought throughout the process of developing impact assessments of policies in different domains, by using approaches that fully account for natural capital.

Past decades' environmental policy efforts have provided a wide array of social and economic benefits through regulations, standards and taxation. These in turn have driven infrastructure and technological investment to mitigate against environment and human health risks, for example, by setting air and water pollution limits, creating product standards, and by building wastewater treatment plants, waste management infrastructures, drinking water systems, clean energy and transport systems.

Such policies have permitted the economy to grow well beyond what might otherwise have been feasible. For example, without tightening

air pollution standards and the [illegible] technical improvements, the transport, manufacturing and construction sectors of the economy could not have grown so fast as they have without severe health effects.

As a [illegible], health, quality of life and environmental conditions have improved for most people in Europe, awareness and concerns are higher than ever, environmental policies and investments [illegible]. Other key benefits to date include pro-growth investment strategies creating new markets and increasing employment; level playing field for companies in internal markets; driving innovation and rolling out of technological improvements; and consumer benefits.

Employment is a major benefit with an estimated quarter of total European jobs linked either directly or indirectly to the natural environment ([illegible]). Europe can make further progress here through eco-innovations in products and services, building on patents and other knowledge that has been acquired by governments, businesses and universities through [illegible] years of experience.

By contrast, however, government spending on environment and energy research and development typically remains at less than [illegible] % of total government spending on research and development. This has declined dramatically since the 1980s. At the same time research and development expenditure in the EU at [illegible] % of GDP ([illegible]) lags way behind the Lisbon strategy target of 3 % by 2010 and behind major competitors in green technologies such as the USA and Japan and, recently, China and India.

Still, in many areas (such as air pollution reduction, water and waste management, eco-efficient technologies, resource-efficient architecture, eco-tourism, green infrastructure and green financial instruments) Europe already has first mover advantages. These could be exploited further within a regulatory framework that fosters further eco-innovation and sets standards based on an awareness of the natural capital. Past decades' efforts have borne fruit: the European Union, for example, has more patents related to air pollution, water pollution and waste than any other economic competitor ([illegible]).

There are also ancillary benefits from combined implementation of environmental legislation. For example combining climate change mitigation and air pollution abatement legislation could deliver benefits in the order of [illegible] per year through reductions in damage to public health and ecosystems ([illegible]) ([illegible]). Environmental producer responsibility legislation (such as REACH ([illegible]), WEEE Directive ([illegible]), RoHS Directive ([illegible])) has contributed to push multi-national companies, for example, to design production processes at global level that meet EU standards and so deliver benefits for consumers across the world. In addition, EU legislation is often replicated in China, India, California and elsewhere, highlighting further the multiple benefits of well-designed policies in the globalised economy.

European countries have also invested substantially in monitoring and regular reporting of environmental pollutants and wastes. They are beginning to use the best available information and communication technologies and sensors to develop information flows from in-situ local sensors to Earth observation with specialised sensors. The development of near real-time data and regularly updated indicators help to improve governance by providing stronger evidence for early interventions and preventative actions, supporting greater levels of risk-sharing and enhancing overall performance reviews.

There is now an abundance of environmental and geographical data in Europe to support environmental objectives, and many opportunities exist to exploit these data through analytical methods and information technologies. However, restrictions on access, charging fees or intellectual property rights have meant that these data are not always easily accessible by policymakers and others working in the field of environment.

There are a number of information policies and processes in place or being negotiated in the EU to support further responses to emerging challenges. Rethinking their uses and links between them could critically improve the efficacy of existing and proposed information gathering and networking activities in support of policies.

Key elements in this mixture include research from the European Research Framework Programmes, the new European space and Earth observation policy (including the Global Monitoring for Environment and Security initiative and Galileo), wider geo-web application on spatial data infrastructure (INSPIRE), and an extension of e-government in the form of the Shared Environmental Information System (SEIS).

The opportunity also exists now to implement these information systems more fully and to use them to support the EU 2020 strategy ([?]) objectives in this area, using the latest information technologies, such as smart grids, cloud computing and mobile geographical information systems (GIS) based feedback loops.

Past experience shows that it often takes 15 to 30 years from framing an environmental problem to a sufficiently full understanding of impacts (for example, through reporting on countries on conservation status or environmental impacts). Such extended time lags cannot prevail given the speed and scale of challenges. Interconnected policies that take the long-term view are needed, based on risk and uncertainty, and need to fit in interim steps for review and evaluation, can help to manage the trade-offs between the need for long-term coherent action and the time it takes to put such measures in place.

There are also numerous examples, based on credible early warnings from science, where early actions to reduce harmful impacts would have been extremely beneficial ([?]). They include climate change, chlorofluorocarbons, acid rain, unleaded petrol, mercury and fish stocks. These show that the time lags from the first scientifically based early warnings to the point of policy action that effectively reduced damage, was often 30 to 100 years during which time exposures, and hence harm, increased considerably. For example, over a decade of extra skin cancers could have been avoided if action had been taken on the first early warning in the 1970s, rather than on the discovery of the ozone hole itself in 1985 ([?]). Experience in the climate change field with addressing long-term impacts ([?]) ([?]) may be helpful in other fields that face similar time-scales and scientific uncertainties.

Dedicated management of natural capital and ecosystem services increases social and economic resilience

The desire to make economic and social progress that does not come at the expense of the natural environment is not new. Many European industries have decoupled emissions of key pollutants and the use of certain materials from economic growth. What is new is that management of natural capital requires decoupling of economic growth not only from resource use but also from environmental impacts within Europe and globally.

Natural capital embraces many components. It is the stock of natural resources from which ecosystem goods and services can be derived. Such capital provides the sources of energy, food and materials; the sinks for wastes and pollution; the services of climate, water and soil regulation; and the environment for living and leisure — in essence, the core fabric of our societies. Using it often involves trade-offs between different services and striking a balance between maintaining and using stocks.

Getting this balance right depends on appreciating the many linkages between natural capital and the other four types of capital that hold together our societies and economies (i.e. human, social, manufactured and financial capital). The common features between such capitals, for example over-consumption and under-investment, indicate the potential of a much more coherent action across policy domains (such as spatial planning, integration between economic sectors, and environmental considerations), deeper longer term approaches to knowledge that recognise many of these risks may emerge over many decades (such as scenario planning), and smart decisions on near-term actions that anticipate long-term needs and avoid technological lock-in (such as infrastructure investments) ([?]).

There are three main types of natural capital (Chapter 1) which require different policy measures to manage them. In some cases, natural capital that is depleted can be substituted by other types of capital, such as non-renewable energy resources that are used to develop and invest in renewable energy sources. However, more often, it cannot. Much natural capital, for example biodiversity, cannot be replaced at all and needs to be preserved for current and future generations to ensure the continued availability of basic ecosystem services. Similarly, non-renewable resources need to be managed carefully so as to prolong their economic life while investing in possible substitutes.

What the explicit management of natural capital and ecosystem services offers, is a comprehensive and integrating concept for dealing with environmental pressures from multiple sectoral activities. Spatial planning, resource accounting, and coherence amongst sectoral policies, implemented at different geographical scales, can help manage the trade-offs between preserving natural capital and using it to fuel the economy. Such an integrated approach would provide a framework for measuring progress more broadly. One advantage would be the ability to analyse the effectiveness of policy actions across a range of sectoral objectives and targets.

At the heart of managing natural capital therefore are the twin challenges of maintaining the structures and functions of ecosystems that underpin natural capital and enhancing resource efficiency by finding ways of using fewer resource inputs and having less environmental impacts.

In this context, increasing resource efficiency and security through an extended life-cycle approach for energy, water, food, phosphorus, soils, minerals, metals and materials can help reduce Europe's dependence on resources globally and promote innovation. Prices that take full account of the consequences of using resources will also be an important basic means for signalling to firms and consumer behaviour towards higher resource efficiency and innovation.

This is especially important for Europe given the growing competition for resources from Asia and Latin America and the growing pressure on the EU-27's current status as the world's largest economic and trading block. Japan, for example, has long been recognised as the front-runner on resource efficiency but other countries — such as China — are setting ambitious targets in this respect, recognising the twin benefits of cost reductions and future market opportunities.

Since the industrial revolution there has been a shift away from using renewable resources to non-renewables to fuel our economy. Towards the end of the 20th century non-renewables accounted for some 90 % of total material inputs in industrialised countries compared to about 50 % in 1900 ([?]).

Europe relies heavily on the rest of the world for non-renewables, and increasingly some of these non-renewables — such as fossil fuels or rare earth metals used in information technology products — are becoming difficult to source cheaply if at all, often for geo-political as much as supply reasons. Such trends make Europe vulnerable to external supply shocks that may result from an over-reliance on non-renewables. Addressing this issue could be a key element in meeting the resource efficiency objective under the EU 2020 strategy ([?]).

A broader argument for shifting towards long-term development based on natural capital management is that today's poor governance of natural resources is forwarding risks to future generations. Environmental impacts, as reflected by climate change, biodiversity loss and ecosystem degradation, have steadily built up as a result of decades of over-consumption and under-investment in maintenance and substitution of resources.

These impacts, often concentrated in developing countries, will be difficult to mitigate and adapt to. Moreover, property rights for natural capital are often undefined, especially in developing countries, and the relative invisibility of natural capital degradation leads inevitably to passing on of accumulated 'debts' to future generations.

Ecosystem-based approaches offer coherent ways of managing the existing and expected demands for non-renewable and renewable resources in Europe and avoiding further over-exploitation of natural capital. Particularly, land and water resources offer viable entry points for strengthening integrated ecosystem-based approaches to resource management. The Water Framework Directive, for example, has the aim of protecting ecosystems — aquatic and terrestrial — at its core. Approaches that recognise the multi-functional benefits of ecosystems are central to proposals for post 2010 biodiversity policies, and gaining traction in the marine, maritime, agriculture and forestry sectors.

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Box 8.1 Accounting for natural capital can help illustrate trade-offs between uses

The following examples provide a flavour of the challenges [illegible] natural capital:

- *Soil:* Europe's soils [illegible] [illegible] [illegible]
- *Wetlands:* There has been an estimated loss of 50 % of wetlands globally since 1900, [illegible] [illegible]
- *Fish:* Fish are only accounted for in terms of primary production at 1 % of [illegible] [illegible]
- [illegible] [illegible]

Source: EEA.

An integrated management of natural resources becomes more prominent, competing demand for resources increasingly requires trade-offs. This creates a need for accounting techniques — including, in particular, comprehensive accounting of land and water resources — that make transparent the full costs and benefits of ecosystem use and maintenance.

The information tools and accounting approaches to support integrated natural capital and ecosystem services management, including their relationship to sectoral activities, are not yet part of the standard administrative and statistical systems. Much can still be gained from asking new questions of existing accounts, for example, on the true benefits to society of nature derived from agriculture, fishing and forestry which currently account for 1 % of EU GDP [illegible] [illegible] across the economy.

In addition, the identification of critical thresholds in resource use and the development of ecosystem accounts, ecosystem service indicators and ecosystem assessments are ongoing in Europe and globally. Examples of such initiatives are The Economics of Ecosystems and Biodiversity (TEEB), the revision of Integrated Environmental and Economic Accounting (SEEA) by the United Nations ([illegible]), the European Strategy for Environmental Accounting ([illegible]), and ecosystem accounting work at EEA.

More integrated actions across policy domains can help in greening the economy

Environmental policies have primarily influenced production processes and protected human health. They therefore only partly address the [illegible] [illegible] [illegible] environmental problems, such as over-use of the land and oceans, are [illegible] [illegible] (Chapter 1). [illegible] often originate from multiple sources and economic activities that compete for short-term benefits from resource exploitation. Tackling them will require cooperation across several domains to deliver coherent, cost-effective measures that address the trade-offs inherent in maintaining capital in line with society's values and long-term interests, and contribute to greening the economy.

The need to integrate environmental concerns into sectoral activities and other policy domains has long been acknowledged — as attempted, for example, in the EU Cardiff integration process since 1998 ([illegible]). As a result, many EU sector policies explicitly take into account environmental considerations to some degree, for example the Common Transport Policy and the Common Agricultural Policy for which sectoral reporting initiatives like the Transport Environment Reporting Mechanism (TERM), Energy and Environment Reporting Mechanism and indicator reporting on the integration of Environmental concerns into Agricultural policy (IRENA) are well established. In future they could benefit further from integrated analysis of environmental, economic and social aspects, trade-offs, costs and policy effectiveness through broader use of established environmental accounting techniques.

Furthermore, there are many links between environmental issues as well as links between environmental and macroeconomic activities (see especially Chapter 6) that go beyond single cause-effect relationships. Often several activities combine to influence environmental problems: this is well recognised, for example, in the context of greenhouse gas emissions, which stem from a wide range of sectoral activities, not all of them accounted for in monitoring and trading systems.

In other cases, multiple sources and economic activities interact to either enhance or counteract each other's environmental impacts. Taken together, they result in clusters of environmental pressures. Addressing such clusters can offer opportunities for more cost-efficient responses. The co-benefits between climate mitigation and air quality improvements provide an example (Chapter 7). In other cases, such clusters carry the threat that environmental action in one sector counteracts efforts done in another. An example for this is the setting of ambitious biofuels targets, which may help climate mitigation, but increase pressures on biodiversity (Chapter 4).

Either way, where environmental pressures are triggered by multiple sources and economic activities, there is a need to secure coherence in the way we tackle them as far as feasible. Clustering of sectoral policies dependent on the same resources also has the potential for improved coherence in tackling common environmental challenges to maximise benefits and avoid unintended consequences. Examples of achieving such coherence include:

- Resource efficiency, public goods and ecosystem management. Building on established and emerging practice around ecosystem management in environmental and sectoral policies, to ensure the long-term viability and efficient use of renewable resources by the main sectors (i.e. agriculture, forestry, transport, industry, fisheries, maritime).
- Agriculture, forestry, maritime, green infrastructure and territorial cohesion. Developing green infrastructure and ecological networks on land and at sea to secure the long-term resilience of Europe's terrestrial and marine ecosystems, the goods and services provided by them and their distributional benefits.
- Sustainable production, intellectual property rights, trade and aid. Implementing existing product standards and patents for innovation that accelerate substitution out of scarce and towards more renewable resources, reduce Europe's trade footprint, promote recycling potential, improve Europe's competitiveness and contribute to welfare improvements worldwide.
- Sustainable consumption, food, housing and mobility. Bringing together the three areas of consumption that together contribute more than two-thirds of major worldwide lifecycle environmental pressures from consumption in Europe.

More coherent policies across multiple sources of environmental pressures are already emerging in [illegible] of interlinkages and ahead of developing multi-faceted solutions. For example, the links between climate mitigation, reduced reliance on fossil fuels, substitution by renewables, energy efficiency and multi-sectoral energy needs underpin the design of the EU Climate and Energy package. This marks a key difference compared to the situation 15 to 20 years ago and provides potential for more effective collaboration between sectoral and environmental interests.

Stimulating fundamental transition towards a greener economy in Europe

Greening the European economy, as discussed already, can help further reduce environmental pressures and impacts. However, more fundamental conditions and actions that enable the transition to a truly 'green economy', centred on natural capital and ecosystem services, will be needed to stay within planetary limits.

The need for a green economy also becomes stronger in this time of financial and economic crisis. Intuitively, a slumping economy might be considered positive for the environment: incomes drop or grow only slowly, accessing credit that allows overspending is more difficult and hence we produce and consume less, with a reduced burden on the environment. However, stagnant economies are often not able to make the necessary investments to secure a responsible environmental management, and we see less innovation and less attention to environmental policy. Instead, when the economy returns to its previous growth path (as it usually does), it also tends to return to its previous pattern of eroding natural capital.

Thus, a green economy will require dedicated policy approaches embedded in a coherent, integrated strategy covering demand and supply aspects, both economy-wide and at the sectoral level ([illegible]). In this context, the key environmental principles of precaution, prevention, rectification of damage at source, and polluter pays, combined with a strong evidence base, remain most relevant and need to be more broadly and consistently applied.

The precautionary and prevention principles were inserted in the EU Treaty in order to help cope with the dynamics of complex natural systems. Their broader application during the transition to a green economy will steer innovation that leads away from the often unsuccessful and conventional technologies that have been shown to cause long-term harm to people and ecosystems ([illegible]).

The rectification of damage at source can be stimulated through deeper integration across sectors and further advance the multiple gains from investments in green technologies. For example, investment in energy efficiency and renewable energies delivers benefits to the environment, employment, energy security, energy costs, and can help combat fuel poverty.

The polluter-pays principle can stimulate a greening of the economy through taxes that allow market prices to reflect full costs of production, consumption and wastes. This can be achieved via greater use of fiscal reform which, in addition to removing harmful subsidies, replaces distortionary taxes on economic 'goods' such as labour and capital, with more efficient taxes on economic 'bads', such as pollution and inefficient resource use ([illegible]).

In a broader perspective, 'prices' as a facilitator of trade-offs can help improve further progress in sectoral integration and resource efficiency but more fundamentally shift behaviours across governments, businesses and citizens in Europe and globally. However, for this to happen — as known for decades, but rarely applied — prices need to reflect the true economic, environmental and social value of resources, relative to available substitutes.

Evidence of the benefits of fiscal reform has grown in recent years. Such benefits include environmental improvements, employment gains, a stimulus to eco-innovation, and more efficient tax systems. Studies show the benefits from applied environmental tax reform in several European countries that have been implemented over the last 20 years. Similarly they convincingly demonstrate the advantages of additional reforms designed to achieve the EU climate and resource efficiency goals ([illegible]) ([illegible]) ([illegible]) ([illegible]) ([illegible]).

The revenues from environmental taxes vary significantly across EU Member States, from more than 4 % of GDP in Denmark, to less than 2 % in Spain, Lithuania, Romania, and Latvia in 2008 ([illegible]). Despite the large benefits of such taxes, and consistent policy support over the last 20 years from OECD and the EU, environmental tax revenues as a proportion of overall tax revenues in the EU are at their lowest level for more than a decade, even if the number of environmental taxes is increasing.

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There is substantial potential for fiscal reform in support of the triple objectives of greening the economy, supporting deficit reduction policies in many EU Member States and responding to ageing populations. These range from removing harmful subsidies and exemptions on fossil fuels, fisheries and agriculture, to establishing taxes and extending permits on the consumption of the critical natural capital that underpins a green economy (such as carbon, water and land).

A further component of a green economy transition is to move to accounting fully for natural capital — and to thus go beyond GDP as a measure of economic growth. Doing so will enable societies to record the full price of our way of life, reveal concealed costs being forwarded to future generations, make explicit ancillary benefits, highlight new ways for economic development and jobs in a green economy based on green infrastructure, and reframe the base for fiscal revenues and their use.

In practical terms, looking 'Beyond GDP' means creating measures that convey not just what we have produced in the last year but also the state of the natural capital that determines what we can produce sustainably now and in the future. Specifically these measures would comprise two additional terms, beyond the depreciation of our man-made, physical capital: the depletion of our non-renewable natural resources and how much income they generate; and the degradation of our ecosystem capital and how we should reinvest to maintain the current capacity of using ecosystem services.

A genuine measurement of natural capital depreciation should take account of the many functions of natural ecosystems to ensure that management of one function does not result in the degradation of other functions. In the case of ecosystems, the management objective is not to maintain a flow of income but to maintain the ecosystem capacity of delivering the full bundle of services. Therefore a key element of any valuation of ecosystem degradation needs to be an appraisal of required restoration costs. This can be done, for example through estimates of the reduction of yields, hypothetical costs, pollution abatement, and green infrastructure restoration. The methodology for this approach is already being tested for Europe.

Accounting fully for natural capital will also require new classifications, ideally linked to existing ones as described in the statistical framework: the new system of national accounts (SNA). Important examples are emerging, for example in the area of ecosystem services ([illegible]) or carbon accounting and carbon labelling.

In addition, a new information environment will have to address the widespread lack of accountability and transparency, and the loss of trust amongst citizens in governments, science and business. The challenge now is to improve the knowledge base in order to support more accountable and participatory decision making. Providing access to information is essential for effective governance, but engaging people in collecting data and sharing their lay knowledge is arguably just as important ([illegible]) ([illegible]) ([illegible]).

A further reflection concerns equipping Europeans with the skills to make the transformation to a green economy. Education, research and industrial policy have roles to play here by providing the next generation of materials, technologies, processes and products to offer examples related to systemic risks and vulnerabilities) that help reduce Europe's dependencies, increase resource efficiencies and enhance economic competitiveness in line with the EU 2020 strategy ([illegible]).

Other factors include incentives for businesses using new financial mechanisms, enhancing existing workers' [illegible] to green industries, and deploying unskilled workers displaced by delocalised production. A good example is the European recycling industry which holds a 50 % global market and has been increasing employment by some 10 % annually, mostly for unskilled workers ([illegible]).

More generally, many multi-national businesses are also responding to the natural capital challenge, recognising that the future economy must face the issues to manage, value and fund such capital ([illegible]). There is scope to foster further the role of small and medium enterprises in natural capital management.

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List of abbreviations

Endnotes

Chapter 1

Hungary	[illegible]	[illegible]
Iceland	[illegible]	[illegible]
Ireland	[illegible]	[illegible]
Italy	[illegible]	[illegible]
Latvia	[illegible]	[illegible]
Liechtenstein	[illegible]	[illegible]
Lithuania	[illegible]	[illegible]
Luxembourg	[illegible]	[illegible]
Malta	[illegible]	[illegible]
Netherlands	[illegible]	[illegible]
Norway	[illegible]	[illegible]
Poland	[illegible]	[illegible]
Portugal	[illegible]	[illegible]
Romania	[illegible]	[illegible]
Slovakia	[illegible]	[illegible]
Slovenia	[illegible]	[illegible]
Spain	[illegible]	[illegible]
	[illegible]	[illegible]
Sweden	[illegible]	[illegible]
Switzerland	[illegible]	[illegible]
Turkey	[illegible]	[illegible]
United Kingdom	[illegible]	[illegible]
	[illegible]	[illegible]
	[illegible]	[illegible]
	[illegible]	[illegible]
Albania	[illegible]	[illegible]
Bosnia and Herzegovina	[illegible]	[illegible]
Croatia	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Former Yugoslav Republic of Macedonia	[illegible]	[illegible]
Montenegro	[illegible]	[illegible]
Serbia	[illegible]	[illegible]

(¹) [illegible]

Greenhouse gas emissions	[illegible]
Energy efficiency	[illegible]
Renewable energy sources	[illegible]
[illegible]	[illegible]
Pressures on ecosystems	[illegible]
Conservation status	[illegible]
Biodiversity	[illegible]
Soil degradation	[illegible]
[illegible]	[illegible]
Waste generation	[illegible]
Waste management	[illegible]
Water stress	[illegible]
Water quality	[illegible]
Water pollution	[illegible]
Transboundary air pollution	[illegible]
Air quality in urban areas	[illegible]

(¹) [illegible]

(¹) [illegible]

(¹) [illegible]

(¹) [illegible]

(¹) [illegible]

(²) [illegible]

(³) The 6th Environment Action Programme (6th EAP) [illegible]

Chapter 2

(¹) [illegible]

(²) [illegible]

(³) [illegible]

(¹) [illegible]

(¹) [illegible]

(¹) [illegible]

(¹) [illegible]

(¹) [illegible]

(¹) [illegible]

Chapter 3

(1) [illegible]

(2) [illegible]

(3) [illegible]

(4) [illegible]

(5) [illegible]

(6) [illegible]

(7) [illegible]

(8) [illegible]

Chapter 4

(1) [illegible]

(2) [illegible]

(3) [illegible]

(4) [illegible]

(5) [illegible]

(6) [illegible]

(7) [illegible]

Chapter 5

(1) [illegible]

(2) [illegible]

(3) [illegible]

(4) [illegible]

(5) [illegible]

(6) [illegible]

(7) [illegible]

(8) [illegible]

(9) [illegible]

(10) [illegible]

(11) [illegible]

(12) [illegible]

Chapter 6

(1) [illegible]

Chapter 7

(1) [illegible]

( ) DALYs (disability adjusted life years) indicate the [illegible] of healthy life years lost in a population, due to premature mortality, and to years spent with reduced quality of life due to disease.

( ) There is little agreement, however, about the definition of 'middle class' in [illegible].

Chapter [illegible]

( ) However, it should be noted that these benefits are expected to be greater by 2030 than in 2020, especially if [illegible] longer period would be available for implementing measures and for changes to occur in the energy system.

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(7) [illegible]

(8) EEA, [illegible]

(9) [illegible]

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(20) IPCC, 2007. [illegible] Cambridge.

(21) EC, [illegible]

(22) [illegible]

(23) EC, [illegible]

(24) [illegible]

(25) EEA, [illegible] Copenhagen.

(26) EC, [illegible]

(27) [illegible]

[illegible]

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[illegible]

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[illegible]

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(32) [illegible]

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[illegible]

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Figure 5.2

(1) [illegible]

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Figure 5.3

(1) CLC, 2006. Corine land cover 2006 [illegible]
Corine land cover 2000 [illegible]
Corine land cover 1990 [illegible]
Corine land cover 1990–2000 changes, [illegible]

Corine land cover 2000–2006 changes, [illegible]

Figure 5.4

(1) [illegible]

Map 5.6

(1) [illegible]

(2) SEBI indicators, 2010. [illegible]

Map 5.7–Map 5.8

(1) Hettelingh, J.-P., Posch, M., [illegible] 2008. [illegible]

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Figure 5.1

([illegible]) [illegible]

Figure 5.2

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Box 5.1

([illegible]) [illegible] Epidemiology [illegible]

([illegible]) [illegible] Environmental Health Perspectives [illegible]

([illegible]) [illegible]

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Box 5.2

([illegible]) [illegible]

([illegible]) WHO, 2008. [illegible] WHO Regional Office for Europe, Copenhagen.

Map 5.1

([illegible]) [illegible]

Figure 5.3

([illegible]) [illegible]

Figure 5.4

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Figure 7.1

(1) [illegible]

(2) [illegible]

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Figure 7.4

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Figure 7.5

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Box 7.1

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