THE EUROPEAN ENVIRONMENT
STATE AND OUTLOOK 2015

EUROPEAN BRIEFINGS — ENVIRONMENTAL THEMES

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Air pollution

Despite considerable improvements in past decades, air pollution is still responsible for more than 400 000 premature deaths in Europe each year. It also continues to damage vegetation and ecosystems.

Continued improvements in air pollution levels are expected under current legislation, but beyond 2030 only slow progress is expected. Additional measures are needed if Europe is to achieve the long-term objective of air pollution levels that do not lead to unacceptable harm to human health and the environment.

Context

Poor air quality adversely affects human health, the environment, and the climate. Both short-term and long-term exposure to air pollution harms health. This harm occurs either via direct exposure to air pollutants, or indirectly via pollutants transported through the air, deposited, and then accumulated in the food chain. Air pollution also harms ecosystems by contributing to eutrophication and acidification of water and soil, leading to loss of flora and fauna. Air pollution can also harm agricultural crops and forests causing yield losses. Furthermore, certain air pollutants affect the climate system by triggering positive or negative changes in global radiative forcing (see SOER 2015 briefing on the air and climate system).

Current European Union (EU) air pollution policy is underpinned by the 2005 Thematic Strategy on air pollution (TSAP).[1] This strategy established interim objectives for air quality and also established measures to ensure progress toward the goals of the 6th Environment Action Programme (6th EAP), which ran from 2002 to 2012. The 6th EAP's goal was to attain 'levels of air quality that do not give rise to significant negative impacts on, and risks to human health and the environment'. To move toward achieving the TSAP objectives, EU air legislation follows a twin-track approach of implementing both local air quality standards and source-based mitigation controls. These source-based mitigation controls include binding national limits for emissions of the most important pollutants.

The main policy instruments on air pollution within the EU include the Ambient Air Quality Directives,[2][3] and the National Emission Ceilings (NEC) Directive,[4] which contains emission ceilings for 2010 and years thereafter. In addition, there is source-specific legislation addressing industrial emissions, road and off-road vehicle emissions, fuel quality standards etc. Emissions are also addressed internationally under the 1979 Convention on Long-range Transboundary Air Pollution.

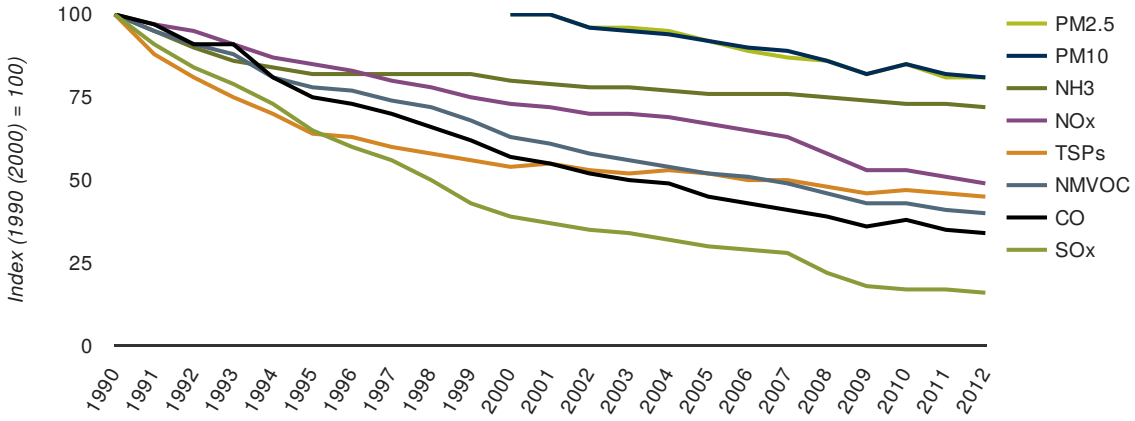
At the local level, the EU requires air quality management plans to be implemented in areas where exceedances of air quality standards occur. These plans are required to bring concentrations of air pollutants to levels below the EU legislative limit and target values.

Key trends

Vehicles, industry, power plants, agriculture, households, and waste contribute to Europe's air pollution. Emissions of the main air pollutants in Europe have declined in recent decades (Figure 1), resulting in generally improved air quality across the region. However, certain sectors have not followed this trend, and have seen emissions of some pollutants increase. For example, fine particulate matter ($PM_{2.5}$) emitted directly into the air from coal and biomass combustion in households and from commercial and institutional buildings, have risen in the EU by around 9% and 11% respectively over the period 2003 to 2012.[5] These sources are now the most important contributors to total PM

emissions in the EU.

Figure 1: EU-28 emission trends for the main air pollutants



Note: Parties to the Convention on Long-range Transboundary Air Pollution (LRTAP) are formally requested to report emissions of PM only for the year 2000 and onwards. Hence emission trends for these years only are shown. PM_{10}: particulate matter with a diameter of 10 µm or less; $PM_{2.5}$: particulate matter with a diameter of 2.5 µm or less; TSP: Total suspended particulate; NMVOC: Non-methane volatile organic compounds; NH_3: ammonia; NO_X: nitrogen oxides; CO: carbon monoxide; SO_X: sulphur oxides.

Data sources: EEA. National emissions reported to the Convention on Long-range Transboundary Air Pollution (LRTAP Convention)

Emission reductions of certain pollutants have resulted in a notable decrease of ambient concentrations of sulphur dioxide (SO_2), carbon monoxide (CO), benzene (C_6H_6), lead (Pb) and mercury (Hg). However, due to the complex chemistry undergone by certain pollutants in the atmosphere, emission reductions have not always produced a corresponding drop in concentrations. For example, there have been substantial reductions in emissions of many of the precursors for PM and O_3 in Europe, but concentrations of these have generally decreased only slowly.

Emissions from wood burning and coal burning are an important source of directly emitted PM and carcinogenic substances such as polycyclic aromatic hydrocarbons (PAHs). These emissions come from households, and commercial and institutional facilities. Emissions of benzo(a)pyrene (BaP), a PAH formed mainly from the burning of organic material, have increased by 11% between 2003 and 2012. Population exposure to BaP concentrations is significant and widespread, especially in central and eastern Europe.[5][6]

Main air pollutants affecting human health: PM, O_3 and NO_2

- EU limit values for PM_{10} (Map 1) and NO_2 were exceeded widely in Europe in 2012. The target value for O_3 was also exceeded at a large number of measuring stations.
- 21% of the EU urban population lives in areas where the EU air quality 24-hour limit value for PM_{10} was exceeded in 2012. For EEA-33 countries the estimate is 38% of the urban population. Exposure to PM_{10} levels exceeding the stricter World Health Organization (WHO) air quality guidelines (AQGs) is significantly higher, comprising 64% of the total EU urban population in 2012.
- 14% of the urban population of both the EU and EEA-32 live in areas where the EU O_3 target value for protecting human health was exceeded in 2012. The percentage exposed to O_3 levels exceeding the WHO AQG standard is significantly higher, comprising 98% of the EU's total urban population.

Map 1: Concentrations of PM_{10} in 2012 at traffic, urban, industrial and rural sites

Source: AirBase — The European air quality database v. 8.
Note: The red and dark red dots indicate stations reporting exceedances of the 2005 daily limit value (50 µg/m^3), as set out in the Air Quality Directive (EU, 2008).

Air pollution impacts on ecosystems

- Significant improvements in reducing ecosystem exposure to excess levels of acidification have been made over past decades, largely due to declines in emissions of sulphur dioxide, one of the main acidifying compounds. However, this improvement has not been matched with a parallel improvement in eutrophication levels. This is because emissions of pollutants containing nitrogen — which can lead to eutrophication — have not fallen as much as emissions of sulphur.[7]
- Ammonia (NH_3) emitted from agricultural activities, and nitrogen oxides (NO_X) from combustion processes are the predominant eutrophying air pollutants. Exceedances of eutrophication critical loads occur across most of continental Europe. It is estimated that around 63% of European ecosystem areas — and 73% of the area covered by Natura 2000-protected sites — were exposed to air-pollution levels exceeding eutrophication limits in 2010.[7]
- The EU target value for protection of vegetation from O_3 has been exceeded in a substantial part of the agricultural area in Europe, notably in southern and central Europe. The long-term objective for vegetation protection from O_3 was exceeded in 88% of the total agricultural area in 2011.[7]

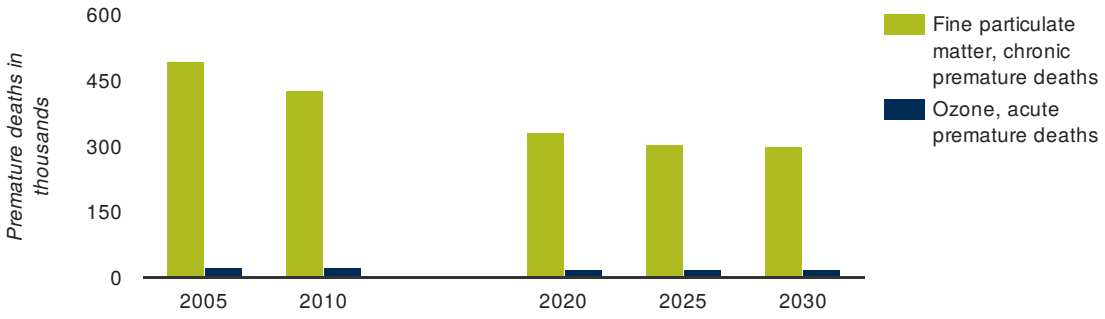
Prospects

Air pollution is projected to further decline in future years, but beyond 2030 only slow progress is expected. In late 2013, the European Commission proposed a Clean Air Policy Package for Europe, which aims at achieving full compliance with existing air quality legislation by 2020, and at further improving Europe's air quality by 2030 and beyond.[8] The package proposes strengthening the implementation of existing legislation; introducing stricter national emission-reduction commitments; and reducing emissions from medium-size combustion plants.

As part of this package, the Commission has put forward a revised NEC Directive, which proposes new national emission-reduction commitments for 2020 and 2030. This revised NEC Directive would apply to the pollutants currently covered (NO_x, NMVOC, SO_2, and NH_3) and would add two new pollutants, $PM_{2.5}$ and methane (CH_4). It would also promote mitigation measures for black carbon.

The proposals — if agreed and fully implemented — are projected to reduce health impacts (premature mortality due to PM and O_3 pollution) by 53% in the EU by 2030 relative to 2005. 40% of this is estimated to be delivered by a full implementation of existing legislation.

Figure 2: Estimated future air pollution health impacts of fine particulate matter and ozone under a current legislation scenario



Note: The current legislation or 'baseline' scenario assumes full implementation of current air-related policies. It is based on recent energy projections used as a reference for climate, energy and transport policy analysis as well as on agricultural projections.

Data sources: European Commission. A Clean Air Programme for Europe

However, even with the implementation of these proposals, about 50% of the EU's ecosystem area is projected to exceed eutrophication critical loads in 2030.

Beyond 2030, a time horizon of 2050 has been suggested as an aspirational year to achieve Europe's long-term objectives of achieving levels of air pollution that do not lead to unacceptable harm to human health and the environment.[9] To achieve such longer-term air quality objectives, it will become increasingly important that air pollution and climate-change policy are considered in an integrated manner. Measures to abate air pollution and GHGs often target the same sources. Factoring air quality into decisions about how to reach climate change targets, and vice-versa, can deliver greater benefits to society.

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Biodiversity

Europe's biodiversity continues to be eroded resulting in ecosystem degradation. Recent data show that 60% of species assessments and 77% of habitat assessments continue to be in unfavourable conservation status. Constant habitat loss, diffuse pollution, over-exploitation of resources, and growing impacts of invasive alien species and climate change contribute cumulatively.

The main EU target of 'halting the loss of biodiversity and the degradation of ecosystem services' by 2020 remains a serious challenge.

Context

Biodiversity, or biological diversity, is the variety of life and includes all living organisms found on Earth. It plays a key role in the functioning of ecosystems and the provision of ecosystem services which are essential for human life and well-being. These include provisioning services (e.g. fisheries, biomass), regulating and maintenance services (e.g. pollination, nutrient cycling, water purification) and cultural services (e.g. recreation). Yet despite biodiversity's intrinsic value and its fundamental importance for humans, biodiversity is highly threatened by human activities and continues to be lost. This is estimated to reduce global GDP by 3% each year.[1]

In 2010 it was clear that neither the existing global nor the European Union's (EU) 2010 biodiversity target of reducing/halting biodiversity loss had been met,[2][3] despite important progress in nature conservation measures in Europe, e.g. the expansion of the Natura 2000 network of protected areas and the recovery of some wildlife species (e.g. large carnivores). At the same time, key drivers of biodiversity loss remain or have increased, offsetting the positive actions to reverse this.

As a result, in 2010 world leaders adopted 20 targets — known as the Aichi Biodiversity Targets — for the period 2011–2020 with the aim to 'significantly reduce the current rate of biodiversity loss'.

In 2010, the EU set the ambitious overall target of 'Halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as is feasible, while stepping up the EU contribution to averting global biodiversity loss'. In 2011, the European Council adopted its EU Biodiversity Strategy to 2020, reinforced by the European Parliament Resolution in 2012 (see Box 1).

> **Box 1: The six targets covered by the EU Biodiversity Strategy to 2020**
>
> 1. Fully implement the Birds and Habitats Directives;
> 2. Maintain and restore ecosystems and their services;
> 3. Increase the contribution of agriculture and forestry to maintaining and enhancing biodiversity;
> 4. Ensure the sustainable use of fisheries resources;
> 5. Combat invasive alien species (IAS); and
> 6. Help avert global biodiversity loss.

The Birds and Habitats Directives (known as the Nature Directives) aim to protect biodiversity and are the key pieces of legislation underpinning the EU Biodiversity Strategy to 2020. Other relevant EU legislation includes the Water Framework Directive, the Marine Strategy Framework Directive, the Common Agricultural Policy and the Common Fisheries Policy.

In 2013 the European Commission adopted the Green Infrastructure Strategy.[4] In 2014 the European Council adopted a regulation on the prevention and management of the introduction and spread of IAS.[5]

Key trends

The key threats to biodiversity

The key threats to biodiversity — habitat change, pollution, over-exploitation, IAS, and climate change — continue to exert pressure causing loss of species and habitats and resulting in ecosystem degradation and weakening ecosystem resilience.

Habitat change — including loss, fragmentation and degradation — of natural and semi-natural habitats due to land-

use change is a main pressure. For example, through fragmentation of the rural landscape because of urban sprawl and grey infrastructure developments; homogenisation and loss of habitat caused by agricultural intensification and land abandonment, and intensely managed forests.

Over-exploitation of natural resources, in particular through fisheries in the marine environment, remains a large problem.

The accelerated establishment and spread of **IAS** — more than 12 000 alien species[6] now occur in Europe — is not only an important driver of biodiversity loss, but also causing considerable economic damage to agriculture, forestry and fisheries worth billions of euros per year.[7][8] Europe faces an increasing trend of new IAS across all environments.[7]

Encouragingly, some **pollution pressures** have decreased such as the nutrient enrichment of European waters and the balance of nitrogen found on farmland. However, the level of nitrogen still substantially exceeds ecosystem eutrophication limits in most of Europe and the eutrophication risk is predicted to remain in 2020.

Increasing impacts from **climate change** are already affecting species' distribution, range and interaction and are projected to become a more significant threat in the coming decades.[9] Climate change will also interact with and exacerbate other threats.

Status and trends of European biodiversity

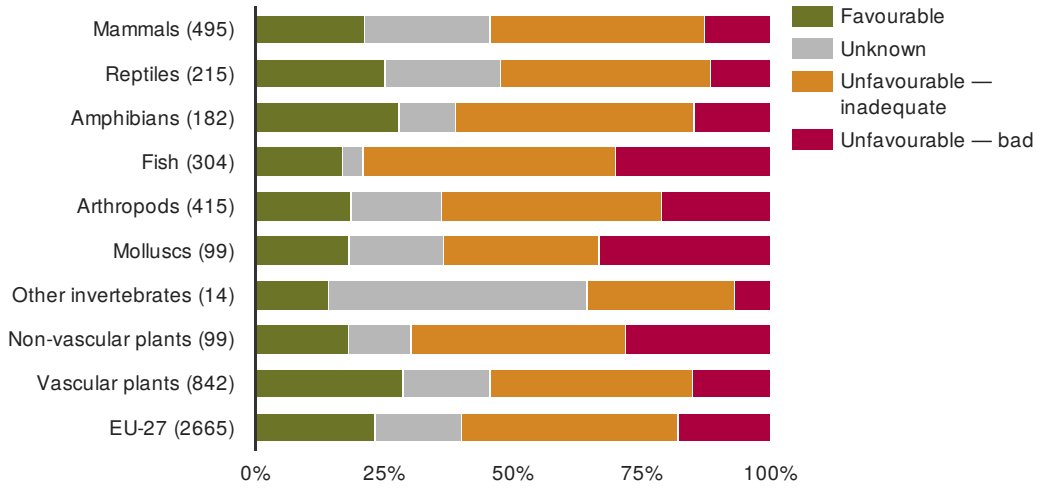
Much is still unknown when it comes to the complete status and trends of European biodiversity and its relation to the functioning of ecosystems and the long-term delivery of services. Nonetheless, available information on selected species, habitats and ecosystems across Europe give cause for concern.

Information reported by EU Member States under the Birds and Habitats Directives indicates that local biodiversity loss could be considerable. Under the Habitats Directive, the assessment for 2007–2012 shows that only 23% of animal and plant species assessments (Figure 1) and 16% of the habitat type assessments (Figure 2) were considered to be in a favourable conservation status.

A high proportion of species assessments (60%) and habitat assessments (77%) remain in unfavourable condition. The proportion of assessments of conservation status which are unknown has decreased (to 17% for species and 7% for habitats).

Data on population trends for various groups of species show both worrying and encouraging results. There has been a dramatic decline in grassland butterflies of almost 50% between 1990 and 2011 with no sign of recovery.[10] Europe's common bird populations have declined by 12% since 1990 (common farmland birds have declined by 30%). Encouragingly, some populations of European bats[11] and large carnivores[12] appear to have recovered to some extent from past declines, demonstrating positive results of conservation action and unplanned changes such as land abandonment.

Figure 1: Conservation status of species of European interest[13]



Data sources:EEA. Conservation status of habitat types and species (Article 17, Habitats Directive 92/43/EEC)

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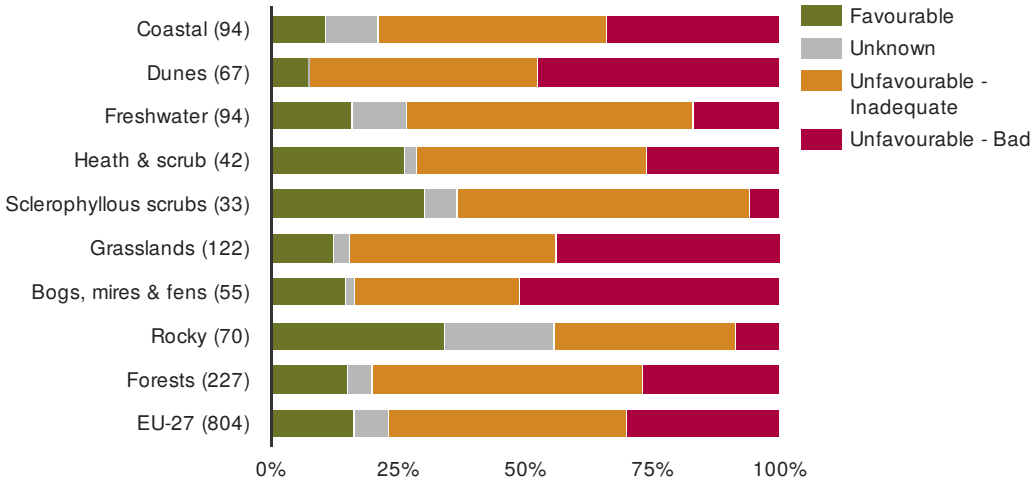
Figure 2: Conservation status of habitats of European interest[13]



Data sources:EEA. Conservation status of habitat types and species (Article 17, Habitats Directive 92/43/EEC)

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Prospects

In Europe there has been progress on some issues. A significant achievement includes the expansion of the Natura 2000 network of protected areas to 18% of EU land and 4% of EU marine waters. This means that the Aichi target for global coverage of protected areas by 2020 of at least 17% of the terrestrial and inland water areas has been met while much progress is still needed for meeting 10% of the coastal and marine areas. Conserving and managing the Natura 2000 network effectively, and enhancing their coherence through developing green infrastructure, such as wildlife corridors, is a critical step to protect Europe's biodiversity.

It will be very challenging for Europe to meet the overall target of halting the loss of biodiversity and the degradation of ecosystem services by 2020. Many of the direct, and all of the indirect influences on biodiversity loss, arise from a range of sectors and policies that exerts considerable pressure on biodiversity. These include agriculture, fisheries, regional development and cohesion, forestry, energy, tourism, transport and industry. Consequently, the fate of European biodiversity is also closely intertwined with the developments in these areas. Thus, the adequate integration of biodiversity considerations into certain economic sectors as well as regional policies remains critical in attempting to reduce the pressures on biodiversity. Successful mainstreaming of biodiversity into these areas — in both the public and private sectors — will be required.

The EU Biodiversity Strategy to 2020[1] — if fully and effectively implemented — is foreseen as an important step towards halting the loss of biodiversity. For example, the effective integration of biodiversity concerns into sectors such as agriculture, forestry and fisheries (aim of targets 3 and 4) will be important in attempting to reduce the direct impacts on biodiversity. Another key step is the restoration of at least 15% of degraded ecosystems across Europe, the promotion of green infrastructure in the EU in urban and rural areas and ensuring no net loss of biodiversity and ecosystem services (target 2). All of which have the potential to considerably benefit biodiversity, as well as society, through strengthening the coherence of the Natura 2000 network, increasing ecosystem resilience and providing nature-based solutions to climate change adaptation. Target 2 also aims to improve the knowledge base on ecosystems and their services in the EU[14] in order to assess the economic value of ecosystem services and to promote the integration of these values into accounting and reporting systems at EU and national level by 2020.

In today's increasingly globalised economy, international trade chains accelerate habitat degradation far away from the place of consumption.[15] Given that Europe has a high ecological footprint and relies heavily on the import of resources and goods from all over the world, Europe's impact on biodiversity loss and ecosystem degradation extends well beyond its borders. Consequently, European efforts to halt biodiversity loss on its continent should ensure that pressures are not transferred to other parts of the world thereby exacerbating global biodiversity loss.

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Climate change impacts and adaptation

Global climate change impacts Europe in many ways, including: changes in average and extreme temperature and precipitation, warmer oceans, rising sea level and shrinking snow and ice cover on land and at sea. These have led to a range of impacts on ecosystems, socio-economic sectors and human health.

Adaptation to the observed and projected impacts in coming decades is needed, complementary to global climate mitigation actions. The EU strategy on adaptation to climate change supports national adaptation strategies and other actions in countries aimed at mainstreaming EU policies, providing funding and enhancing research and information sharing.

Context

Climate change has already led to a wide range of impacts on the environment, the economy, and society.[1][2] These impacts have been felt both in Europe and across the world. Even if greenhouse gas (GHG) emissions were to stop today, climate change would continue for many decades as a result of past emissions and the inertia of the climate system.[2] It is therefore necessary to adapt to the changes that have already occurred and to prepare for plausible scenarios of future climate change.

To help promote this adaptation, the European Commission in 2013 adopted the communication 'An EU Strategy on adaptation to climate change'.[3] The communication supports adaptation actions in countries, and promotes better research and information-sharing. It also supports 'mainstreaming', the process whereby adaptation concerns are integrated into existing sectoral EU policies (like agriculture or regional development). Overall it aims to help make Europe more climate-resilient, enhancing its capacity to respond to the impacts of climate change at local, regional, national, and EU levels.

Adaptation is also considered in other EU initiatives, particularly Europe 2020 — Europe's growth strategy,[4] and the Resource-Efficient Europe flagship initiative.[5] Moreover, a new international climate change agreement is expected to be negotiated by the end of 2015. Several adaptation-related elements of such an agreement are currently being discussed. These include capacity building, institutional arrangements, financing, incentives for private investments, and provisions promoting transparency through monitoring, reporting and verification.

Key trends

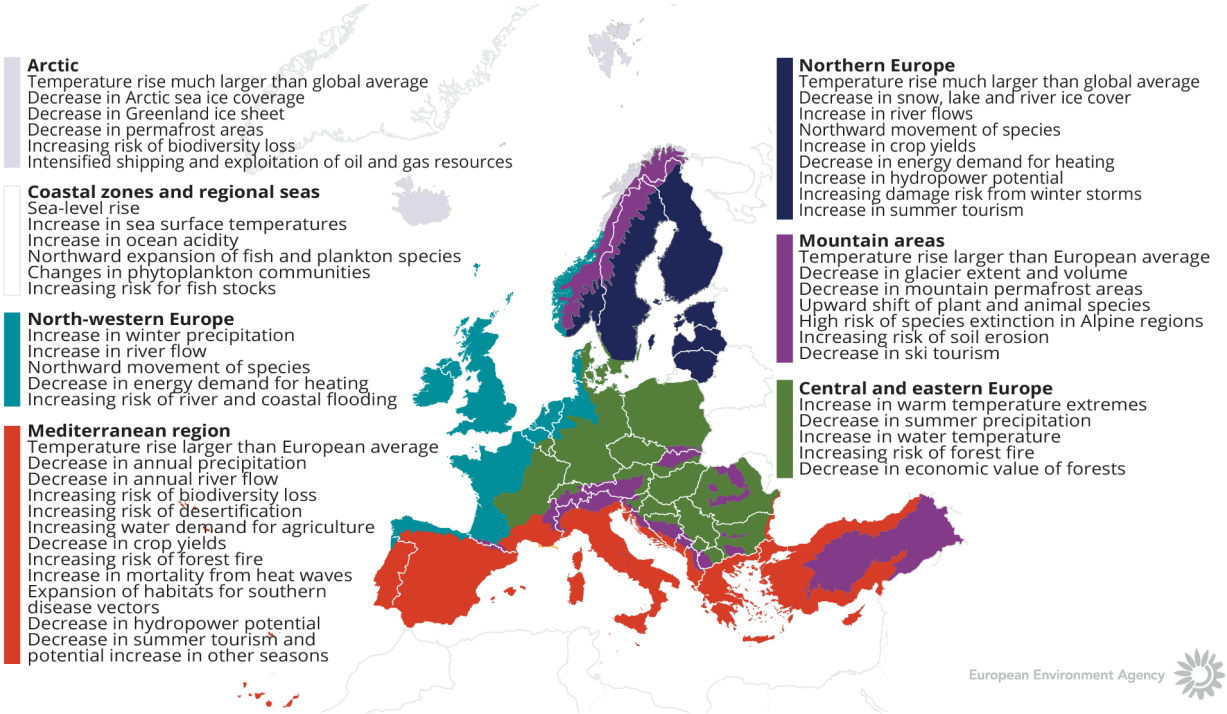
Climate change impacts

Human influence — primarily emissions of greenhouse gases, but also changes in land use — has been the dominant cause of the observed warming since the mid-20th century. The last decade was the warmest since global temperature records became available. Climate change impacts can be seen in accelerating global sea-level rise, in changes in various climate extremes and in changes in the global water cycle. Precipitation has generally increased in northern and north-western Europe, but has generally decreased in southern Europe. Snow cover in Europe has been decreasing, and the extent and volume of Arctic sea ice have been decreasing much faster than previously projected[1][2] (see SOER 2015 briefing on the air and climate system; and on climate change).

Observed climate change has already led to a wide range of impacts on environmental systems, economic sectors,

and human health and well-being in Europe. These impacts vary across Europe depending on climatic, geographic and socio-economic conditions. Figure 1 shows key observed and projected impacts from climate change for the main biogeographical regions in Europe.

Figure 1: Key observed and projected impacts from climate change for the main regions in Europe



Source: EEA (2012)

Adaptation

These climate change impacts have spurred policymakers at national and European level to introduce adaptation policies that will help societies and economies to cope with the effects of climate change and socio-economic changes.

On a European level, 'mainstreaming' of climate change adaptation is taking place within various EU policies, such as freshwater and coastal management, biodiversity and nature protection, and disaster-risk reduction.[6][7]

In order to assist the development of adaptation policies in Europe, the EU maintains a website, the European Climate Adaptation Platform (Climate-ADAPT). Climate-ADAPT enhances the sharing of up-to-date, reliable, and targeted information and data. It supports the development and implementation of adaptation policies across all levels of governance in Europe, for example by providing examples of adaptation options, case studies of implemented actions, and an adaptation-support tool.

On the national level — and at the city and regional levels — implementing adaptation is still at an early stage.[8][9] Most progress has been reported for freshwater management, flood-risk management, and agriculture. The adaptation actions in these sectors have mostly consisted of 'mainstreaming' adaptation priorities into these national sectoral policy areas.

Although adaptation implementation is still at an early stage, adaptation planning work is underway in most countries. As of June 2014, 20 EEA member countries have adopted national adaptation strategies (13 more than in 2008). 17 of these countries have also developed an adaptation national action plan to help further define the adaptation

actions they will implement.[7]

Most European countries report that the level of public awareness regarding the need for adaptation has increased during the past five years and that adaptation has reached the national political agenda.

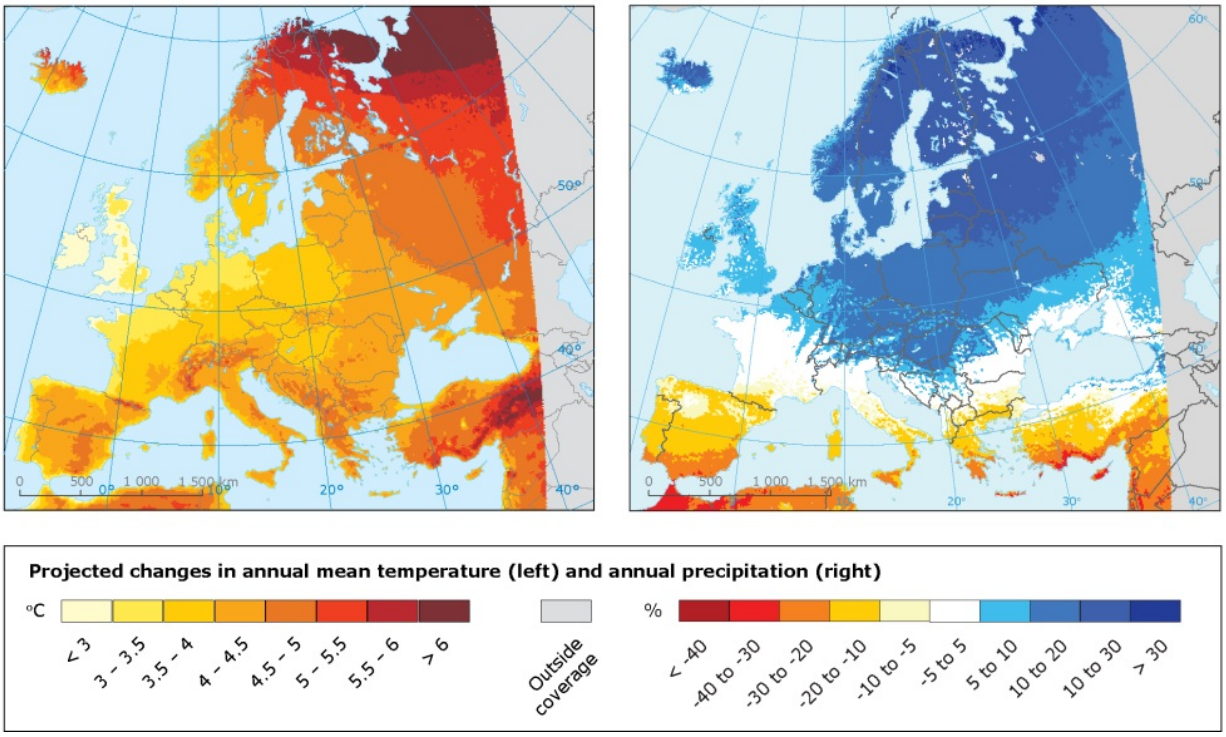
On a transnational level, adaptation action is mainly the result of shared natural resources such as transboundary water catchments. Transnational cooperation of this sort is often supported by European funding instruments (e.g. in the Baltic Sea region) and through European regional conventions (e.g. the Danube Commission).

Prospects

Climate change impacts

In the long term, the magnitude and rate of climate change depends on future global greenhouse gas emissions. The European Union is committed to limiting global temperature increase to below 2 °C above the pre-industrial level, as agreed globally under the UNFCCC. However, the projected rise in global average temperatures over the 21st century is 0.3 °C–1.7 °C for the lowest emission scenario, and 2.6 °C–4.8 °C for the highest emission scenario.[2]

Figure 2: Projected changes in annual mean temperature (left) and annual precipitation (right)



Source: Climate change projections for Europe based on an ensemble of regional climate model simulations provided by the EURO-CORDEX initiative.

Note: Projected changes are for 2071-2100, compared to 1971-2000, based on the average of a multi-model ensemble forced with the Representative Concentration Pathways (RCP) 8.5 high emissions scenario. All changes marked with a colour (i.e. not white) are statistically significant. Individual models from the EURO-CORDEX ensemble or high-resolution models for smaller regions may show different results.

Indicators: Global and European temperature (CSI 012), Mean precipitation (CLIM 002).

Annual average land temperatures over Europe are projected to continue increasing by more than the global average temperature. The largest temperature increases are projected over eastern and northern Europe in winter,

and over southern Europe in summer. Annual precipitation is generally projected to increase in northern Europe and to decrease in southern Europe, thereby enhancing the differences between currently wet regions and currently dry regions (Figure 2). The intensity and frequency of extreme weather events is also projected to increase in many regions, and sea-level rise is projected to accelerate significantly.[1]

Climate change may increase existing vulnerabilities and deepen socio-economic inbalances in Europe. Major climate risks for Europe include increased coastal and river floods, significant reduction in water availability, and extreme heat events.[10] According to a recent study, under a high-emission scenario and in the absence of adaptation actions, some climate impacts would roughly double by the end of this century. Heat-related deaths would reach about 200 000 per year; the cost of river flood damages would exceed EUR 10 billion/year; and every year forest fires would affect an area about 800 000 ha. In this scenario, people affected by droughts would also increase by a factor of seven to about 150 million per year, and welfare loss due to sea-level rise would more than triple to EUR 42 billion/year.[11]

Adaptation

Adaptation policy at the European level will receive new financial resources in the coming years. 20% of the EU budget for 2014–2020 will be used for climate-related actions (i.e. adaptation and climate-change mitigation). This funding will be disbursed to Member-State level through a range of EU funds such as the European Regional Development and Cohesion Funds, European Structural and Investment funds, LIFE+ projects, and the INTERREG regional cooperation funds.[12][7]

In 2017, the European Commission will report to the European Parliament and the Council on the state of implementation of the 2013 communication 'An EU Strategy on adaptation to climate change', and will propose its review if needed.

Assessment processes are also in place at national level, and will lead to better knowledge in the future about effective adaptation. Four European countries are currently implementing a monitoring, reporting or evaluation scheme. Nine countries have already developed — or are developing — indicators on climate change impacts, risks or adaptation.

Climate change risk or vulnerability assessments are available for 21 European countries, but more information is still needed, particularly on the estimated benefits and costs of different adaptation options. Another area that requires more research is the issue of how best to craft adaptation responses in the light of uncertainty concerning future climate change impacts, societal change, and the effectiveness of adaptation responses.

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Forests

Forests provide a range of ecosystem services from capturing and storing carbon to providing bio-fuel, timber as well as social benefits. However, our forests, which have increased in area by 17 million hectares since 1990, face growing pressure from fragmentation, expanding urban areas, climate change and loss of biodiversity.

The claims on forests services are increasing. Understanding the role of more than 14 million forest owners/managers is imperative to developing balanced, sustainable policy on forest resources.

Context

The use and management of forest resources vary greatly across Europe and depends on factors such as local social and economic situations, history, traditions and government policies both within and outside the forest ecosystems. Europe's forests reflect this variety of economic, social and environmental conditions in the region (see Table 1).

Increased land use, expanding urban areas, and climate change have contributed to place more pressure on forests. Forest management is complex as forests can produce a wide variety of goods and services. Many of these outputs can be produced simultaneously, and trade-offs may occur especially between commercial and non-market outputs from forests.

For example, intensified harvesting of trees to meet the demand for biomass puts pressure on forest management, old growth forests, and levels of deadwood.[1] The demands for these outputs vary between countries and over time. They are mostly increasing and might be competing, leading to more complicated decisions for forest managers and policymakers. Healthy, e.g. productive and resilient, forests are essential to encounter these demands.

There is no common forest policy in Europe. The European Union's (EU) Forest Strategy[2] highlights the importance of European forests as key repositories for biological diversity and as key providers of ecosystem services such as soil and water protection, absorption of carbon from the atmosphere, bio-fuels, timber production, amenity, and that they provide social benefits.

Meanwhile forest-related objectives such as nature conservation, climate change mitigation and the supply of biomass and wood products are being stepped up by policymakers from different sectors.

For example, the importance of maintaining healthy forest ecosystems has gained more attention through the implementation of the Natura 2000 network of protected areas.

Climate change and energy issues and efforts to combat illegal logging and improving forest governance outside Europe (e.g. the EU Timber Regulation[3]), are other examples of forest-related legislative acts.

The EU's Forest Strategy seeks to amend this lack of coordination and coherence between the various forest-related policies.

Key trends

Forest area in Europe has increased since 1990 by 17 million hectares (ha) of which more than half are planted forests. This has been the result of afforestation (e.g. planting and seedling of trees on land that was not previously forested) and through natural expansion of forests such as on abandoned land. The area of forests undisturbed by

man has overall remained stable at around 3% of the land area (Table 1). Today forests amount to about 180 million ha making Europe one of the most forest-rich regions in the world with more than 40% of land covered by forests.

Table 1: Key facts on European forests by region and for EU-28[4]

	North[5]	Central-West[6]	Central-East[7]	South-West[8]	South-East[9]	EU-28[10]
Forest and other wooded area, 10^6 ha	**75**	39	23	42	45	180
Forest and other wooded area,% of total land	**56**	28	30	48	35	41
Forests available for wood supply, 10^6 ha	**55**	34	20	25	22	133
Growing stock, m^3/ha	117	227	**237**	81	140	154
Net annual increment, m^3/ha	5	8	**8**	4	6	6
Fellings, 10^6 m^3	**181**	172	93	29	17	469
Fellings/net annual increment,%	**71**	65	66	37	47	65
Forest undisturbed by man,%	**6**	0,3	2	0,4	6	3
Semi-natural forest,%	**92**	86	91	86	77	89
Plantations,%	2	14	7	14	**17**	8
Forest dominated by introduced tree species	2	**11**	4	7	1	5
Forest area protected for biodiversity	7	10	4	**23**	6	11
Forest area protected for landscape	2	**26**	12	6	1	10
Forest area designated for the protection of soil, water and other ecosystem services	12	18	25	**42**	10	20
Forests in private ownership	71	62	27	**73**	17	60
Forest sector work force 1 000 fte[11]	346	**923**	658	582	405	2 560

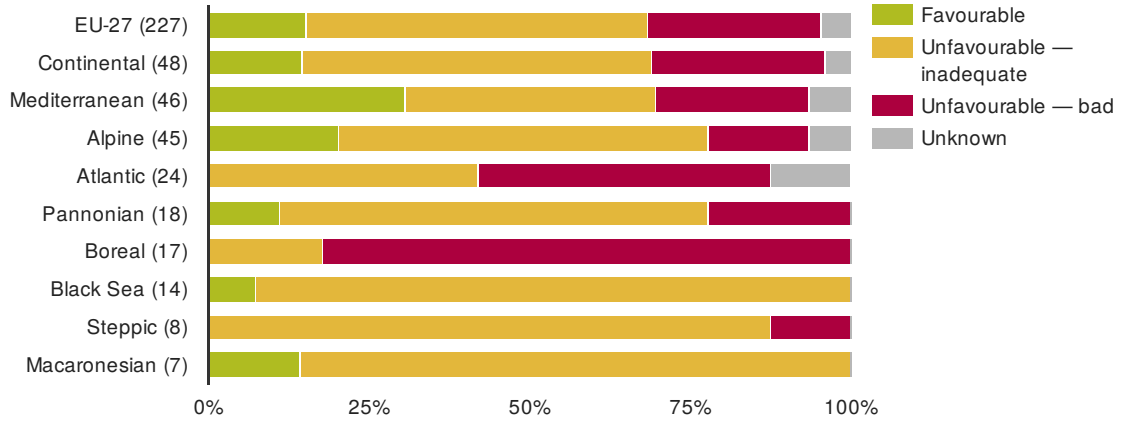
Forests in Europe are increasingly at risk from environmental stresses due to human induced pressures. The condition of forests is an important dimension when looking at trends in forest resources, however difficult to measure. The loss of foliage in European forests was monitored to assess damages by air pollution on forests. This was triggered by a decline in forests in Central Europe from the 1980s until 2009. Most of the forests monitored showed no change in defoliation although damaged forests have been observed in Central Europe and in Mediterranean coastal areas.

Catastrophic events, primarily the result of climate change, have an increased negative impact on forest growth and condition. The number of fires has increased in recent decades.[12] Most forest fires occur in the Mediterranean region and destroy around 400 000 ha every year. Between 1990 and 2005, the recorded forest area affected by insects and diseases had nearly doubled in Europe (2.7% of the forest area). Damages resulting from storms, wind and snow are estimated to affect 0.4% of the forest area. Such threats to forests are likely to lead to higher rates of tree mortality and make forests more vulnerable to natural hazards and human made pressures.[13] Some threats can be mitigated by forest management creating more resilient forest structures.

The development of human infrastructure, land-use change, excessive forest harvesting and forest fires in Europe has resulted in a landscape of fragmented forests.[14][15] This reduces the capacity of forest-dependent species to move to other forested areas and their ability to survive and adapt to climate change. Forests play an important role in

the conservation of biological diversity. The area of protected forests in Europe increased by around half a million hectares annually between 2000 and 2010. Half of the protected forests are managed for conservation of biodiversity. In Europe, protected forest areas account for more than 45% of the Natura 2000 protected areas, 31.3% of the national designated protected areas, and about 12% of the total forest area. Despite the efforts to halt loss of biodiversity, 80% of forest habitat assessments still have unfavourable conservation status (see Figure 1).

Figure 1: Conservation status of forest habitat types by region



Note: The habitats referred to are those covered by Annex I of the Habitats Directive 92/43/EEC

Data sources:EEA. Conservation status of habitat types and species (Article 17, Habitats Directive 92/43/EEC)

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European Environment Agency

An increase in the scarcity of water has led to a focus on the provision of drinking water from forests. Forests serve to replenish and provide clean drinking water. Following efforts in recent years, more than 20% of European forests are dedicated to protect water and soils, mainly in mountainous areas. One third of European lakes are located in forested catchment areas.[16]

Forests growing in flood plains have significant roles in water retention. 4.5% of European forests can be defined as floodplain forests. One third of European rivers are flowing through forested catchment areas.

Forests play an important role in mitigating climate change by absorbing carbon from atmosphere. Europe's forests store almost 80 billion tonnes of carbon in their biomass. The stock of carbon in forest biomass has increased by around 3 billion tonnes since 1990. This means that forests absorb around 7% of the annual greenhouse gas (GHG) emissions from the region.

Prospects

The restoration and maintenance of biodiversity in forests will support resilience to natural and human induced pressures, including the expected impacts of climate change. Current policy targets support this approach. These include halting biodiversity loss by 2020, reducing GHGs by 20%, increasing biomass energy from wood, and ensuring legal compliance for wood or forest products imported in the EU.

Targets are set to halt global forest cover loss by 2030 and to reduce gross tropical deforestation by at least 50% by 2020 (EU Deforestation Communication of 2010, reiterated in the 7th EAP[17]). The Biodiversity Strategy[18] and the EU's Forest Strategy[2] emphasise the need for improved integration of biodiversity measures in forestry to support halting the loss of species and habitats. These include maintaining deadwood, preserving high nature value (HNV) forest areas[19], applying ecosystem-based measures to increase the resilience of forests, ensuring that afforestation is carried out respecting the diversity of domestic species and adapting to the effects of climate change.

The use of wood can substitute fossil fuels and other carbon intensive materials but can reduce the carbon stock in the forest. Optimal climate change mitigation strategies depend on sustainable forest management and will vary from place to place taking into account regional and local conditions. As such, protecting these forests should be a high priority in order to protect their generally large carbon stocks. In most semi-natural forests in Europe, efforts to promote carbon sequestration and biodiversity are mutually supportive.[20] The option of including the net value of the carbon absorbed by forests into emission trading and reduction targets is currently under consideration.

Understanding the role of forest owners and managers is imperative in order to properly address the trade-offs in the use of forests and integrating conservation and sustainable use goals. The competence and judgement of public sector agencies, private sector companies and other advisory actors will impact the way in which the policy can be implemented.[21]

A coherent policy approach to European governance of forest resources is needed to protect and maintain forests and their functions within sustainable limits. Monitoring at the European level is essential to build a knowledge base on forests. Forest data and information are collected at national levels, but this information is not available and seldom comparable from country to country. The EU's Forest Strategy calls for such harmonisation of forest information and suggests using national forest inventories and monitoring systems.

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Freshwater quality

Much cleaner than 25 years ago, many waterbodies are still affected by pollutants and/or altered habitats. In 2009, only 43% showed a good/high ecological status; the expected 10 percentage point increase for 2015 (to 53%) constitutes only a modest improvement in aquatic ecosystem health.

Water management should improve with the second round of river basin management plans covering the 2016-2021 period resulting in the realisation of more policy objectives through stringent, well-integrated implementation and public participation.

Context

The continuing presence of pollutants in Europe's waters threatens aquatic ecosystems and raises concerns for public health. Discharge from urban wastewater treatment, and industrial effluents and losses from farming, are the main sources for water pollution. For example, agriculture causes widespread problems of nutrient enrichment in freshwater across Europe, despite recent improvements in some regions.

The main aim of European Union (EU) water policy is to ensure that throughout the EU, a sufficient quantity of good quality water is available for people's needs and for the environment. Since the first water directives in the 1970s, the EU has worked to create an effective and coherent water policy. The Water Framework Directive (WFD), which came into force in 2000, establishes a new framework for the assessment, management, protection and improvement of the quality of water resources across the EU.

EU Member States should aim to achieve good status in all bodies of surface water and groundwater by 2015 unless there are grounds for exemption. Only in this case may achievement of good status be extended to 2021 or 2027 at the latest. Achieving good status involves meeting certain standards for the ecology, chemistry, morphology, and quantity of waters. In general terms, good status means that water shows only a slight change from what would normally be expected under undisturbed conditions (i.e. with a low human impact).

Water quantity and water quality are closely linked, and good ecological status depends as much on the quantitative water resource aspects as on its quality. In many locations, water demand often exceeds availability. Over-abstraction is causing low river flows, lower groundwater levels, and the drying-up of wetlands, which have detrimental impacts on freshwater ecosystems. Climate change is projected to increase water shortages, particularly in the Mediterranean region.[1]

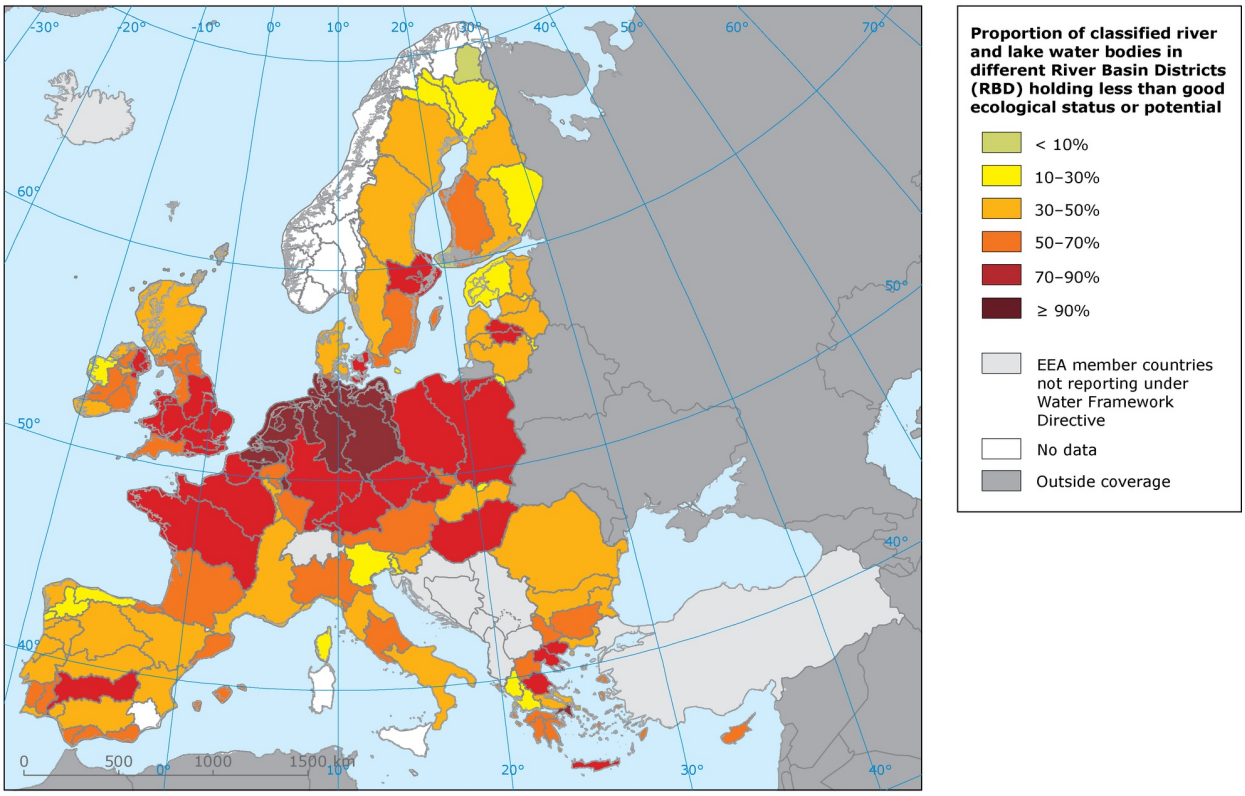
In 2010, EU Member States released 160 River Basin Management Plans (RBMPs), which contain plans for protecting and improving the water environment. The information in the RBMPs, together with other related sources of information, has been analysed to establish an assessment of the status of and pressures affecting Europe's waters. Over the last few years, European countries that are not EU Member States have developed similar river basin activities to those introduced by the Water Framework Directive. During 2015 EU Member States will finalise the second set of RBMPs. These will be the basis for an update of the status of Europe's waters and will illustrate progress in reducing pressures.

Key trends

Overall, more than half of the river and lake water bodies in Europe are reported to hold less than good ecological status or potential (Map 1). Ecological status is a criterion for the quality of the structure and functioning of surface water ecosystems. River water bodies are reported to have worse ecological status and more pressures and impacts than lakes.

The pressures reported to affect most surface water bodies are pollution from diffuse sources, in particular from agriculture, causing nutrient enrichment. Hydromorphological pressures also affect many surface water bodies, mainly from hydropower, navigation, agriculture, flood protection and urban development resulting in altered habitats. A large proportion of water bodies have poor ecological status and are affected by pollution pressures, particularly in central and north-western European areas with intensive agricultural practices and high population density.

Map 1: Proportion of classified river and lake water bodies in different River Basin Districts (RBD) holding less than good ecological status or potential

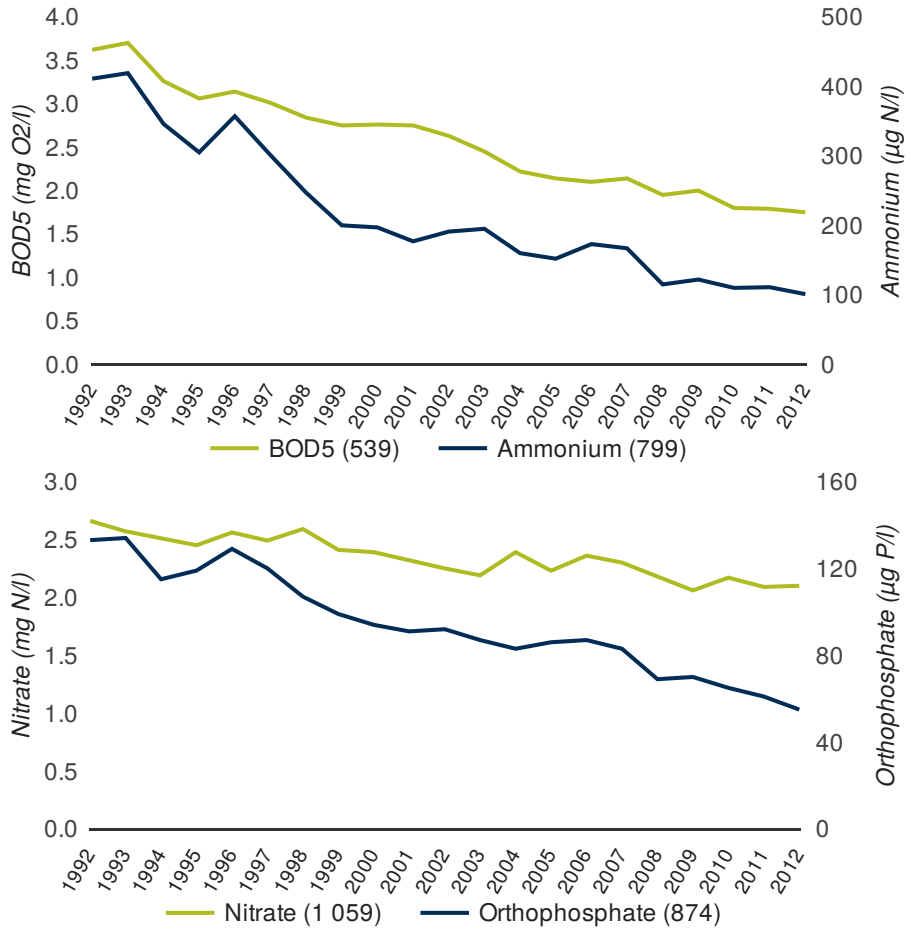


Source: WISE WFD Database.

Many years of investment in the sewage system, and better wastewater treatment under the Urban Waste Water Treatment Directive — together with national legislation — have led to some remarkable improvements. Europe's waters are much cleaner today than they were 25 years ago when large quantities of untreated or partially treated urban and industrial wastewater were discharged into water.

Levels of oxygen-consuming substances (BOD5), ammonium, and phosphate decreased markedly in European rivers over the last two decades (Figure 1).

Figure 1: Changes in water quality variables during the last two decades



Source: Waterbase - Rivers provided by European Environment Agency (EEA)

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Modern-day agricultural practices often entail the intensive use of fertilisers and manure, leading to high nutrient surpluses that are transferred to groundwater as well as surface water. About 25% of groundwater across Europe is classified as having poor chemical status, with nitrate being the primary cause. In European rivers, the nitrate concentration on average declined by 20% over the period 1992 to 2012 (Figure 1). This reflects the effect of measures to reduce agricultural inputs of nitrate at a European level (the Nitrates Directive) and at national level, as well as improvements in wastewater treatment.

The Bathing Water Directive and the Drinking Water Directive have, together with national measures, resulted in good bathing water quality and clean drinking water in Europe. Some sites (e.g. bathing waters polluted during heavy rain or some shallow wells) still have to improve their performance.

Hazardous substances in freshwater resulting in poor chemical status can harm aquatic life and pose a risk to human health. The information provided in the RBMPs on chemical status is not sufficiently clear to establish a baseline for 2009. Hazardous substances are emitted to waters through a range of substances via many different pathways and from a variety of sources, including industry, agriculture, transport, mining and waste disposal, as well as from homes,

where chemicals found in household products are discharged. Pesticides used in agriculture have been widely detected in surface water and groundwater. Mining, landfill sites, and contaminated land from historical industrial and military activities all exert a localised but significant pressure upon waters in parts of Europe.

If the morphology (structure) is degraded or the water flow (hydrology) is markedly changed, a water body with good water quality will not achieve its full potential as an ecosystem. For centuries humans have altered European surface waters (straightening and canalisation, disconnection of flood plains, land reclamations, dams, weirs, bank reinforcements, etc.) to facilitate agriculture and urbanisation and to produce energy and protect against flooding. There are several hundred thousand barriers and transverse structures in European rivers, and many water courses have had their seasonal or daily flow regimes changed. The WFD is the first piece of European environmental legislation that addresses hydromorphological modifications and their impacts on water bodies. The next RBMPs are obliged to include measures to reduce hydromorphological pressures if they cause less than good ecological status.

Prospects

The results from the first River Basin Management Plans showed that many European water bodies currently fail the WFD's objective of achieving good ecological and chemical status. In 2009, 43% of surface water bodies were in good or high ecological status, and in 2015, 53% of water bodies are expected to reach good ecological status.[2] This is far from meeting the objective of good ecological status and only constitutes a modest improvement in ecological status.

To achieve good status, Member States will have to address the pressures affecting water bodies. Pollution is one pressure. Morphological changes, over-abstraction, and hydrological changes affecting water flow are others. While Member States are relatively clear about the types of pressures their river basins are encountering, precise information is missing on how these pressures will be addressed and to what extent the selected measures will contribute to the achievement of the environmental objectives in 2015.

Full implementation of the WFD throughout all sectors is needed to reduce the different pressures and to commit all users in a river basin to focus on the achievement of healthy water bodies with good status. Although considerable success has been achieved in reducing the discharge of pollutants into Europe's waters in recent decades, challenges remain for urban and industrial wastewater and for pollution from agricultural sources. Wastewater treatment must continue to play a critical role in the protection of Europe's surface waters, and investment will be required to upgrade wastewater treatment and to maintain infrastructure in many European countries. Measures are needed to ensure the removal of emerging pollutants and to reduce storm water discharges.

Despite improvements in some regions, diffuse pollution from agriculture remains a major cause of the poor water quality currently observed in parts of Europe. Measures exist to tackle agricultural pollution and they need to be implemented. Full compliance with the Nitrates Directive is also required. The new reform of the Common Agricultural Policy (CAP) provides an opportunity to further strengthen water protection.

There are ample possibilities for improving water management through stringent and well-integrated implementation in order to achieve the objectives of the WFD. However, the next cycle of River Basin Management Plans, which will be agreed on in 2015, need to also take into account a wider consideration of water resource management as well as the impacts of climate change.

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Marine environment

Seas and oceans act as a coherent ecosystem. Across all of Europe's regional seas, marine biodiversity is in poor condition: only 7% of marine species assessments indicate 'favourable conservation status'. Effects of climate change (e.g. acidification) add to the cumulative impacts.

Effective policy implementation can reduce impacts. For example, for several stocks the number of fish caught at 'maximum sustainable yield' levels continues to increase, suggesting healthier stocks.

Context

European seas include a wide range of marine and coastal ecosystems, ranging from the stable environment of the deep ocean to highly dynamic coastal waters. These ecosystems provide a home for up to 48 000 species.[1] The range and distribution patterns of these ecosystems vary across regional seas, with the Mediterranean hosting the highest natural biodiversity.

Our growing understanding shows that seas and oceans act as a coherent ecosystem, within which all species and habitats are active and essential components. There is also an enhanced appreciation of the interconnectedness between marine ecosystems and human communities. Humans have been operating with and within marine ecosystems for millennia, causing change through often complex interactions. The consequences of human activities are now so profound that there are negative impacts on the structure and function of marine ecosystems around the globe.[2][3][4] This can have negative consequences for the delivery of ecosystem services upon which human communities depend.[5][6][7][8] At the same time exploitation of the seas continues to grow (EU Blue Growth policy[9]).

The European Union (EU) Member States are responsible for more than half of the regional seas surrounding the European continent and outermost regions, an area of more than 5 700 000 km^2. Moreover, 206 million people, or 41% of the EU population, lived in Europe's coastal regions in 2011.[4] Therefore, the EU has — and is undertaking — the responsibility to face the environmental challenges influencing its seas.

EU environmental policy responses in the marine domain include the Marine Strategy Framework Directive (MSFD), the Common Fisheries Policy (CFP), the 7th Environment Action Programme, the 2020 Biodiversity Strategy, and legislation such as the Birds Directive, Habitats Directive and Water Framework Directive.

The MSFD, as the environmental pillar of the Integrated Maritime Policy (IMP[9]), is the key component of the EU's policy response to achieve healthy, clean and productive seas. The objective of the MSFD is for European marine waters to achieve 'good environmental status' (GES) by 2020. It aims to promote the sustainable use of the seas and conserve marine ecosystems through the implementation of an ecosystem-based approach to the management of human activities in the marine environment (Box 1).

Box 1: Ecosystem-based management

Ecosystem-based management is an integrated approach to management that considers the entire ecosystem, including humans. The goal is to maintain ecosystems in a healthy, clean, productive and resilient condition, so that they can provide humans with the services and benefits they depend on.

It is a spatial approach that builds around acknowledging connections, cumulative impacts, and multiple objectives. In this way, it differs from traditional approaches that address single concerns e.g. species, sectors or activities.

Source: Modified from McLeod et al., 2009.[10]

Key trends

There is a scarcity of EU available information on marine biodiversity, as an indicator for patterns of change in the seas. It thus remains difficult to analyse changes in a coherent and consistent manner. However, observations show that many marine species across all European seas continue to experience a decrease in population size as well as a loss of distribution range and habitat due to impacts from human pressures. At the same time, there are also examples of species where the declining trends appear to be halted (see table of Patterns of change in the seas).

One reason why it is difficult to analyse changes in a consistent manner is that changes often happen in a non-linear fashion as so-called ecological 'tipping points' are crossed (these result in an entire ecosystem shifting into a new state). Such a new state can be characterised by both the altered biodiversity composition and changed resilience of marine ecosystems compared to the previous state, [11][12] and is often less conducive to human development.[3]

Another reason why it remains difficult to present a European overview is that the information base is often too fragmented to make a coherent assessment. For example, 80% of the species and habitats assessments under the MSFD are categorised as 'unknown' and only 4% have achieved the 2020 target of 'good' status. For the rest: 2% are considered in 'bad' status and 14% were reported as 'other'.[13]

The same pattern has been observed for the most vulnerable European marine habitats and species, which are protected by the Habitats Directive. From 2007 to 2012, only 9% of the marine habitat assessments were considered to be in 'favourable conservation status', 66% were considered to be in 'bad/inadequate' status, and 25% were categorised as having 'unknown' status. Marine species fared worse, with only 7% of the assessments being favourable. More than 66% were categorised as 'unknown', and 26% were categorised as 'bad/inadequate' in the 2007–2012 period.

For commercially exploited fish stocks, the number of assessed stocks in EU Atlantic and Baltic waters fished above their maximum sustainable yield (MSY), has fallen from 94% in 2007 to 39% in 2013 with a slight increase to 41% in 2014,[14] and several stocks are considered in good status.[15] A high number of stocks remain unassessed, in particular in the Mediterranean and Black Seas.[16] 91% of the assessed stocks in Mediterranean Sea and 5 out of 7 of the assessed stocks in the Black Sea are being fished over MSY.[14]

Assessments by regional sea conventions, OSPAR and HELCOM, are also finding that marine ecosystems, their biodiversity features, and their related ecosystem services remain under pressure in spite of on-going efforts to reverse current trends (Box 2).

Box 2: Loss of biodiversity in the North East Atlantic Ocean and Baltic Sea

In 2010 OSPAR concluded '...on the basis of the current evidence, that the United Nations' (UN) target of reducing the loss of biodiversity by 2010 is far from being achieved in the North-East Atlantic Ocean'.

For the Baltic Sea, HELCOM concluded in 2010 that 'the status of biodiversity appears to be unsatisfactory in most parts of the Baltic Sea'. HELCOM estimates that 3.9% of the species in the Baltic Sea are threatened and 8.3% are red-listed (out of 2 791 assessed species).

HELCOM also found that out of 24 marine ecosystem services identified in the Baltic Sea, only 10 were operating properly, with 7 being under severe threat.

Source: OSPAR (2010),[17] HELCOM (2010)[18], and HELCOM (2013).[19]

Prospects

The state of European seas is already impacted by historical and current human use resulting in various pressures.[9] These include the selective extraction of species (i.e. fisheries), seafloor damage, pollution by nutrient enrichment and contaminants, the spreading of non-indigenous species, and climate change.[20] At the same time, human dependence on marine ecosystems and their services is increasing, and this is taking place without the full understanding of the complex interactions of natural and human-driven changes (Borja, A., 2014).[21] The patterns of change indicate that Europe has not yet achieved healthy seas (see table of Patterns of change in the seas), and is thus eroding the potential services and benefits such seas could deliver.

Despite this, evidence shows that targeted policy actions and committed management efforts can protect and/or restore species and habitats, and thus help preserve ecosystem integrity. Certain EU marine nature-conservation and fisheries-management efforts are clear examples of positive action.

The marine Natura 2000 network of protected sites, designated under the Habitats and Birds Directives since 1992, accounts for 229 000 km^2 or 4% of EU marine waters and constitutes a significant achievement. It is supplemented by an additional 109 000 km^2 of national sites, ensuring that a total of 5.9% of EU waters are within a network of marine protected areas (MPAs). Nevertheless, Europe faces a large challenge if it is to meet the Convention on Biological Diversity Aichi Target 11, which requires 10% of EU waters to be within MPAs or other effective area-based management measures by 2020. This means that in less than 6 years, Europe still needs to designate the same area of MPAs as have been designated under the marine Natura 2000 network over the last 20 years.[4] Additional efforts are needed to achieve ecologically coherent and effectively managed MPA networks in European seas[22] as required by the MSFD.

In the Baltic Sea, the status of predators such as grey seals and white-tailed sea eagles has been improving over recent decades.[18] Moreover, recent monitoring shows that part of the Kattegat (the sea area between Denmark and Sweden) is starting to recover from decades of nutrient enrichment (eutrophication).[23] In parts of the North-East Atlantic Ocean, encouraging trends are observed for estuarine fish diversity, as well as for the health of seabird colonies in areas under control from invasive species such as rats (Defra, 2010).[24]

For commercially exploited fish stocks, fishing pressure (i.e. fish mortality levels) has been decreasing since 2007 in EU Atlantic and Baltic waters. Evidence indicates an improvement of the status of several of the fished stocks.[14] The CFP must overcome various challenges for Europe to reach the goal of fishing at MSY rates for all fish stocks by 2020. This goal will also serve as a contribution to reach the GES objective of the MSFD. These challenges include fleet overcapacity, availability and respect of scientific advice, and an adequate uptake of management measures.

Such examples show that it is possible to manage human impacts on the marine environment and to reverse marine biodiversity loss. While a more coherent information base is needed on issues such as the state of fish stocks and biodiversity features, current knowledge does allow us to move forward.

There is a need to build on the ecosystem-based approach to the management of human activities introduced by the MSFD and other EU policies, such as the CFP, in order to achieve healthy and clean seas. A key challenge will be to steer policy expectations for further exploitation of the seas, such as 'Blue Growth', towards the EU policy objectives of halting the loss of biodiversity and achieving 'good environmental status' by 2020. Overcoming this challenge is needed for Europeans to fully benefit from the services provided by marine ecosystems now and in the future.

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Mitigating climate change

EU greenhouse gas emissions have been decreasing and are now 19% below 1990 levels. Latest data confirm that the EU is on track to overachieve its 2020 target of a 20% reduction compared to 1990 levels.

The EU aims to decarbonise its energy system and cut its greenhouse gas emissions by 80 to 95% by 2050. To achieve this goal, it has set a binding target of reducing emissions by at least 40% compared to 1990 levels by 2030. Further efforts beyond currently implemented climate and energy policies are required to keep the EU on track towards these objectives.

Context

In 1992, countries adopted the United Nations Framework Convention on Climate Change (UNFCCC) to cooperatively consider options for limiting average global temperature increases and the resulting climate change.[1] Continuous discussions under the UNFCCC led to the adoption in 1997 of the Kyoto Protocol,[2] which legally binds developed countries to achieving greenhouse gas (GHG) emission reduction targets.

In 2010, the international community agreed on the need to reduce emissions in order to prevent global temperature increases from exceeding 2 °C compared to pre-industrial levels[3] (no more than 1.2 °C above today's level). This would require cutting global emissions by 40% to 70% compared to 2010 by 2050.[4]

More than 90 countries agreed to take on mitigation commitments until 2020 including the major developed and developing nations. The European Union (EU) and a handful of other developed countries made their commitments under the Doha Amendment to the Kyoto Protocol for a second commitment period running from 2013 to 2020.[5]

The pledges up to 2020 are insufficient to ensure the global temperature rise stays below 2 °C but they don't preclude meeting this objective.[4][6] To secure the chances to stay below 2 °C, the international community has decided to work towards an international climate agreement for the period after 2020, which should be applicable to all. The negotiation on this new global agreement is expected to be concluded in 2015 in Paris.

In this context of international efforts to limit climate change, the EU is committed to cutting its emissions by 2020 by at least 20% compared to 1990 levels. It has offered to increase the reduction to 30% below 1990 levels, subject to other countries offering similar efforts towards 2020.[7][8]

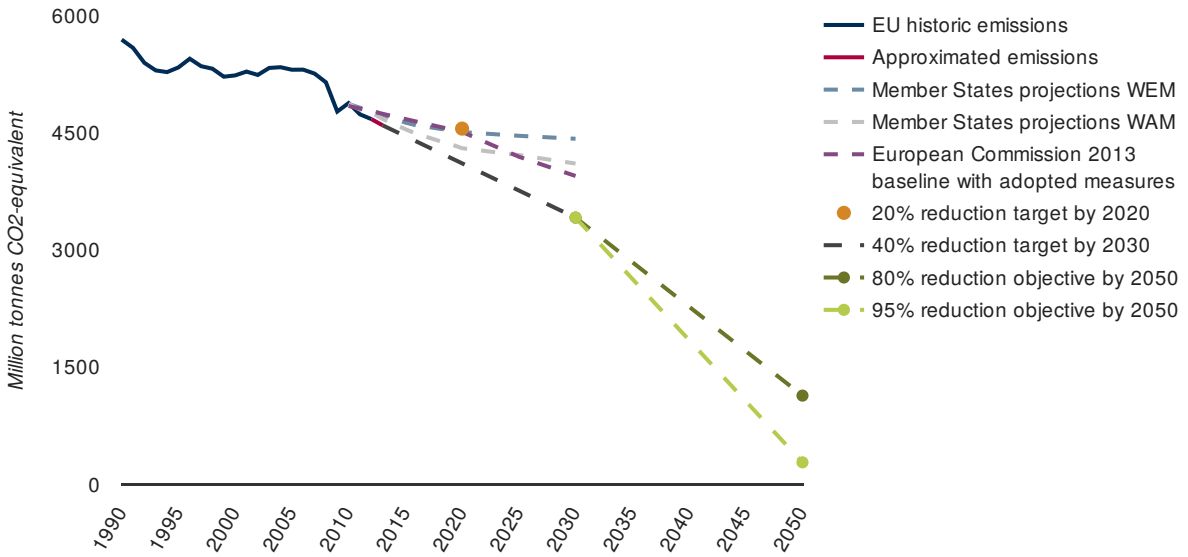
These commitments have been backed by concrete policies and measures to reduce GHG emissions in Europe. The EU implemented an Emissions Trading System (ETS) for industrial installations in power generation and manufacturing in 2005[9][10] and strengthened it in 2009 to help the EU achieve its 2020 objectives.[11] Since 2012, the EU ETS also includes aviation.[12] The EU ETS today covers about 45% of EU emissions. In parallel, annual targets have been set for each Member State to reduce emissions in the sectors not covered by the EU ETS.[13] Binding targets are now in place to reduce CO_2 emissions from new cars and vans.[14][15] Further efforts also include the promotion of renewable sources of energy,[16][17] measures to improve the efficiency of energy supply and use,[18][19] the regulation of F-gases,[20] etc.

The EU has also articulated a long-term goal for 2050 of reducing Europe's GHG emissions by 80% to 95% compared to 1990 levels.[21][22][23] To ensure that the EU is on a cost-effective track towards meeting this objective, the European Council adopted in 2014 a new set of climate and energy targets for 2030 .[24][25] This includes a binding target of reducing emissions by at least 40% compared to 1990 levels, a target, binding at EU level, of achieving a share of at least 27% for renewable energy consumption, and an indicative target at EU level of at least 27% for improving energy efficiency, compared to projections of future energy consumption.

Key trends

The EU has been reducing its own GHG emissions and its share of global GHGs. The EU has already almost reached its unilateral 20% reduction target, eight years ahead of 2020. Between 1990 and 2012, total GHG emissions in the EU decreased by 18%[26][27] (Figure 1). During this period, the EU's share of global GHG emissions declined from 13% to 10%.[28] In this same period, average per-capita emissions decreased by a quarter, from 11.7 to 9.0 tonnes of CO_2 equivalent per capita.[28] The GHG emissions intensity of the EU economy improved substantially, with a 44% decrease of emissions per unit of gross domestic product (GDP).[28][29]

Figure 1: Greenhouse gas emission trends, projections and targets



Note: Total EU greenhouse gas (GHG) emissions include those from international aviation and exclude those from land-use, land-use change and forestry. The 2013 GHG emissions data are preliminary estimates (from approximated GHG inventories). Final data will be determined in 2015. WEM: with existing measures; WAM: with additional measures.

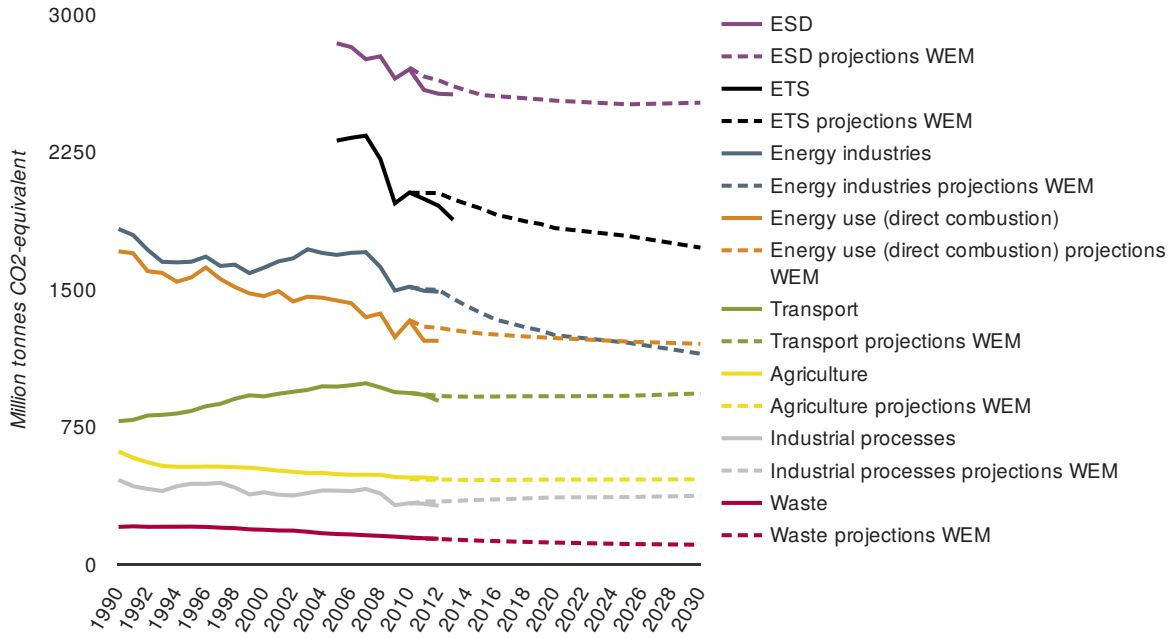
Data sources:

a. EEA. National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism
b. 2020 targets c. 2050 objectives d. European Commission Baseline scenario

Almost all of the European countries with an individual GHG reduction or limitation target under the Kyoto Protocol's first commitment period (2008–2012) are on track towards achieving their respective targets.[30] Besides the additional contribution in most countries of activities enhancing carbon sinks (such as forestry) the use of Kyoto Protocol flexible mechanisms (the purchase of emission reduction credits from other countries) will help ten European countries (including seven Member States)[31] reach their individual target.

During the period from 1990 to 2012, GHG emissions in Europe decreased in the majority of sectors, with the notable exception of transport (Figure 2). The largest absolute reductions were in the emissions from energy use in industrial, residential, and commercial sectors (energy-related emissions represent about 80% of EU GHG emissions). However, significant reductions in relative terms took place in other sectors, such as agriculture and waste management. The largest reductions, which took place in industrial sectors, can be explained by efficiency improvements in restructured iron and steel plants, a reduced reliance on highly-emitting fuels such as coal, and structural changes of the economy toward a higher share of services and a lower share of industry in total GDP.[28]

Figure 2: Greenhouse gases sectoral trends and projections 'with existing measures'



Note: Broken lines represent projections. ESD — Effort sharing decision; ETS — Emissions Trading System; WEM — with existing measures.

Data sources:

a. EEA. National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism

b. EEA. Projections reported by Member States in March 2013 under the Monitoring Mechanism Decision (Decision 280/2004/EC); EUTL.

Although GHG emissions trends in the EU were considerably affected by economic or macroeconomic factors during the period from 1990 to 2012, EU and national policies have been playing an increasing role in these decreasing trends.

The economic crisis that the EU encountered during the 2008–2012 period is estimated to have contributed to less than half of the total emission reduction observed during this period. The combined effects of other factors and policies have played at least as important a role in GHG emission reductions as the economic crisis. A significant share of emission reductions during this period was due to climate and energy policies, in particular the increase of renewables in the EU energy mix and the improvement in energy efficiency of the economy.[28]

Prospects

Aggregated projections from Member States indicate that total EU GHG emissions will further decrease. With the set of national domestic measures in place by mid-2012, EU emissions are expected to reach a level of 21% below 1990 levels by 2020[26][32] and only 22% below 1990 levels by 2030. Implementing the additional measures that were at planning stage in Member States by mid-2012 could help achieve reductions of 24% by 2020 and 28% by 2030 compared to 1990. The EU reference scenario used in the Commission's impact assessment of the 2030 climate and energy policy framework[33] indicates that with current legislation agreed in the EU, total GHG emissions in the EU might be 32% lower in 2030 compared to 1990.

The largest emission reductions in the EU by 2020 are projected to take place in the sectors covered by the EU ETS, where emissions are capped at EU level. Large reductions are expected to come from already-adopted measures supporting renewable energy[20] or aiming at limiting and reducing pollution from large combustion plants.[34] When it comes to non-ETS emissions, most Member States expect that their national targets for the period from 2013 to 2020 will be met through policies or measures already in place.[32] However, in about half of the Member States[35] additional measures will need to be implemented to achieve the targets. In particular, key contributions are expected from energy-efficiency measures targeting the buildings sector.

Full implementation of existing policy instruments is a necessary first step towards further emission reductions in all Member States. However, the anticipated reductions by 2030 remain insufficient compared to the 40% reduction target and the even steeper reduction needed beyond 2030, in order for the EU to remain on a trajectory towards a low-carbon and resource-efficient economy. To achieve the 40% reduction target by 2030 compared to 1990 levels, the ETS sector will have to reduce its emissions by 43% and the non-ETS sector by 30%, compared to 2005, respectively.[24] In the EU ETS, further reductions will be driven through strengthened emission caps. Outside the ETS, new policies and measures remain necessary to address emissions in sectors for which projected trends remain problematic, in particular in the transport sector.

Fulfilling Europe's long-term objectives could be achieved through fundamental changes in our energy and transport systems, in particular by further improving their efficiency and by ensuring coherent planning and infrastructure on various governance levels. However, becoming more resource efficient will not be sufficient on its own to achieve Europe's long-term objectives, for example if the volume of transport continues to grow or if we keep increasing the number of domestic appliances. After all, we could become more efficient but still put excessive demands on the environment. For that reason, in order to achieve sustainability we also need to focus on the limits of natural systems.

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Noise

Noise pollution poses a high environmental risk to human health, with road traffic being the greatest contributor. At least 10 000 cases of premature deaths from noise exposure occur each year, although incomplete data mean this number is significantly underestimated.

Further efforts are needed to decrease noise pollution in Europe. There is also a clear need to improve implementation of the Environmental Noise Directive in Member States, in particular with respect to the completeness, comparability and timeliness of reporting.

Context

Environmental noise can be defined as unwanted or harmful outdoor sound. It is a product of transport and industrial activity on land, in the air, on waterways, and on oceans. It is a pervasive pollutant that directly affects the health and well-being of exposed humans and wildlife. Tackling noise pollution is challenging — its harmful impacts are clear, yet it occurs as a direct consequence of society's demands for increased mobility and productivity.

Populations exposed to high noise levels can exhibit stress reactions, sleep-stage changes, and clinical symptoms like hypertension and cardiovascular diseases. All of these impacts can contribute to premature mortality. The World Health Organization (WHO) reports an onset of adverse health effects in humans exposed to noise levels at night above 40 decibels (dB).[1]

There is also increasing scientific evidence regarding the harmful effects of noise on wildlife.[2] Whether in the terrestrial or marine environment, many species rely on acoustic communication for important aspects of life, such as finding food or locating a mate. Anthropogenic noise sources can potentially interfere with these functions and thus adversely affect species richness, population size, and population distribution. In some instances, noise can be a cause of death, particularly in marine fauna. Underwater sound can travel great distances underwater, and its impacts may be felt far from the source of origin.

The Environmental Noise Directive (END),[3] is the main European Union (EU) legal instrument through which land-based noise emissions are monitored and actions developed. It places an obligation on EU Member States to use common criteria for noise mapping (see Box 1). The END also obliges countries to develop and implement action plans to reduce exposure in large cities and places close to major transport infrastructure.

The END also requires Member States to select and preserve areas of good acoustic environmental quality, referred to as 'quiet areas'. The EEA has recently published guidance on protecting such areas. The EEA has also published guidance to assist countries on how to consider the latest health-impact evidence in developing their action plans.

Box 1: Noise indicators in the Environmental Noise Directive

The END requires two main indicators to be applied in the assessment and management of environmental noise.

- The first indicator (L_{den}) is the decibel level for day, evening, and night periods and is designed to measure 'annoyance'. The END defines an L_{den} threshold of 55 dB.
- The second indicator (L_{night}) is the decibel level for night periods and is designed to assess sleep disturbance. An L_{night} threshold of 50 dB is defined.

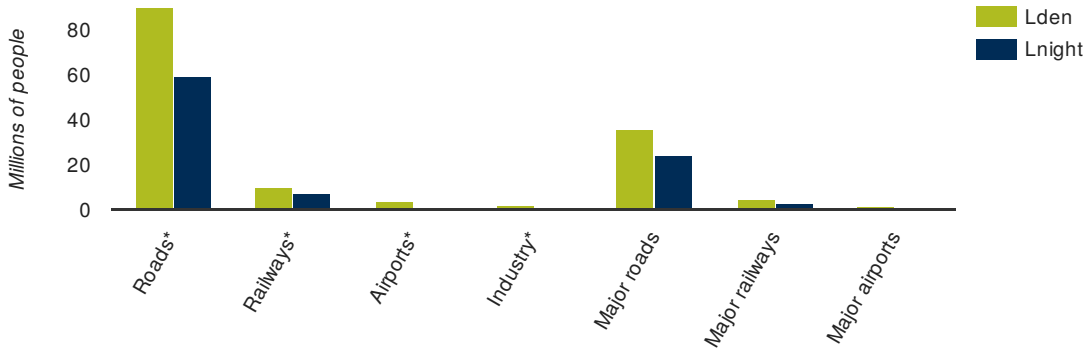
Since the implementation of the END, research has suggested that levels of 50 dB L_{den} may be more representative of annoyance,[4] while for sleep disturbance the WHO has set a night noise guideline (NNG) for Europe of 40 dB L_{night}. Where this is not achievable in the short term, the WHO recommends an interim target of 55 dB L_{night} (WHO 2009).[5] Countries must report the numbers of people exposed above both thresholds for each noise source (e.g. roads, railways, airports, industry). The EEA uses these data to create an indicator for environmental noise in Europe. Countries are also invited to report to the EEA data corresponding to the WHO NNGs, although reporting of these data is voluntary.

Key trends

The Noise Observation and Information Service for Europe (NOISE) displays noise-mapping data reported by countries under the END to the EEA. Data are available at European and national scale for most EEA member countries, including 472 urban agglomerations. Countries do not always report complete datasets — information varies depending both upon the type of source concerned and the year of reporting (2007 or 2012). Overall, information is significantly less complete for the 2012 data, preventing any robust exposure or trend analysis.

Figure 1 shows exposure to environmental noise in Europe for 2011. Road traffic noise clearly contributes to the greatest level of exposure within the European population, with at least 125 million people being exposed to levels above the END threshold of 55 dB L_{den}.

Figure 1: Exposure to environmental noise in Europe within* and outside urban agglomerations, 2011



Note: * Noise sources within urban agglomerations. L_{den}: Environmental Noise Directive indicator for day, evening and night level, L_{night}: Environmental Noise Directive indicator for night level. Based on data reported by countries by 28 August 2013. Noise mapping and assessment methods may differ by country. Gaps in reported information have been filled with expert estimates where necessary.

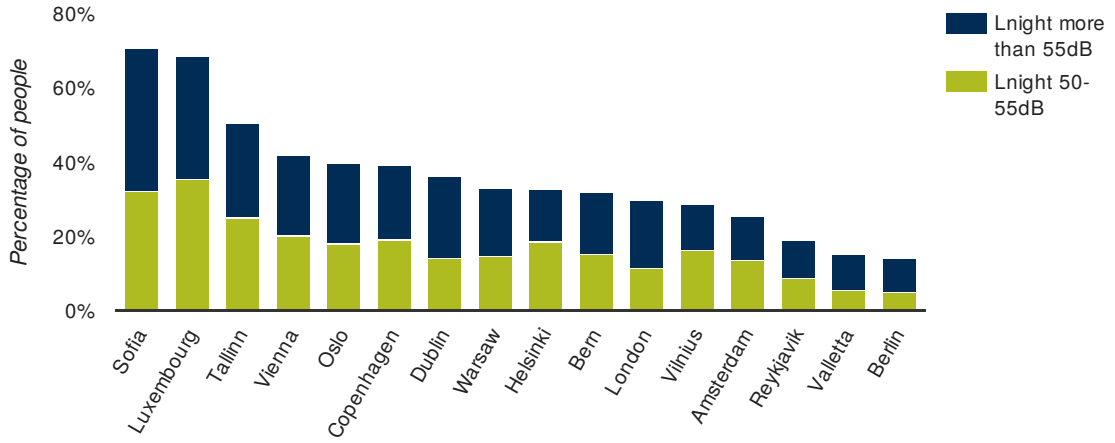
Data sources:EEA. Noise Observation and Information Service for Europe

In addition, many people were also exposed to rail, aircraft, and industrial noise, particularly in towns and cities. Similarly, night-time road traffic is another major source of noise exposure, with over 83 million Europeans exposed to harmful levels of noise greater than 50 dB Lnight.[5]

The average exposure to noise (i.e. Lden above 55 dB and Lnight above 50 dB) in selected urban agglomerations remained broadly constant between 2006 and 2011, according to comparable data reported by countries for these two years.

In urban environments it is evident from Figure 2 that a high percentage of the population in selected capital cities in Europe are exposed to detrimental levels of road-traffic noise according to data reported by countries. Exposure to the WHO interim target level of 55 dB L_{night} is also indicated in Figure 2.

Figure 2: Population exposed to night time noise from road traffic above 50dB in selected capital cities, 2011



Note: Based on data reported by countries by 28 August 2013. Noise mapping and assessment methods differ by country, which means information reported for cities is not always comparable. 55dB L_{night} is the World Health Organization (WHO) Interim Target.

Data sources:EEA. Data delivered by MS under the END requirements until 28/08/2013

Recent estimates of exposure to environmental noise indicate that it contributed to at least 900 000 additional prevalent cases of hypertension in 2011, 43 000 additional cases of hospital admissions and to 10 000 cases of premature mortality each year. These numbers are likely to be significantly underestimated, potentially by more than a factor of two, due to the lack of complete data reported by countries. Almost 90% of the health impact caused by noise exposure is associated with road traffic noise.[5] In terms of economic impact, noise from road and rail traffic is estimated to cost the EU EUR 40 billion per year.[6]

When the END requires a country to implement an action plan to reduce exposure to noise there are several measures a country can take. Examples of effective measures presently being undertaken in EEA member countries to reduce noise exposure include local measures such as the installation of road or rail-noise barriers, or optimising aircraft movements around airports. However, it is widely acknowledged that the most effective actions to reduce exposure tend to be those that reduce noise at source, e.g. by managing the numbers of road vehicles, or their noise emissions by e.g. introducing quieter road tyres.

Prospects

In the short term, the European Commission is expected to undertake a review of the implementation of the END by 2016. Beyond this, the 7th Environment Action Programme (7th EAP)[7] 'living well, within the limits of our planet', aims to ensure that by 2020 noise pollution in the EU has significantly decreased, moving closer to WHO-recommended levels.

There is a clear need to improve the Member States' implementation of the END, in particular with respect to the completeness, comparability and timeliness of reporting. The lack of complete datasets reported under the END may mean there will be a major challenge in the future to robustly evaluate whether the 7th EAP objective of significantly reducing noise pollution by 2020 has been met. Furthermore, it will still be difficult to determine exactly how close Europe has moved toward meeting the WHO NNG for Europe (a level of 40 dB) in the future, as reporting of this information remains voluntary for countries.

To achieve the targets for reducing noise, the 7th EAP proposes to implement an updated noise policy, aligned with the latest scientific knowledge, as well as measures to reduce noise at source and improvements in city design.

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Soil

The ability of soil to deliver ecosystem services — in terms of food production, as biodiversity pools and as a regulator of gasses, water and nutrients — is under increasing pressure. Observed rates of soil sealing, erosion, contamination and decline in organic matter all reduce soil capability. Organic carbon stocks in agricultural soil may have been overestimated by 25%.

A coherent soil policy at EU level would provide the framework to coordinate efforts to survey soil status adequately.

Context

The degree to which society can benefit from soils is dependent on how it uses and manages them. Soils that are sealed for urban development or transport infrastructure lose most of their functions due to disrupted water, nutrient, and biological cycles. This loss is close to irreversible.[1]

Equally, soils can be degraded by the interplay of human and natural processes that cause decline in organic matter and biodiversity, compaction, and erosion by wind and water. Mineral or groundwater extraction can lead to pollution and affect soil stability, even causing subsidence in some urban areas; while large-scale drilling for shale gas production may add to existing contamination processes.

These phenomena affect the delivery of soil-based ecosystem services and can be costly or difficult to resolve. In recognition of these pressures and the importance of soil functions, the European Commission launched a Thematic Strategy on soil, which called for the protection and sustainable use of soil[2] while highlighting several vital soil functions: providing biomass and raw materials; storing, filtering and transforming substances; and acting as a carbon and biodiversity pool, as a platform for human activities and the landscape, and as an archive of heritage.

Soils received further recognition when the UN Rio+20 Summit[3]highlighted soil degradation as part of land degradation, and called for a land-degradation-neutral world in the context of sustainable development, a goal to which the EU subscribed. This target is reiterated in the European Union's 7th Environment Action Programme (7th EAP).[4]

Converting broad policy positions into action requires increased efforts and related targets to reduce soil erosion, to increase soil organic matter and preserve soil biodiversity, to remediate contaminated sites, and to limit soil sealing.

Key trends

Quantifying soil-based ecosystem services, in terms of the physical services provided and their economic value, is a relatively recent research area. While it is currently not possible to describe trends in soil functions, some baseline data are available at pan-European level.[5] More detailed data may exist at national levels.

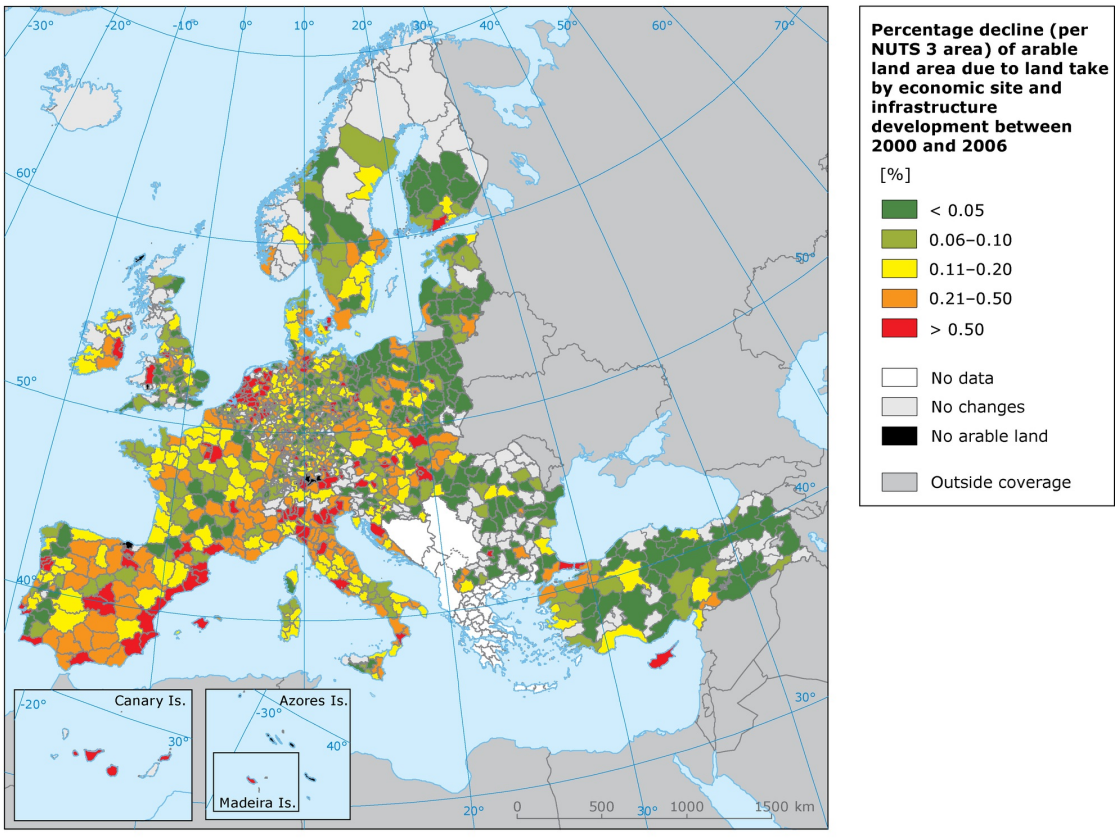
Biomass production as a provisioning service of soil

Soils are used to produce a range of biomass products that serve as food, feed, fibre and fuel. Biomass production can be particularly relevant in biodiversity conservation and climate change mitigation efforts, through supporting elements of 'green infrastructure'[6][7] and flood regulation.

An EU-27 baseline study of biomass production under arable land, grassland[8] and woodland[9] showed that on arable land, local soil quality determines to a greater extent the variability of the biomass production potential than climate. Thus, in most regions, well-managed arable land that preserves the soil quality can compensate for climatic handicaps. However, in the Mediterranean area, good management may not be sufficient to make up for climatic limitations.

Three other factors that affect biomass production are soil management (including irrigation and fertilisation), soil degradation processes (e.g. soil erosion) and 'land take'.[10] From 2000 to 2006, 0.26% of the production potential on arable land in the EU-27 was lost as a consequence of land take;[11][12] over the period 1990–2006, this loss amounted to 0.81%.[13] Map 1 illustrates the issue in relation to industrial and commercial sites plus transport networks and indicates some hotspots.

Map 1: Percentage decline (per NUTS 3 area) of arable land area due to land take by economic site and infrastructure development between 2000 and 2006



Sources: ETC SIA based on Corine Land Cover 2000 and 2006.
Note: Orange and red areas are interpreted as hotspots.

Soil organic carbon pool as a regulating service of soil

A key service provided by soil is the storage and release of organic matter and carbon. Soil organic matter is essential for biomass production and for sustaining biodiversity. Soils can offset other greenhouse gas emissions by capturing and storing carbon, and they can help to adapt to climate change (e.g. in flood regulation owing to the structuring effect of soil organic matter).

Soil organic carbon (SOC) stocks in the EU-27 have been estimated at 75–79 billion tonnes.[14][15] Modelling results from the CAPRESE project suggest that prior assessments may have overestimated the SOC pool in agricultural topsoils[16] by around a quarter.[17][18] This highlights the need for systematic monitoring and the even greater importance of soil organic matter conservation.

The removal of topsoil by erosion is a worrying phenomenon as it impacts on SOC stocks and causes various off-site issues (e.g. siltation[19] of water bodies).[20] A recent study estimated that 130 million ha were affected by water erosion in the EU-27.[15] Improvements in modelling[21][22] are leading to higher precision in erosion estimates.[23] [24]

Storage, filtration and transformation as a supporting service of soil

Soil stores, filters and transforms a range of substances including nutrients, contaminants, and water. In this context, soils act as a biological engine, controlling many key natural life cycles. In parallel, this function in itself implies potential trade-offs: a high capacity to store contaminants may prevent groundwater contamination, but this retention of contaminants may be harmful for biota.

The issue of contamination is crucial for this function as both diffuse and point source pollution[25] can impact human health and ecosystem services, thus affecting a soil's capacity to 'regenerate'. On the basis of non-harmonised national inventories, local soil contamination in the EEA-33 plus the 6 cooperating countries has recently been estimated at 2.5 million potentially contaminated sites.[26] About one third of an estimated total of 342 000 contaminated sites in the EEA-33 plus the 6 cooperating countries have already been identified and about 15% of these have been remediated. However, there are substantial differences in underlying definitions and interpretations in different countries.

The intensity of soil use can considerably influence soil organisms, which in turn drive nutrient cycling.[27] High-intensity arable land results in lower diversity and biomass of soil organisms compared to land that is less-intensively cultivated or under permanent grassland.[28]

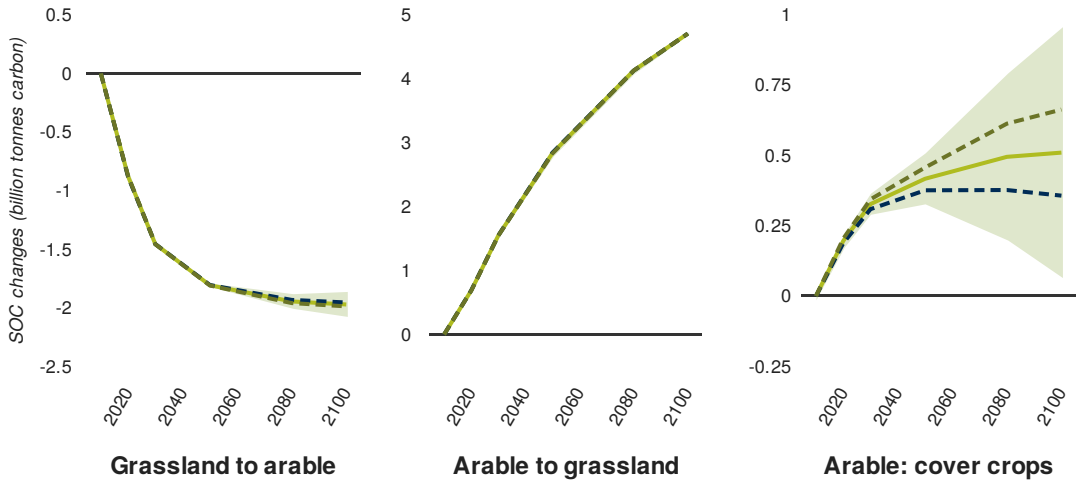
Prospects

As local soil quality largely determines biomass production potential on arable land, nutrient status plays a defining role. Soil fertility is the result of inherent soil characteristics (such as texture), nutrient inputs, and other management practices, which may strongly influence nutrient cycling. Europe-wide harmonised measurements of particular soil characteristics from the LUCAS Topsoil[29][22] and GEMAS[30] projects provide a picture of both the inherent characteristics of the soil and a signature of past soil use and management. Time series of soil characteristics, as expected from the continuation of the LUCAS Topsoil Survey, are required to assess changes and trends in biomass productivity.

The CAPRESE study found that the conversion of arable land to grassland is the most rapid method to gain SOC (Figure 1). Under future scenarios of arable land management, the use of cover crops[31] was found to be the most effective way of increasing SOC, although the effects are markedly regional due to climate. Such findings could be useful for estimating carbon emissions and removals from agricultural land in the context of LULUCF.[32] These results reinforce the message that land management is crucial in protecting, maintaining and improving the delivery

of soil-based ecosystem services. This becomes even more relevant when considering that 40% of the EU area is agricultural land, managed in line with Common Agricultural Policy provisions that require land to be maintained in good agricultural and environmental condition. However, in the event of poor policy implementation, continued soil function loss is expected.

Figure 1: Soil organic carbon (SOC) change at pan-European level under different land use change and soil management scenarios [31]



Note: Values are projected to 2100 using two climatic scenarios. The blue and dark green interrupted lines correspond to the HADCM3_A1FI (HAD) ('world markets-fossil fuel intensive') and PCM_B1 (PCM) ('global sustainability') scenarios respectively; the former is more extreme, the latter more conservative. The bright green line is the average, while the light green region delimits the 2 σ confidence interval/variability. Scenarios were calculated using the CENTURY agroecosystem model.

Explore chart interactively

European Environment Agency

Source: CAPRESE project[17][18].

The lack of good-quality and harmonised soil data at pan-European scale, and the relatively undeveloped state of research on linking soil data with soil functions, makes it difficult to assess the prospects for soil functionality and soil-based ecosystem services. Only when robust baselines and a harmonised soil monitoring framework (addressing relevant soil functions and degradation processes) are in place can regular updates on trends be expected. Despite some promising projects, activities are clearly insufficient to deliver a comprehensive information and knowledge base to adequately support policy making in this area. Further research is thus needed to manage soils sustainably in the future. A binding and coherent soil policy at EU level would provide the framework to do so.

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Waste

Guided by diverse policies, European countries have improved waste management. Manufacturing and service sector waste declined by about a quarter in 2004–2012, while municipal waste generation fell 2%. Along with increased recycling, these trends helped reduce landfilling. Nevertheless, progress to EU waste targets is mixed. Achieving the EU's long-term objective of establishing a circular economy will require far-reaching technological, behavioural and organisational change.

Context

Europe can secure many social and economic benefits from treating waste as a resource. In addition to reducing environmental pressures, better waste management can secure vital resources, create jobs and boost competitiveness. Waste prevention and management have a central role in enhancing resource efficiency and creating a circular economy that enables society to maximise the economic returns on scarce resources.

The European Union (EU) has introduced multiple waste policies and targets since the 1990s. As in other environmental areas,[1] the focus of waste policy has broadened over this period. Examples of policy instruments include:

- legislation on specific waste streams, such as packaging,[2] vehicles[3] and electrical and electronic equipment;[4][5]
- legislation and guidance on waste treatment options, such as landfilling,[6] waste treatment industries[7] and waste incineration;[8][9]
- legislation on the environmental performance of products, such as ecodesign[10][11] and restrictions of the use of certain hazardous substances;[12][13]
- framework legislation and strategies, such as the Thematic Strategy on the prevention and recycling of waste[14] and the Waste Framework Directive.[15]

The overarching logic guiding EU policy on waste is the **waste hierarchy**, which prioritises waste prevention, followed by reuse, recycling, other recovery, and finally disposal or landfilling as the least desirable option.

Key trends

In broad terms, Europe has shifted waste management up the waste hierarchy in recent years. Although differences in national waste definitions and data processing methodologies introduce some uncertainties into an analysis of European trends, there is evidence that less waste is being landfilled as a result of reduced generation of some wastes, and increased recycling and energy recovery.

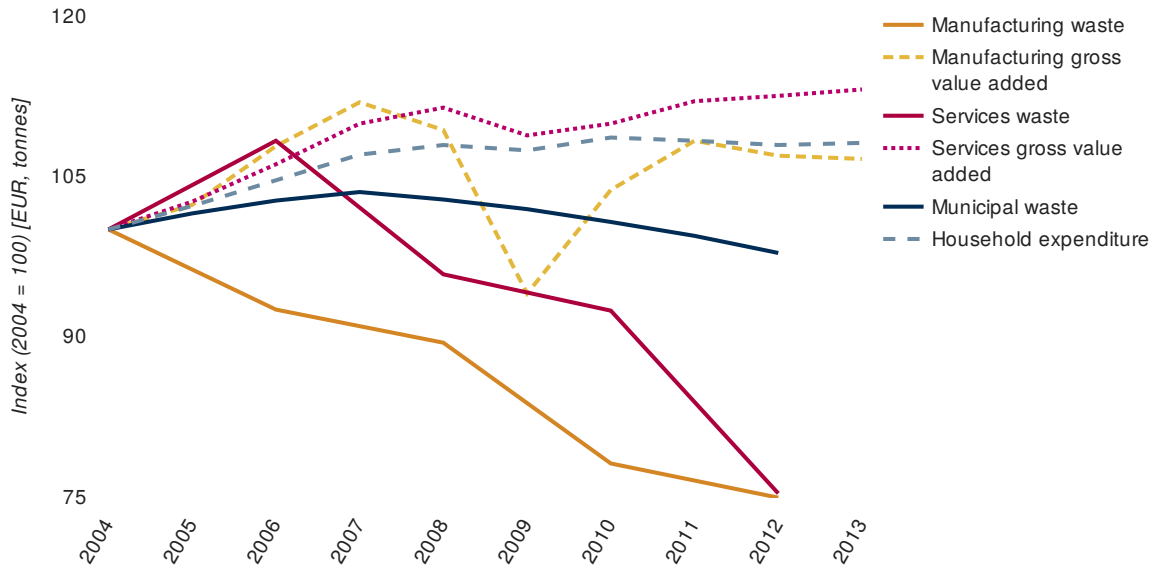
Waste prevention

Economic production and consumption in Europe is becoming less waste intensive, even after the economic downturn since 2008 is factored into the analysis. For example, as illustrated in Figure 1, waste generation from manufacturing in the EU-28 and Norway declined by 25% in absolute terms between 2004 and 2012, despite an increase of 7% in sectoral economic output. Waste generation from the service sector declined by 23% in the same

period, despite an increase of 13% in sectoral economic output.

Turning to consumption, total municipal waste generation in EEA countries declined by 2% between 2004 and 2012, despite a 7% increase in real household expenditure. Per capita generation of municipal waste declined by 5% in the same period, falling from 503 to 478 kg/capita.

Figure 1: Waste generation by production and consumption activities in European countries



Note: Geo coverage for manufacturing and services waste, manufacturing and services gross value added: EU-28 plus Norway; for municipal waste generation and household expenditure: EEA-33. Values for Croatia are missing in manufacturing and services waste generation for 2006.

Data sources: a. Eurostat. National Accounts by 10 branches - volumes b. Eurostat. Municipal waste c. Eurostat. GDP and main components - volumes d. Eurostat. Generation of waste e. EEA – Indicator WST004

Waste management

Europe achieved substantial progress in diverting waste from landfill in recent years — both in absolute terms and as a proportion of total waste generated. Between 2004 and 2010, the EU-28, Iceland and Norway reduced the amount of total waste (excluding mineral, combustion, animal and vegetable wastes) deposited in landfills by 23%; from 205 billion tonnes to 157 billion tonnes.

The decrease in landfilling is partly due to increased recycling and incineration of waste. Recycling rates tend to have improved fastest in waste streams with EU-wide targets.[16][17] In 2011, EEA countries (excluding Iceland, Croatia and Turkey) recycled 63% of their packaging waste, up from 57% in 2006. For municipal waste, EEA countries achieved a recycling rate of 37% in 2012, compared to 28% in 2004. These improvements reflected an increase in the recycling of materials, with only very modest improvements in the recycling of biowaste.[17]

Transboundary movements of waste

Driven by EU trade legislation and recycling targets — along with escalating resource demand in fast growing Asian economies — exports of waste from EU Member States have grown significantly. Exports of waste iron, steel, copper, aluminium and nickel doubled between 1999 and 2011. Waste precious metal exports increased by a factor of three and waste plastics by a factor of five. Exports of hazardous waste more than doubled in the period 2000–2009,

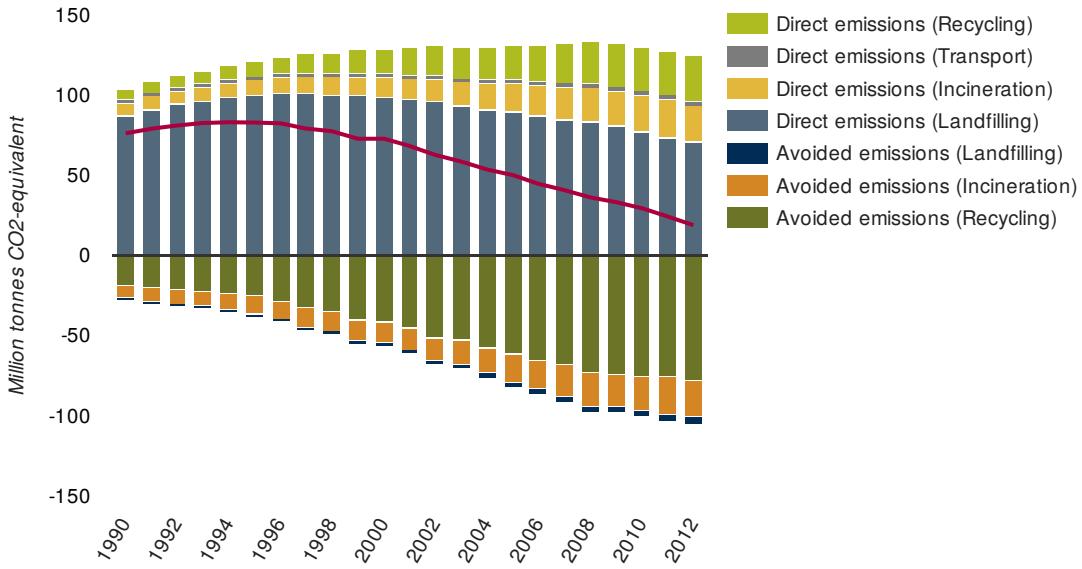
although these overwhelmingly stayed in the EU.[18]

Transboundary movements of waste can enable access to recycling or disposal options that are unavailable or more costly in the source country — meaning lower financial costs for waste management and potentially also lower environmental costs. Trade can also facilitate using waste as an input to production. However, moving waste across borders can involve costs and risks, such as illegal movements of hazardous electronic waste (e-waste). Since informal sector workers in developing countries lack the equipment and skills to handle e-waste safely, the result is significant environmental pollution and health risks for local people, as well as the loss of valuable materials.[18]

Reduced environmental harm

Improved waste management reduces pressures associated with both waste disposal (e.g. pollution from incineration or landfilling) and with extracting and processing new resources. The EEA estimates that improved municipal waste management in the EU-27, Switzerland and Norway cut annual net greenhouse gas (GHG) emissions by 57 million tonnes CO_2-equivalent in the period 1990–2012, with most of that reduction occurring since 2000. The two main factors responsible were reduced methane emissions from landfill and avoided emissions through recycling.[19]

Figure 2: Greenhouse gas emissions from municipal waste management in the EU-27, Switzerland and Norway



Note: This figure shows the greenhouse gas (GHG) emissions associated with municipal waste management for the EU-27 (without Cyprus) plus Norway and Switzerland, differentiated according to the contribution of specific waste treatment paths. The GHG emissions are calculated using a life-cycle approach. In order to see the overall effect of waste management, the avoided emissions (counted as negative values) are plotted with the direct emissions, giving the total annual net GHG emissions from municipal waste management in European countries (the red line).

Data sources: a. Eurostat. Municipal waste statistics

b. CRI. Projections of Municipal Waste Management and Greenhouse Gases' by Ioannis Bakas et al. ETC/SCP working paper 4/2011

Prospects

The EU estimates that full implementation of existing EU waste legislation could save EUR 72 billion a year by 2020, while creating over 400 000 jobs and increasing annual EU waste management and recycling sector turnover by EUR 42 billion.[20] Better recycling infrastructures, collection and recycling rates could also alleviate European reliance on resource imports, boosting security of supply of some of the critical resources used in new technologies.[21] Securing these potential gains will require Member States to achieve the full spectrum of EU waste targets.

Analysis by the EEA[17][22] suggests that progress towards waste targets is mixed. Many Member States seem likely to achieve the target of recycling 50% of some fractions of household and similar wastes by 2020 (although Decision 2011/753/EC enables countries to choose between four different methods for calculating recycling rates, producing different results). But achieving other targets, such as the EU's 'near zero landfill' target in 2020, will depend on a significant change in approaches to current waste management practices.

Policy tools such as taxes or bans on specific wastes or management approaches, pay-as-you-throw schemes and extended producer responsibility could all enable a shift up the waste hierarchy.[17] The large differences in waste management and progress to targets across Europe underline the importance of national and local instruments such as landfill taxes and bans, mandatory separate collection and waste collection fees that encourage recycling.

Measures that deter landfilling can produce adverse effects if they result in illegal dumping of waste or the development of undesirable alternatives, such as excessive incineration capacity or low-quality mechanical biological treatment for mixed waste types. Tools such as landfill taxes therefore need to be complemented with additional measures, for example enhanced supervisory systems and incentives for preferred waste management approaches.

Moving beyond existing policy targets, the Roadmap to a resource-efficient Europe[23] and the 7th Environment Action Programme[20] also signal a new level of ambition in applying the logic of the waste hierarchy, including additional goals on waste prevention and using waste as a resource. As a first step towards these goals, the European Commission is reviewing the EU's targets on municipal and packaging waste.[24]

Achieving the EU's medium- and long-term objectives will require more far-reaching changes, extending beyond the waste sector and engaging all actors in establishing a circular economy. Minimising waste or making it less harmful depends on actions across the full product lifecycle. Factors such as design and choice of material inputs play a major role in determining a product's useful lifespan, the amount of resources and energy used in production, and the possibilities for repairing it, reusing parts or recycling.

Technological and social innovations can also offer new ways to meet society's demand for products and services. Examples include resource-efficient production processes, re-manufacturing, industrial symbiosis, product-service systems, collaborative consumption and take-back schemes. EU and national policy should create the incentives and enabling frameworks to support new business models that can realise these innovations. This could include helping establish new markets for recycled materials.

These measures can contribute to achieving the potential economic and environmental benefits of sustainable waste management. For Europe to fully understand its progress towards these benefits, improvements in information on waste flows is required. The waste data currently collected is insufficient to support thorough analysis of waste prevention and recycling across the continent.

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