THE EUROPEAN ENVIRONMENT
STATE AND OUTLOOK 2015

EUROPEAN BRIEFINGS

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Contents

Agriculture

European agriculture — 40% of the land — serves societal demands for food production, pollination and energy. Long-observed environmental impacts are mixed: decreasing GHG emissions, less pesticide use but exceedance of nutrients, diffuse pollution to water and dramatic loss of grassland biodiversity.

There are fewer farmers and less arable land but demand for food is growing. Europe faces a continuous challenge to reconcile low environmental impact, food security and the viability of rural societies.

Context

Agriculture has shaped Europe's landscapes for thousands of years and it still is one of the principle sectors impacting on Europe's environment. Since the 1950s, traditional farm management, which favoured a range of landscapes, habitats and plant and animal species, was replaced by a rapid industrialisation of agriculture characterised by a wide-spread intensification of farming methods. These were often subsidized. This has resulted in farm specialisation, increased use of chemical inputs and machinery as well as open and homogeneous landscapes. Concurrently, remaining agricultural land with natural constraints has been subjected to marginalisation and abandonment. This is also as a result of wider socio-economic changes in the rural communities.

These parallel phenomena have caused a significant decline in biodiversity across European farmland, including the genetic diversity of crops and livestock, and exerted various other pressures on Europe's environment. Nutrient emissions to air and water have caused eutrophication of habitats and ecosystems. Intensification has often had undesirable impacts on soils, often leading to reductions in organic soil matter and biodiversity, contamination of groundwaters and less productive land. Europe's agriculture has received sustained support under the Common Agricultural Policy (CAP) over the last 50 years. This support has evolved over time, spurred by the growing recognition of agriculture's impacts on the environment. Unfortunately, the CAP had not changed sufficiently to reduce overall biodiversity loss.[1]

Today European farming systems serve different societal demands. The provision of food, however, remains their primary function. Food security, i.e. stable access to affordable food supply of sufficient quality, continues to receive renewed attention on the European Union's (EU) policy agenda. Farming and rural land management also provide other crucial and often under-appreciated ecosystem services (such as pollination, pest control or nutrient recycling) and functions such as flood prevention and cultural benefits.

The recent CAP reform for the period 2014 to 2020 aims to respond to the three main challenges facing the sector: economic, environmental and territorial. The reform may be broadly summarised as guaranteeing food security and improving environmental performance in rural areas which are faced with large-scale competition for land, reflecting rapid changes in the socio-economic situation. An important feature of the new CAP is the recognition that farmers should be rewarded for the services they provide to the public even though they might not have a market value.

Key trends

The long-term sustainability of agriculture and the ability of agro-ecosystems to provide services beyond food production is being undermined by environmentally-harmful farming practices. These cause soil degradation and water contamination, as well as declines in pollinators, the loss of natural biological control of pests and diseases, and of plant and animal genetic diversity.[2][3]

Currently agriculture covers roughly 40% of land in the EU. Land cover changes between 2000 and 2006 show that farmland gave way to built-up areas and forest, either through afforestation or spontaneous growth on abandoned land. Most of the agricultural land in Europe converted to artificial surfaces is taken up by the housing sector (38%).[4] Despite the decrease in the total area of farmland, productivity of European agriculture increased significantly, particularly in the second half of the 20th century as a result of intensification and specialisation.

The total number of farmers in Europe was halved between 1990 and 2010. For several decades, the number of farms in the EU has been on a downward trend. Average farm size is now bigger in terms of agricultural area as well as in economic terms. However, farming in Europe is still carried out primarily on small or very small holdings.[5]

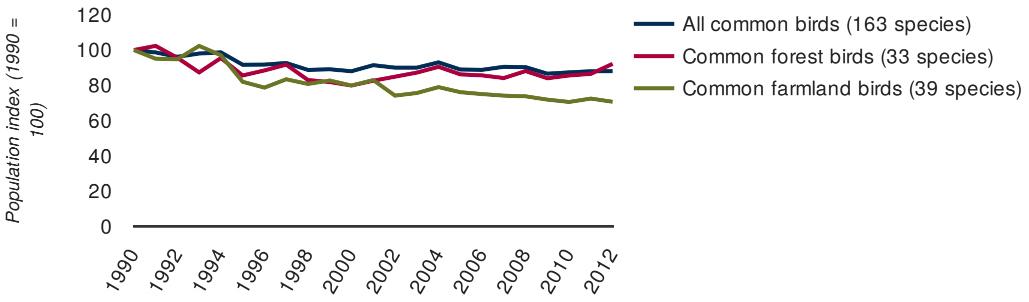
Agricultural production contributes to greenhouse gas (GHG) emissions, via methane produced by livestock and emissions from agricultural soils. However, emissions from the agricultural sector have declined by 22% since 1990.

Although there are strong national differences, overall pesticide use across Europe declined in the period 2000–2009. New pesticides in use, whose active ingredients are more concentrated, lead to a decline in volume of pesticide use without a subsequent decline in environmental impact.[6]

The implementation of the Nitrates Directive and the introduction of set-aside measures have stabilised pollution from nutrients and pesticides. This has reduced the environmental pressures on soil, water and air.[7] Despite an overall decrease in nitrogen emissions from agriculture, nutrient levels still exceed nutrient critical loads in most of the EU.[8] However, set-aside measures have now been abandoned as an EU policy instrument.

Agricultural nitrogen balances are declining but they are still high in some countries, particularly in lowland western Europe. Many water bodies, particularly in regions with intensive agriculture and high population density, suffer from 'diffuse pollution' (i.e. pollution caused by variety of activities which have no specific point of discharge). The resulting eutrophication can manifest in biodiversity loss, increase in algae and reduced oxygen levels.[6]

Figure 1: Common birds in Europe — population index



Data sources: a. EBCC. Common Birds in Europe, population index b. Birdlife International
c. Royal Society for the Protection of Birds d. Statistics Netherlands e. EEA – Indicator CSI050

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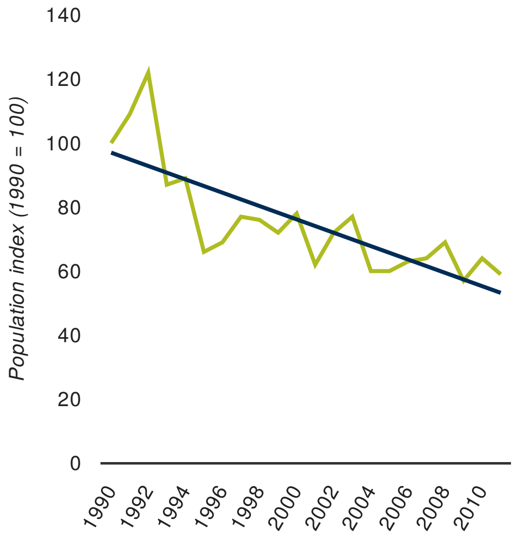
Despite progress in enacting and implementing European policies (such the Birds and Habitats Directives and the Water Framework Directive) as well as the environmental measures within the framework of CAP, Europe has experienced a major decline in biodiversity associated with agro-ecosystems and grasslands.[1] A recent reporting process on the conservation status of species and habitats under the Habitats Directive, showed that 63% of the assessments of habitats linked to grasslands are unfavourable. Only 11% of the conservation status assessments of species linked to grasslands is favourable.

Since 1990, common farmland birds have declined by 30% in Europe (Figure 1). This has been linked to increased specialisation and intensification as well as habitat loss. Between 1990 and 2011, populations of grassland butterflies declined by almost 50%, indicating a dramatic loss of grassland biodiversity (Figure 2).

Figure 2: Grassland butterfly indicator for Europe



Data sources:

a. BCE. European Grassland Butterfly Indicator
b. Statistics Netherlands
c. EEA – Indicator CSI050

Prospects

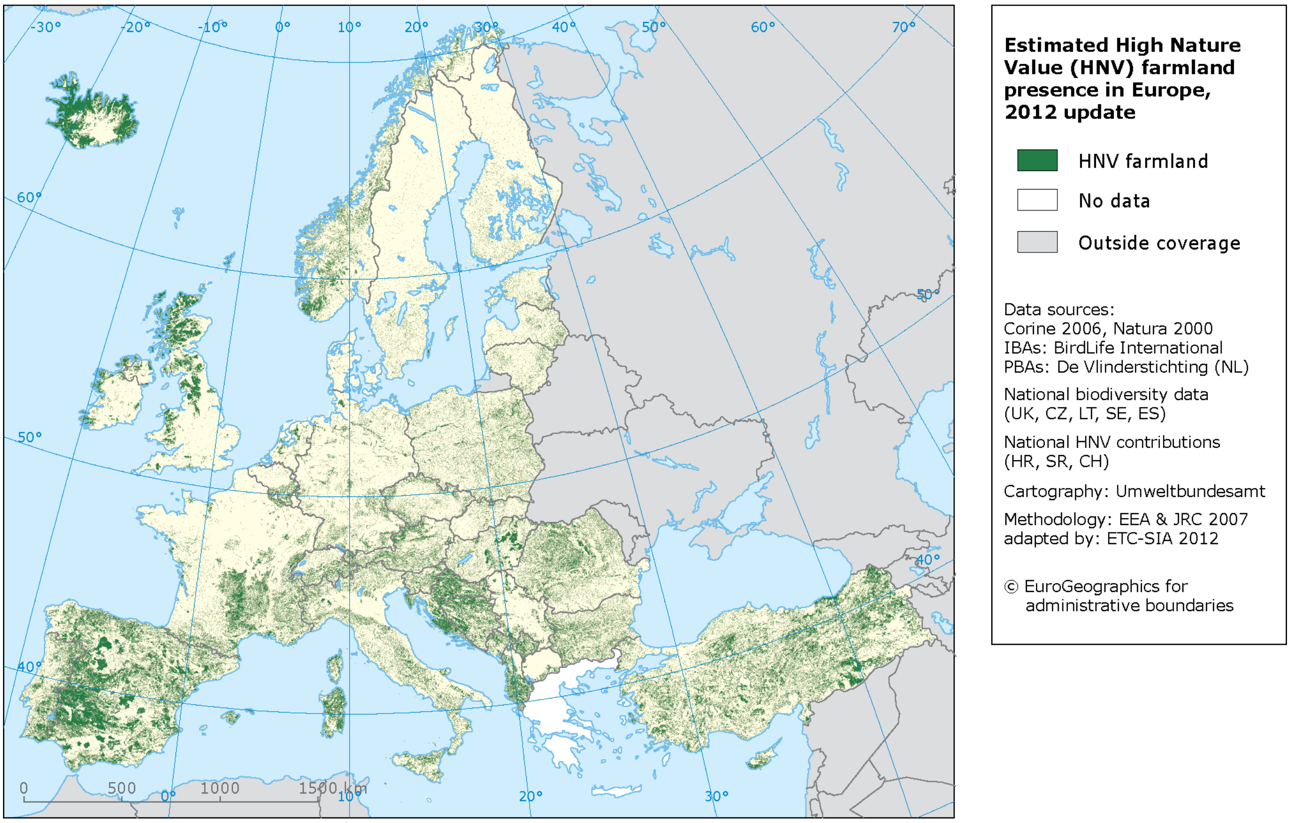
Sustainable farming, which reconciles low environmental impacts, food security, and the viability of rural societies, presents a significant challenge to Europe's agriculture. In the context of European policies, the EU Biodiversity Strategy to 2020 includes a specific target that addresses the role of agriculture and forestry as regards biodiversity in Europe and links directly with the reformed CAP and its greening measures. These will reward farmers for respecting three obligatory greening measures: maintenance of permanent grassland, ecological focus areas and crop diversification.[9]

'Greening' the CAP is intended to slow down the decline in farmland biodiversity, most notably in intensive farming areas. These reform proposals can benefit the environment and biodiversity in particular. However, their positive effects will depend on the implementation of specific measures, not least because additional flexibility in implementation was granted to Member States and farmers in the final version of the legal texts.

Long-term food security can be supported by reducing agriculture's ecological impact. This implies a fundamental shift towards more ecological approaches and an increase in resource efficiency.[2][6] The strategy for selecting an optimal yield target rather than maximal may outweigh any short-term productivity loss. Plant and animal genetic resources for food and agriculture are also an essential part of the biological basis for world food security.[10] Preservation of plant varieties and rearing of endangered breeds is crucial for that purpose. Farms looking to diversify crop and livestock production can support such a process. A transition towards more sustainable agro-ecosystems and increasing the resource efficiency of agriculture normally requires more advanced agronomic skills.

Europe has significant areas of High Nature Value farmland (HNV) (Map 1), which is characterised by a high proportion of semi-natural vegetation and low intensity agriculture, which, inter alia, supports rare species of European wildlife. Protecting HNV farmland areas is particularly important in this context, given the ecosystem services and public goods generated by the farming systems that maintain this land and the socio-economic pressures they face to intensify or abandon production. Clearly, the increased competition for land is expected to influence European agriculture. For example, the production of renewable energy and biofuels raises particular concerns related to the conversion of natural or semi-natural ecosystems, either for the production of biofuel feedstock themselves or for production of other crops that have been displaced by biofuels. The natural shifts in agriculture ecosystems induced by climate change bring further complexity in the management of farmland.

Map 1: Estimated High Nature Value farmland presence in Europe



Data sources: Corine Land Cover 2006 seamless vector data provided by European Environment Agency (EEA); Natura 2000 sites provided by European Environment Agency (EEA).

High Nature Value farmland

The concept of HNV farmland expresses the dependence of certain types of biodiversity on farming practises on certain types of land and the maintenance of specific farming systems. Typical examples of these systems include semi-natural grassland, traditional olive, vine and fruit production, and woodland/pasture. Dehesa and Montado are two well-known examples of the latter on the Iberian Peninsula. Three definitions of HNV farmland have been proposed.[11][12]

- **Type 1** - Farmland with a high proportion of semi-natural vegetation.
- **Type 2** - Farmland with a mosaic of low intensity agriculture and natural and structural elements, such as field margins, hedgerows, stone walls, patches of woodland or scrub etc.
- **Type 3** - Farmland supporting rare species or a high proportion of European or world wildlife populations.

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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.

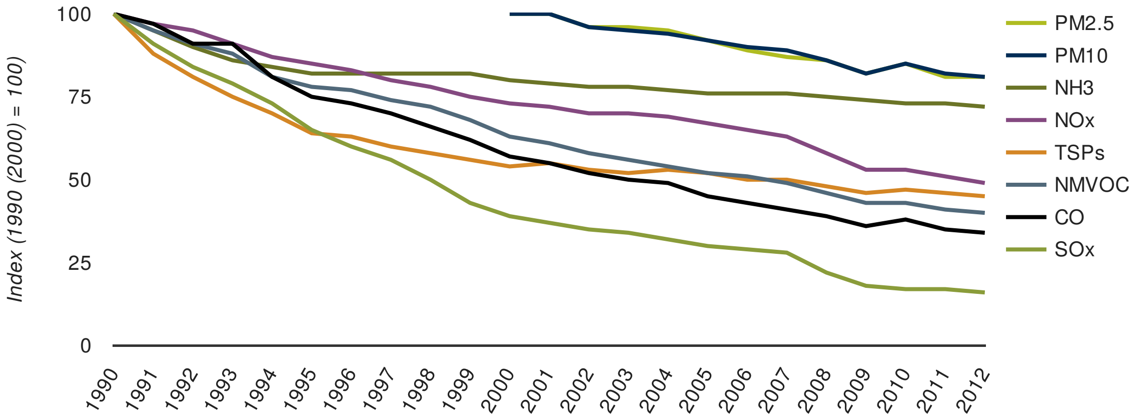
The main policy instruments on air pollution within the EU include the Ambient Air Quality Directives,[2][3] and the National Emission Ceilings (NEC) Directive,[4] which contains emission ceilings for 2010 and years thereafter. In addition, there is source-specific legislation addressing industrial emissions, 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]

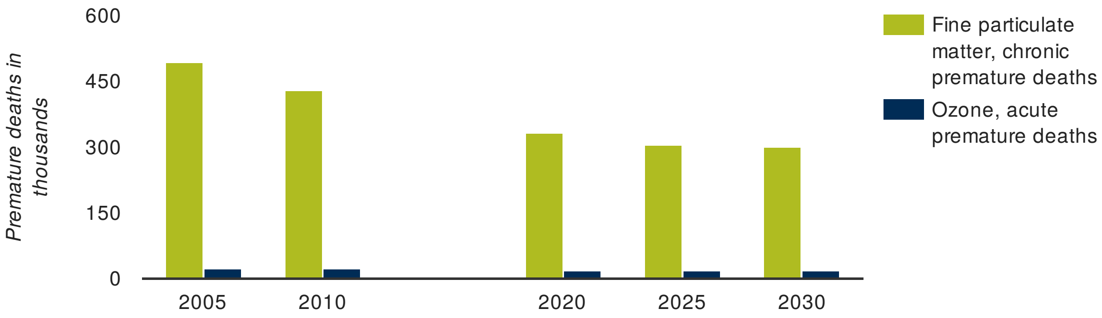
Prospects

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

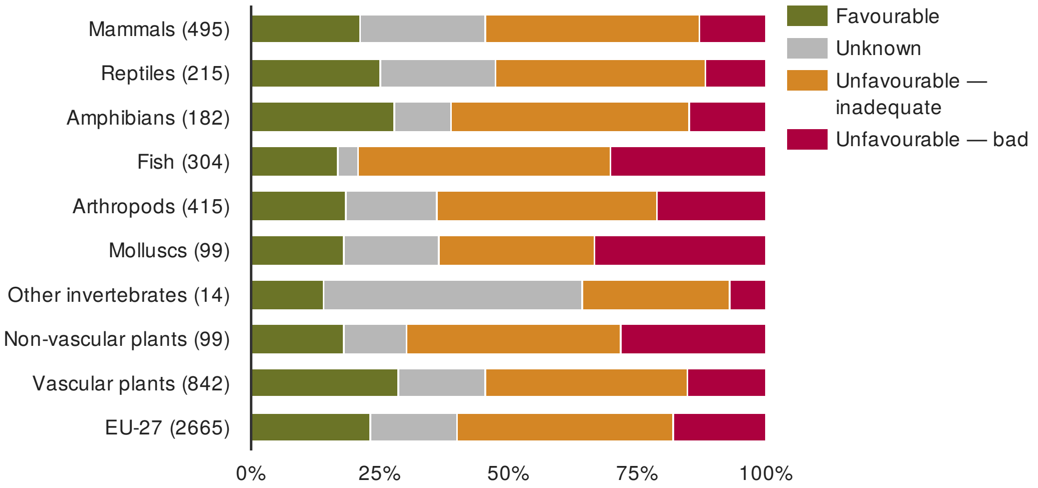
Much is still unknown when it comes to the complete status and trends of European biodiversity and its relation to the functioning of ecosystems and the long-term delivery of services. Nonetheless, available information on selected species, habitats and ecosystems across Europe give cause for concern.

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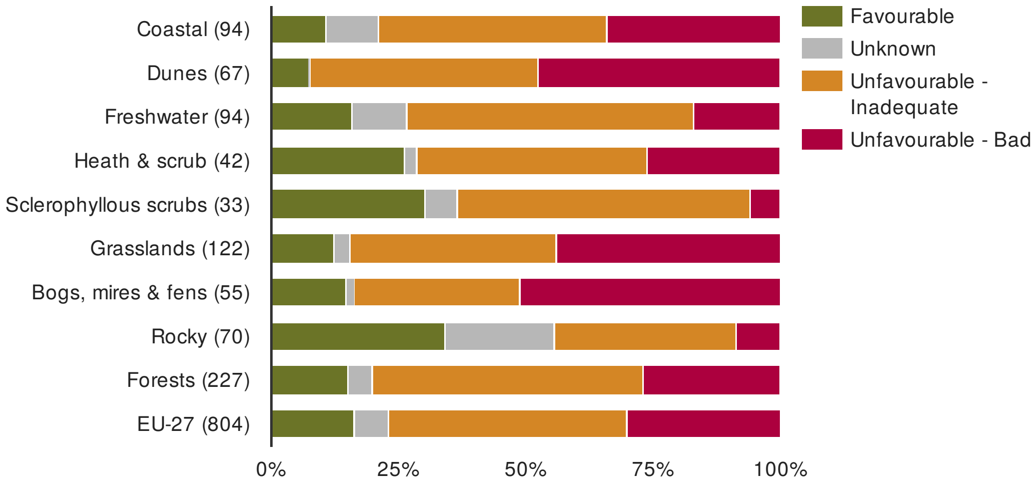
Figure 2: Conservation status of habitats of European interest[13]



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.

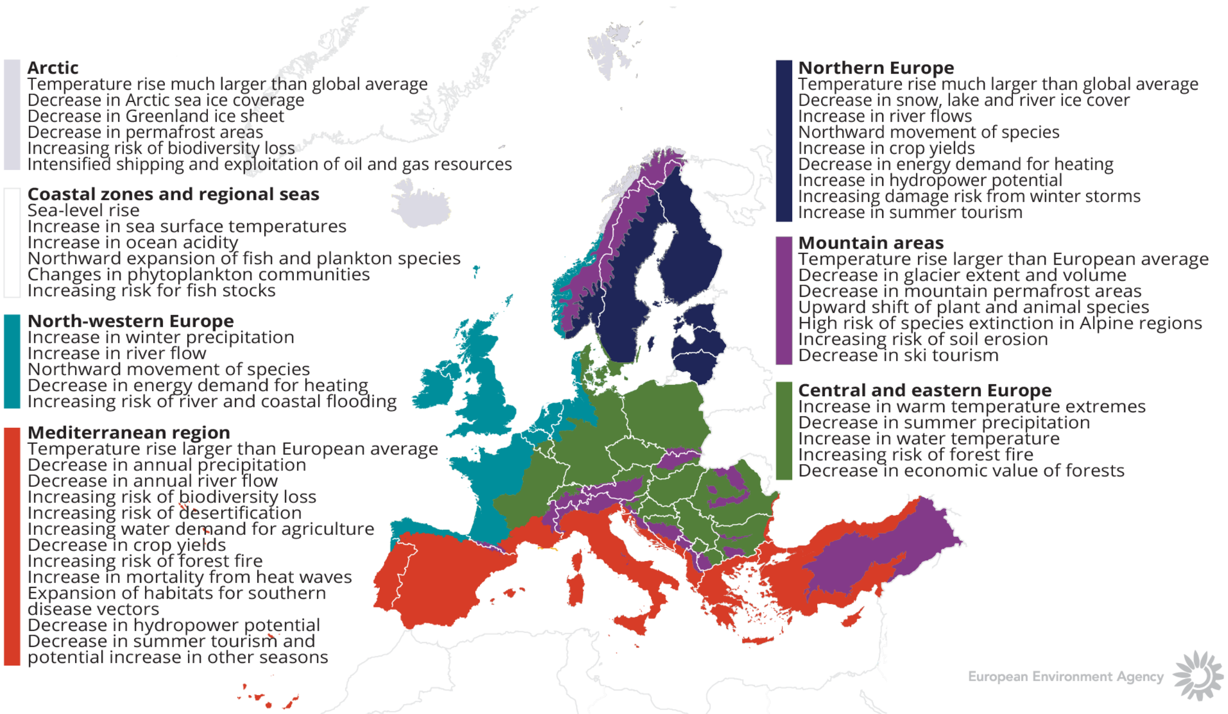
Key trends

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.

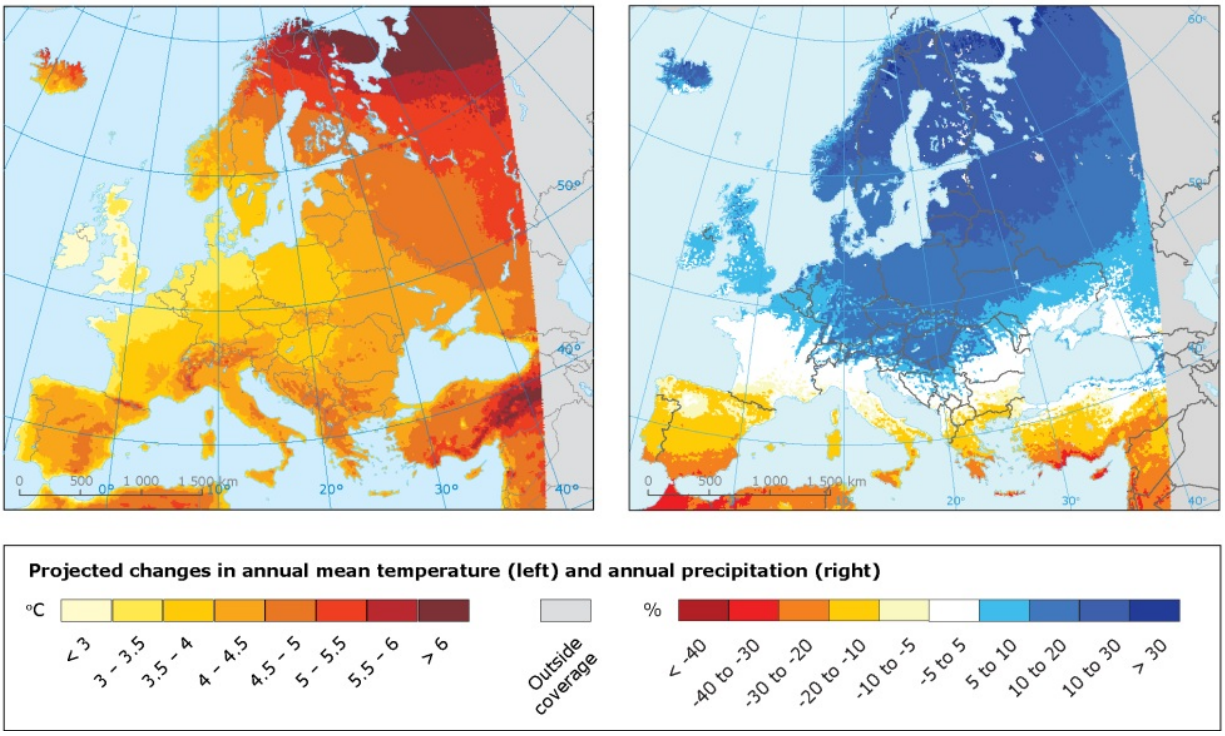
On a transnational level, adaptation action is mainly the result of shared natural resources such as transboundary water catchments. Transnational cooperation of this sort is often supported by European funding instruments (e.g. in the Baltic Sea region) and through European regional conventions (e.g.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

European systems of production and consumption generate diverse environmental, social and economic impacts — supporting livelihoods globally but also creating significant environmental pressures. Household consumption expenditure in Europe increased by 23% in 1996–2012, contributing to increases in some environmental pressures. Reducing the impacts of European consumption requires fundamental changes in lifestyle, including in the size and location of dwellings, transport systems and diets.

Context

Global systems of production and consumption generate a complex mixture of environmental, social and economic costs and benefits — supporting livelihoods across the value chain, but also accounting for much of humanity's burden on the environment. Managing the diverse impacts is a central challenge in the transition to a green economy.

Efforts to monitor and manage society's pressures on the environment have tended to focus on production.

Yet there are good reasons for considering consumption — in both analysis and policy — to be of equal importance.

- First, improving the resource efficiency of production may not, by itself, cause absolute reductions in resource use or impacts. This is because efficiency improvements tend to lead to lower production costs and prices, incentivising increased production and consumption (a process sometimes referred to as the 'rebound effect').
- Second, market prices often provide little indication to consumers and regulators about the environmental and social impacts that occur across complex globalised supply chains. Additional measures are therefore needed to guide consumers towards more sustainable choices.
- Third, while governments have limited ability to influence production processes in other countries, efforts directed at consumption can influence impacts across the entire life-cycle of products and services. Measures targeting consumption therefore have the potential to extend the reach of government policy, influencing resource use and production phase impacts across the world.

Consumption is today recognised as a core concern in long-term environmental and development strategies.

Globally, governments at the Rio+20 Conference in 2012 adopted the '10-Year Framework of Programmes on Sustainable Consumption and Production'. The programmes set objectives and define activities and indicators, addressing issues such as sustainable lifestyles, education, tourism and buildings.[1]

In the EU, the Roadmap to a Resource Efficient Europe[2] provides a framework for policies addressing production and consumption, and defines milestones to be met by 2020, for example phasing out environmentally harmful subsidies by 2020.

More recently, the 7th Environment Action Programme (7th EAP) is the first EU policy to include goals on reducing environmental pressures caused by European consumption, including impacts outside EU borders.[3]

Trends

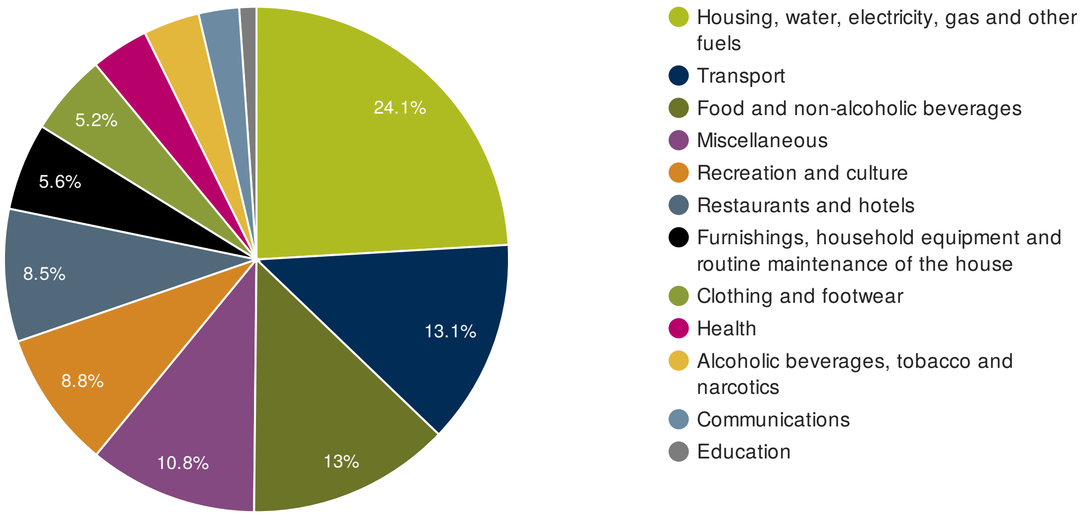
Consumption expenditure trends

Consumption consists of household final consumption expenditure (i.e. all purchases by resident households to meet their everyday needs) and government final consumption expenditure (i.e. goods and services provided to citizens and financed by tax revenues). This assessment focuses on household consumption, which accounts for approximately 60% of EU-28 gross domestic product (GDP), compared to about 20% for government consumption.

Household consumption expenditure in the EU-28, Iceland and Norway grew roughly in line with economic output in the period 1996–2012, increasing by 23% in real terms despite a slight fall following the economic crisis. EU-28 per capita household consumption expenditure was EUR 14 500 in 2012.[4]

Three broad consumption categories — housing and utilities, mobility, and food — account for approximately half of European household expenditure (Figure 1) and more than two-thirds of the direct and indirect environmental pressures caused by household consumption.[5][6][7] The EU prioritised these categories for action in the Roadmap to a Resource Efficient Europe and the 7th EAP in view of their comparatively large life-cycle impacts.

Figure 1: Share of expenditure on household consumption categories



Note: Expenditure in nominal values. Covers the EU-28, Iceland and Norway.

Data sources: a. Eurostat. Household consumption - aggregates at current prices b. EEA – Indicator SCP013

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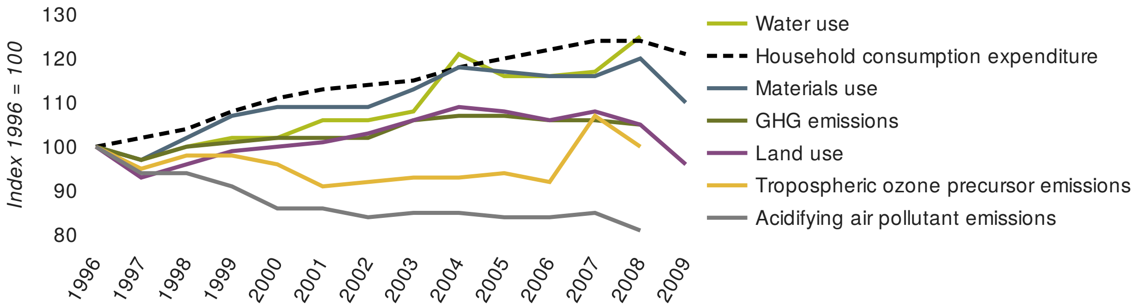
Europe's global footprint

The resources and emissions caused during the production of products and services can be estimated using 'environmentally extended input-output analysis'. According to this method, most of the global environmental pressures associated with EU-27 household consumption declined or grew less rapidly than household expenditure between 1996 and 2009. Only water use increased more than expenditure in this period (Figure 2).

The dominant cause of this decoupling of pressures from expenditure was improved eco-efficiency in the production of goods and services, rather than changing consumption patterns.[5]

Figure 2: Environmental footprint of household purchases of goods and services



Note: The environmental footprint includes pressures within and outside Europe associated with household purchases of goods and services, but excludes direct pressures emitted by households, for example by burning fuels for space heating or driving a car.

Data sources:

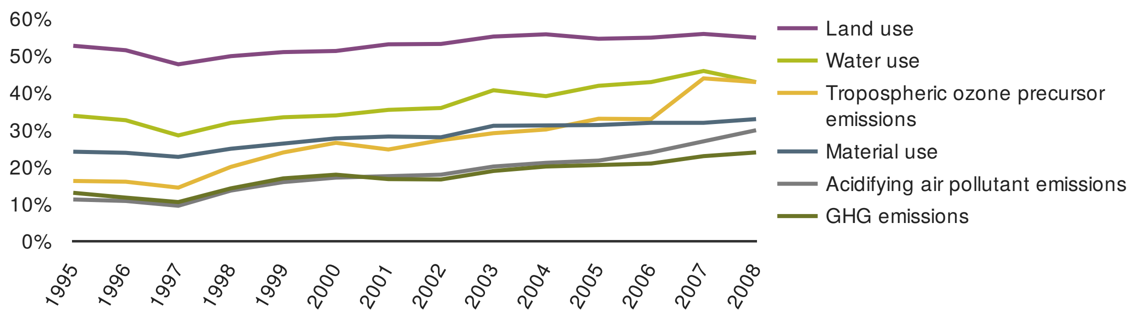
a. European Commission. Pressures caused by domestic final use broken down by COICOP category - calculations made for report Global Resources Use and Pollution Volume 1

b. Eurostat. Final consumption expenditure of households by consumption purpose - COICOP 3 digit - volumes

The growth in greenhouse gas (GHG) emissions illustrated in Figure 2 contrasts with the decreasing trends for EU emissions calculated using production-based methods.[8] However, some uncertainties still remain with calculating the environmental pressures from consumption, and further development of tools and methodologies is needed.

While acknowledging these limitations, the data do indicate that an increasing proportion of the environmental pressures linked to European demand occurs in other parts of the world. In 1995, 13% of GHG emissions caused by EU domestic final demand (i.e. total consumption and investment expenditures) were released outside the EU during the production of goods exported to the EU. By 2008, this had risen to 24% (Figure 3). The figures are higher for other pressures.[9]

Figure 3: Percentage of the EU footprint exerted outside EU borders



Note: The footprint relates to total final demand, comprising household and government consumption and capital investments.

Data sources:JRC. Global Resources Use and Pollution, Volume 1/Production, Consumption and Trade (1995-2008)

For some categories of goods and services a substantial proportion of final consumption is supplied directly by imported goods. Imports accounted for 87% of EU clothing expenditure in 2012, rising from 65% in 2005. Imports of electrical and electronic products accounted for 74% of EU consumption in 2012, up from 50% in 2007. Net imports of these products are somewhat lower but they are also increasing.[9]

Measures that alter European consumption can influence related environmental pressures globally. However, such gains may be offset by increased pressures elsewhere if consumption-oriented approaches are not complemented by broader efforts to reorganise production-consumption systems. For example, reducing food waste can reduce demand for agricultural resources, alleviating associated environmental impacts. But it may also leave a consumer with extra resources to spend on other consumption categories, resulting in a form of rebound effect.[10]

Prospects

Global economic output is projected to triple in the period 2010–2050,[11] implying greatly increased competition for resources. In this context, Europe will need to find ways to adapt its consumption patterns as part of broader efforts to alleviate environmental pressures. A variety of approaches exist to make consumption patterns more sustainable. Some are already firmly established in EU policy, such as the Ecodesign Directive, the Energy Labelling Directive,[12] the Ecolabel Regulation,[13] and the Green Public Procurement Communication.[14] The European Commission has also adopted a harmonised method to calculate the environmental performance of products and organisations.[15] This method will help deliver more credible information to all stakeholders, including consumers.

While these approaches are important, substantially reducing the European environmental footprint will require deeper changes in lifestyles, including in the size and location of dwellings, commuting patterns and diets. Government measures are only part of the solution in effecting such transitions. Consumption patterns are shaped by multiple drivers, including income levels, prices and social norms. Producers play a crucial role in determining these factors, for example via innovation and advertising. Reshaping consumption therefore involves a complex interaction between governments, businesses and consumers.

Consumers can have a significant influence over production-phase impacts via their purchasing decisions, thereby incentivising corporate social responsibility and sustainable supply-chain management. Businesses can work towards transparent, sustainable supply chains and apply ecodesign and dematerialisation strategies in product design. They can also shape consumer choices via marketing and use of certification.[16]

Government policy at all levels can help incentivise social and technical innovation through the introduction of regulations and market-based incentives. For example, within the waste policy framework, bottom-up initiatives have emerged to enable waste prevention, repair and reuse. This has occurred via increased donation, sale and purchase of second-hand goods.

Collaborative consumption initiatives are likewise proliferating in many European countries. Such approaches could reduce the resource-intensity of consumption by meeting consumer needs through leasing, product-service systems and sharing arrangements, rather than purchases. Shifting away from a logic of maximising product sales towards one of service provision can fundamentally alter the incentives driving product development, encouraging a greater focus on durability and reparability.[17][18]

There are many business opportunities within such new approaches, as well as opportunities to build social capital at the community level.[19] Policies should enable and encourage initiatives with the highest potential to reduce overall environmental impacts from European consumption, and support up-scaling by developing favourable framework conditions. Structured monitoring of these innovations and their environmental effects, including possible rebound effects, will be crucial.

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Energy

The EU's energy intensity decreased between 1990 and 2012 while renewables increased strongly. Latest data confirm that the EU is on track towards its 2020 energy targets: increasing renewables to 20% of energy use and reducing primary energy consumption by 20% at EU-level.

The EU has adopted two new energy targets: increasing renewables to minimum 27% of EU energy use and improving energy efficiency by a minimum of 27% by 2030. Further efforts beyond currently implemented policies are needed to keep the EU on track towards the objective of decarbonising the European energy system by 2050.

Context

Since the Industrial Revolution, the global economy has depended on unrestricted access to cheap energy resources, primarily from fossil fuels (see SOER 2015 briefing on resource efficiency). However, a number of factors look set to change this relationship in the coming decades:

- The OECD predicts rapid global economic expansion between now and 2050. This could intensify energy use and exacerbate global competition for energy resources, thereby increasing Europe's exposure to geopolitical risks and fossil-fuel price spikes.
- The way we produce and consume energy has severe impacts on our climate (through greenhouse gas emissions from burning fossil fuels); on air quality (from fossil fuel and biomass combustion); on water quality and quantity (through dam construction for hydropower, water retention for energy crops, or water use for cooling of power plants); and on land resources, including natural habitats and ecosystems (through further deforestation in the tropics for the production of bioenergy, and through fragmentation of habitats due to resource extraction, pipelines and grids). If we do not change our habits, the consequences could be irreversible.
- Technological innovation could either alleviate or exacerbate some of these pressures. In the case of energy efficiency and renewable energy, it could alleviate pressures by decoupling energy consumption from economic growth and by prompting a shift towards less-polluting alternatives. But technological innovation could also weaken the momentum behind global climate-change mitigation efforts by boosting access to polluting fossil resources, and it could exacerbate the pressure on ecosystems through unsustainable demand for water and land use. And by making energy cheaper, innovation may encourage greater energy use, undoing many efficiency gains through the so-called 'rebound effect'.

These concerns suggest we need to fundamentally rethink our energy systems. In order to address these issues, the EU has committed to the '20-20-20' objectives. By 2020, it aims to cut greenhouse gas (GHG) emissions by 20% compared to 1990 levels, increase the share of renewable energy to 20% of energy consumed, and achieve a 20% cut in primary energy use compared with projected levels.[1] A range of approaches to make energy-production and consumption patterns more sustainable have also been enshrined in other EU policies, and have been gradually tightened over the years. These policies include the Industrial Emissions Directive, the Clean Air Policy Package, environmental legislation on water and biodiversity (including Natura 2000), the Ecodesign Directive, the Energy Performance of Buildings Directive, and the Energy Labelling Directive.

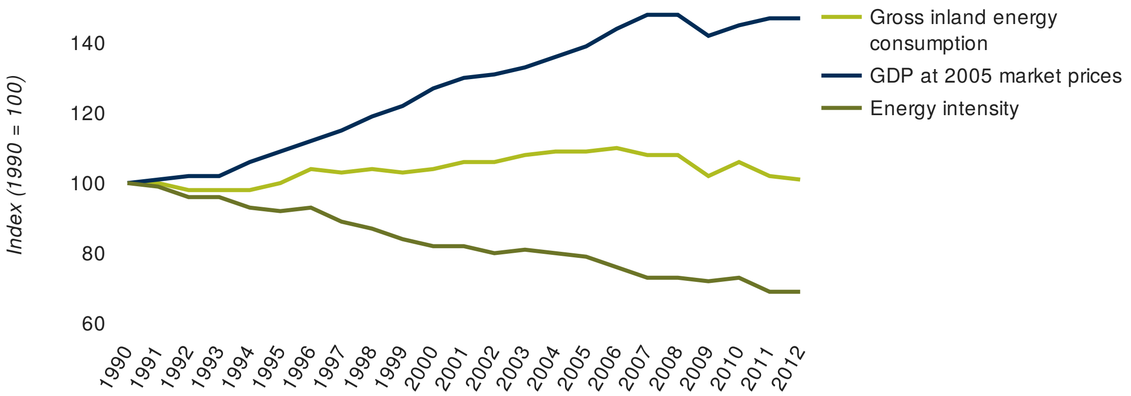
Key trends

Decoupling and Europe's energy intensity

Between 1990 and 2012, there was a decoupling of economic growth from energy consumption in the EU-28[2] (see definition section on energy intensity). This positive evolution occurred in the context of the economic recession; efficiency gains in the power sector; efficiency gains by end-consumers; the rapid penetration of renewable energy sources; and a shift from energy-intensive industries towards services with a higher value added.

Facilitated by European climate and energy policies, the EU's energy intensity decreased by 1.7% per year between 1990 and 2012 (Figure 1). In the same period, the renewables more than doubled their share of energy production (Figure 2); and there was a switch towards fuels that were less GHG-intensive (Figure 3).

Figure 1: Trends in energy intensity, gross domestic product and gross inland energy consumption



Note: Some estimates have been necessary for computing the EU-28 GDP index in 1990.

Data sources: a. The World Bank. World Development Indicators database
b. Eurostat. Gross inland energy consumption c. EEA – Indicator ENER017

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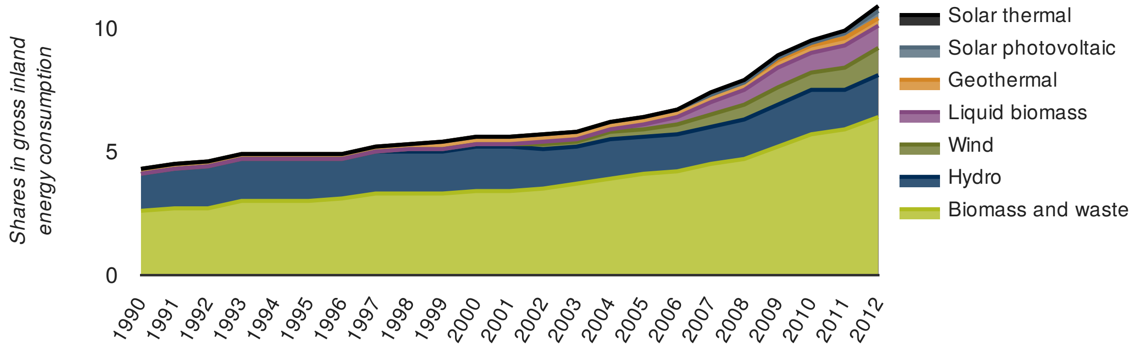
Renewables and nuclear

In 2012, the share of renewable energy consumed in Europe reached 11%, compared to 4.3% in 1990.[3] Biomass energy and hydropower accounted for the largest share of renewables throughout the period, even though technologies such as solar photovoltaics (PV), solar thermal, and wind power had the highest average growth rates since 2005 (Figure 2).

The consumption of nuclear energy in the EU-28 peaked in absolute terms in 2004 (260 Mtoe). From 2005 to 2012, consumption of nuclear energy in Europe fell by 12% due to the shutdown of reactors that had reached the end of their planned lifetime, and the decision of Germany to begin to withdraw from nuclear power in the wake of the Fukushima disaster.[4] Nevertheless, nuclear energy consumption in 2012 was still 11% higher than in 1990.

Figure 2: Contribution of renewable energy sources to gross inland energy consumption



Data sources: a. Eurostat. Energy statistics - consumption all products (Eurostat)
b. Eurostat. Energy statistics - renewable energies (Eurostat) c. EEA – Indicator ENER029

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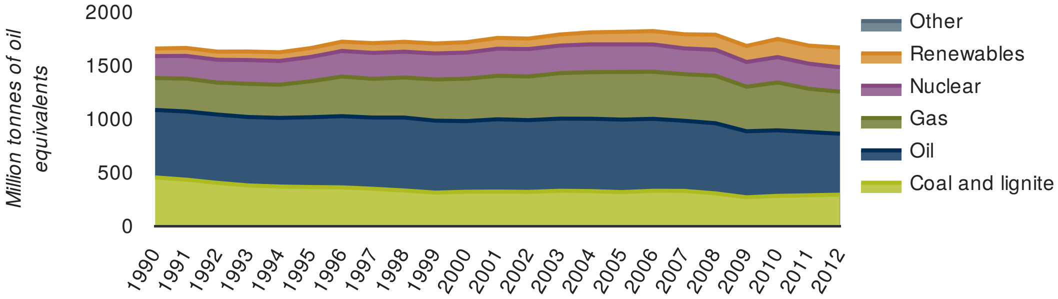
European Environment Agency

Continued reliance on fossil fuels

In absolute terms, fossil fuel consumption in the EU decreased by 9% from 1990 to 2012. The largest absolute reductions took place for coal (–35%) and oil (–10%), while natural gas consumption went up considerably over the period (+32%), offsetting partially the decline in the use of the other two fossil fuels (Figure 2). The coal-to-gas switching was driven by several factors, including tighter health and environmental regulations, consistently falling gas prices in the 1990s, and the attractiveness of combined-cycle gas plants.[5]

For oil, the observed decline mainly took place after 2005, due to a combination of increased use of biofuels in transport, high oil prices, and the economic downturn. Despite the continued decline in the use of fossil fuels in recent decades, in 2012 fossil fuels still accounted for three quarters of all energy consumed in Europe. This gives rise to considerable health, environmental and geopolitical concerns.[6]

Figure 3: Gross inland energy consumption by fuel



Note: "Other" category includes industrial waste and net electricity imports.

Data sources: a. Eurostat. Supply, transformation, consumption - all products - annual data
b. Eurostat. Supply, transformation, consumption - wastes (non-renewable) - annual data

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Prospects

Thanks to significant progress in the climate and energy areas the EU will meet its 20-20-20 commitments for GHG emissions and renewables, although it may just fall short of its commitment to cut energy use by 20% by 2020.

However, there is still significant scope to make further progress after 2020. The EU's 7th Environment Action Programme[7] has a vision for 2050 in which Europeans 'live well within the planet's ecological limits'.

To realise this vision, the European Commission adopted a climate and energy framework to guide policy up to 2030,[8] and EU leaders have endorsed the long-term objective of reducing by 2050 Europe's GHG emissions by 80% to 95% compared to 1990 levels. This will transition Europe to a low-carbon, green economy.

The penetration of new technologies will support this transition through changes in the European energy mix and through efficiency improvements (see SOER 2015 briefing on transport). Unexpected advances in solar technology make it likely that decentralised solar PV will play a greater role in the European energy mix than previously anticipated.

In contrast, other technologies that were once believed to be promising now look less attractive. For example, the cost-competitiveness of nuclear power has deteriorated following the tightening of security standards since the Fukushima accident, and there has been a much slower-than-expected roll-out of carbon-capture-and-storage technology.

However, not all technological development will ease pressures on the environment. The recent technological progress in the extraction of unconventional oil and gas could have global implications on fossil-fuel prices and availability, hampering the transition towards a sustainable low-carbon system. This suggests that market forces and technology alone will not deliver the hoped-for energy transformation.

There is therefore a need to ensure that new energy projects are made environment-compatible, so that they preserve or enhance ecosystem services. This will require better integration of environmental objectives into European energy policy.[7] This applies to all the likely energy projects of the future: fossil-fuel extraction and use; renewable energy generation; carbon capture and storage; and advanced power grids.

In addition to these macro-level changes, there is also great potential to change consumer behaviour. The emergence of collaborative consumption and of innovative sharing schemes aided by the internet and communications technology suggests that consumers can play a significant future role in saving energy (see SOER 2015 briefing on consumption).

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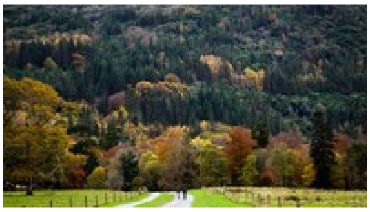
Forests



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]

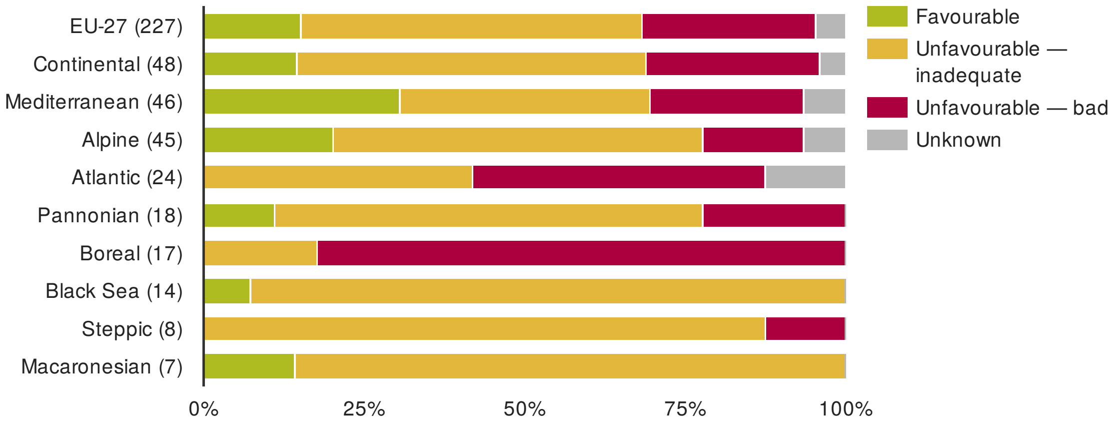
	North[5]	Central-West[6]	Central-East[7]	South-West[8]	South-East[9]	EU-28[10]
Forest and other wooded area, 10^6 ha	**75**	39	23	42	45	180
Forest and other wooded area,% of total land	**56**	28	30	48	35	41
Forests available for wood supply, 10^6 ha	**55**	34	20	25	22	133
Growing stock, m^3/ha	117	227	**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]

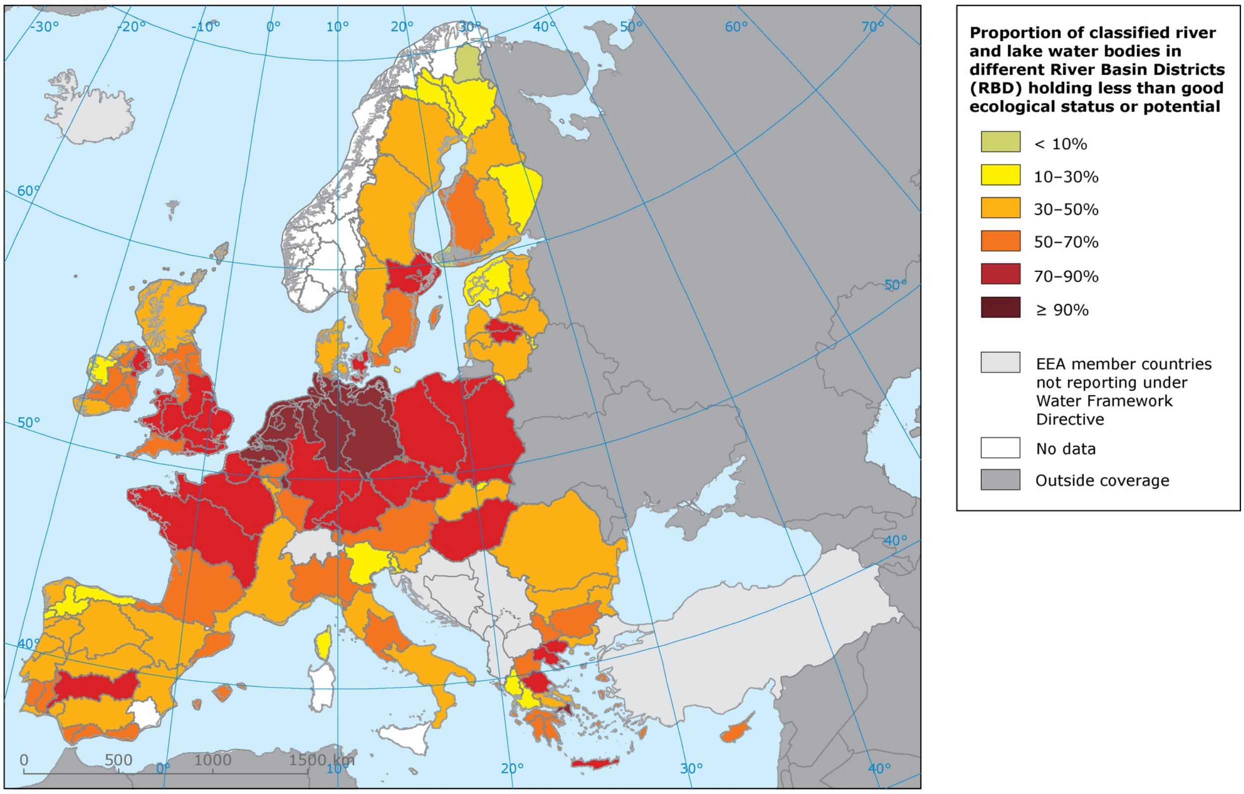
In 2010, EU Member States released 160 River Basin Management Plans (RBMPs), which contain plans for protecting and improving the water environment. The information in the RBMPs, together with other related sources of information, has been analysed to establish an assessment of the status of and pressures 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

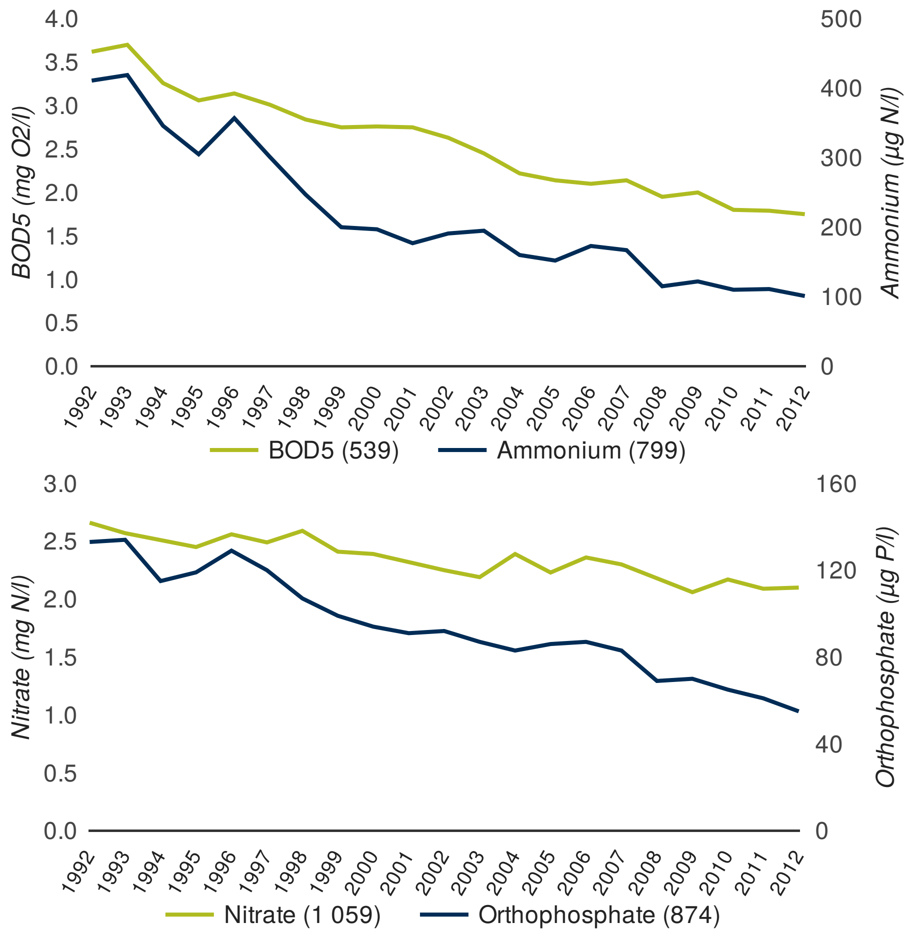


Source: WISE WFD Database.

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)

Explore chart interactively

European Environment Agency

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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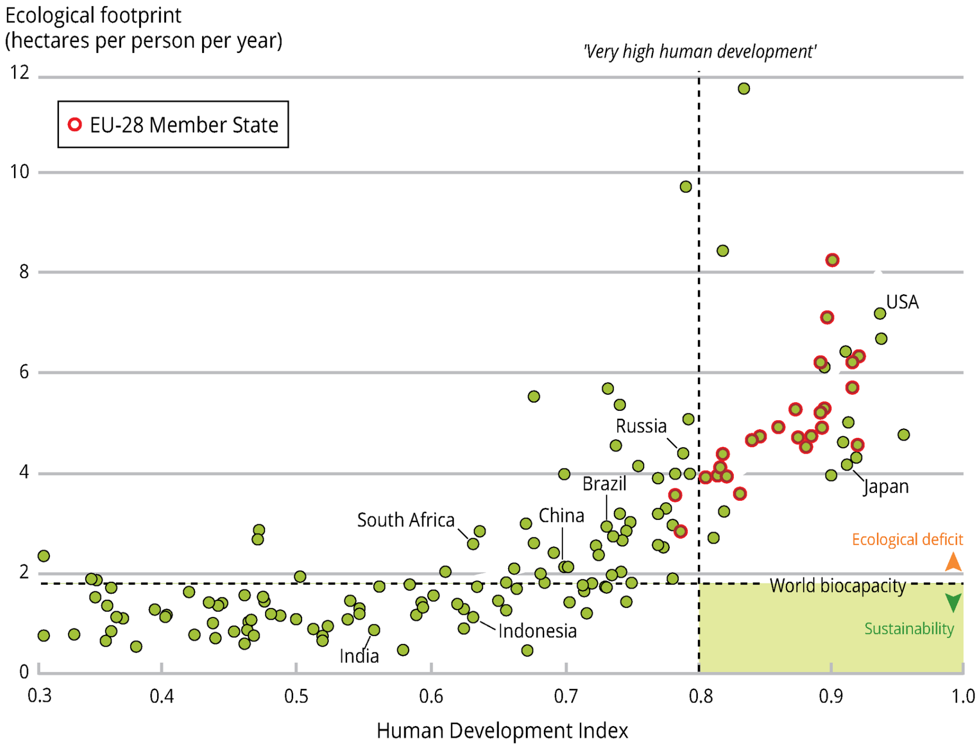
Green economy

Europe's resource efficiency has improved in recent years but this has not always translated into improved ecosystem resilience or reduced risks to health and well-being. Creating a green economy will require fundamental changes in the production-consumption systems that meet basic demands, such as for food, mobility, energy and housing. This will depend on better implementation and integration of environmental and economic policies, a broader knowledge base for long-term transitions, and use of finance and fiscal policies to support major investments in innovation and infrastructure.

Context

The concept of the 'green economy' has emerged in recent years as a strategic priority for governments and intergovernmental organisations.[e.g. 1][2] In Europe, it features prominently in a range of medium- and long-term EU programmes and strategies, including the Europe 2020 Strategy,[3] the 7th Environment Action Programme,[4] the EU Framework Programme for Research and Innovation (Horizon 2020)[5] and sectoral policies in areas such as transport and energy.

Figure 1: Correlation of ecological footprint (2008) and the human development index (2012)



Source: National footprint accounts 2008 and Human Development Index (HDI)
Note: Please read reference [6] for additional information.

The growing prominence of the green economy in EU policy reflects a recognition that the prevailing economic paradigm is inconsistent with Europe's long-term development goals, encapsulated in the 2050 vision of 'living well within the planet's limits'.[4] Across the world, the transition to high levels of human development has been achieved by adopting production and consumption patterns that put a disproportionate burden on the environment (Figure 1). As a result, some countries today live well, while others live within the limits of the planet. None do both.

A 'green' economy is essentially one in which socio-economic systems are organised in ways that enable society to live well within planetary boundaries. The concept therefore has several dimensions. The first is a focus on increasing **resource efficiency**: identifying the innovations and approaches that enable society to extract maximum value from resources and minimise harmful emissions and waste.

Although essential, resource efficiency alone will not guarantee that natural capital stocks are maintained for future generations or that economic activity delivers acceptable living standards and social cohesion. Efforts to enhance resource efficiency must therefore be complemented with a focus on **ecosystem resilience** and on **people's well-being**. After all, an economic model that transcends ecosystem boundaries will not be sustainable in the long term; one that cannot provide decent jobs and earnings will not be politically or socially viable.

Trends

Resource efficiency

Europe's resource efficiency has increased in recent years, alleviating some of the environmental pressures associated with economic production. For example, EU-28 greenhouse gas emissions have decreased by 19 % since 1990 despite a 45 % increase in gross domestic product. Fossil fuel use has also declined, as have emissions of some pollutants from transport and industry. More recently, the EU's total resource use has declined by 19 % since 2007, less waste is being generated and recycling rates have improved in nearly every country.

These trends potentially mark important progress in Europe's efforts to reconfigure its production-consumption systems but significant problems persist. European resource use and harmful emissions remain high in absolute terms. Some of the apparent efficiency improvements may partially reflect the relocation of material extraction and manufacturing to other parts of the world. And the level of ambition of existing environmental policy may be inadequate to achieve Europe's long-term environment and climate objectives. For example, projected greenhouse gas emissions reductions are currently insufficient to bring the EU onto a pathway towards its target of reducing emissions by 80–95 % by 2050.

Environmental resilience and people's well-being

In addition, Europe's recent progress in reducing environmental pressures has not always been matched by improved ecosystem resilience or reduced risks to people's health and well-being. For example, although water pollution is declining, most freshwater bodies across Europe are not expected to achieve good ecological status by 2015. Similarly, Europe is not on track to meet its overall target of halting biodiversity loss by 2020, even though some more specific targets are being met. Loss of soil functions, land degradation and climate change remain major threats to ecosystem resilience, undermining flows of environmental goods and services and therefore jeopardising the social resilience of communities reliant on them.

Turning to people's health and well-being, there have been marked improvements in the quality of drinking water and bathing water and some reductions in hazardous pollutants. However, air and noise pollution continue to cause serious health impacts. In 2011, about 430 000 premature deaths in the EU were attributed to fine particulate matter (PM2.5),[7] while exposure to environmental noise is estimated to contribute to at least 10 000 premature deaths due to coronary heart disease and strokes each year.[8] Environmental impacts on human health and well-being are particularly pronounced in urban settings where multiple pressures coexist. Conversely, well planned urban areas providing easy access to natural, green environments can deliver substantial health and well-being benefits, including protection from the impacts of climate change.[9]

Environmental policies are also creating socio-economic opportunities and thereby contributing to the Europe 2020 Strategy for smart, sustainable and inclusive growth. For example, employment in the environment industry sector, which produces goods and services that reduce environmental degradation and maintain natural resources, increased by 44 % between 2000 and 2011, while sectoral value added increased by 57 %. It has been one of the few economic sectors to have flourished in terms of revenues, trade and jobs since the 2008 financial crisis.

Response

The trends set out above indicate that although policy has delivered some important advances, Europe remains a long way from achieving the transition to a green economy.

In part this reflects the fact that the complex links between environmental and socio-economic systems can undermine efforts to reduce environmental pressures and related impacts. For example, technology-driven efficiency gains may be undermined by lifestyle changes or increased consumption, partly because efficiency improvements can make outputs cheaper (the rebound effect). Policies and local management efforts can be counteracted by external pressures related to global megatrends. Changing exposure patterns and human vulnerabilities, for example linked to urbanisation, can offset reductions in pressures. And the unsustainable systems of production and consumption that are responsible for many environmental pressures also provide diverse benefits, such as jobs and earnings, which can create strong incentives for sectors or communities to resist change.

The systemic, transboundary and long-term characteristics of the environmental challenges facing Europe indicate that neither environmental policies alone, nor economic and technology-driven efficiency gains will be sufficient to effect the transition to a green economy. Rather, transition will require more fundamental changes in the global production-consumption systems that meet basic demands, such as for food, mobility, energy and shelter.

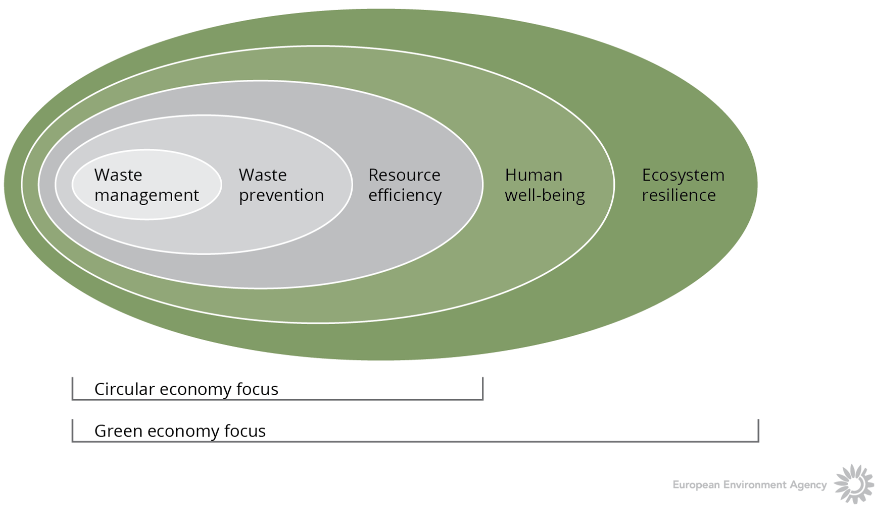
The 7th Environment Action Programme sets out four key pillars of an enabling framework for the transition to a green economy: implementation, integration, information and investments. In a green economy approach, the focus is on identifying synergies that enable economic, environmental and social objectives to be advanced concurrently.

For example, **implementation** of environmental regulations plays an important role in protecting ecosystems but can also contribute to enhanced resource-efficiency by incentivising companies to invest in eco-innovation. This in turn gives businesses a ‘first-mover’ advantage to export their innovations abroad, thus generating earnings and jobs. Major EU engineering companies already earn up to 40 % of revenues from their environment portfolios, and this is set to increase.[10] Similarly, taxing environmentally damaging activities can raise revenues, allowing governments to reduce taxes on labour or reduce budget deficits. Combined with eliminating environmentally harmful subsidies, such fiscal reforms are essential in the transition to a green economy.

The green economy perspective provides a framework for **integrating** the environment into the policies of key economic sectors. For example, European policy on material resource use can be represented as a nested set of objectives (Figure 2). Whereas a circular economy focuses on optimising material resource flows by minimising waste, the green economy approach extends the focus to how water, energy, land and biodiversity should be managed to secure ecosystem resilience and human well-being. The green economy also addresses wider issues, such as competitiveness and unequal exposure to environmental pressures and access to green spaces.

In addition, efforts to promote a renaissance of industry in Europe[e.g.11] could form part of an integrated approach to managing production and consumption so as to ensure that efficiency improvements are secured across the supply chain.

Figure 2: The green economy as an integrating framework for policies on material use



Expanding the **environmental knowledge base** can support better implementation and integration of environment and climate policy, inform investment choices, and support long-term transitions. An expanded knowledge base also enables policymakers and businesses to take decisions that fully reflect environmental limits, risks, uncertainties, benefits and costs.

At present there is a gap between available, established monitoring, data and indicators and the knowledge required to support transitions. Addressing this gap requires investment in better understanding of systems science, forward-looking information, systemic risks, and the relationship between environmental change and human well-being. Accounting systems — both physical and monetary — are also important to inform policy and investment decisions, because getting the balance right between use, protection and enhancement of natural capital requires information on the current status of stocks and flows.[12][13]

Investment has an essential role in the transition to a green economy, in part because the systems that meet basic social needs such as water, energy and mobility rely on costly and long-lasting infrastructure. Investment choices can therefore have long-term implications for the functioning of these systems and their impacts, as well as for the viability of alternative technologies. Transitions depend in part on avoiding investments that lock in existing technologies, limit options, or hinder the development of substitutes.

Enormous amounts of capital are needed to finance infrastructure such as smart electrical grids, renewable energies, electrification of transport, and resource-efficient buildings. In addition to fiscal reforms, innovative financing mechanisms, such as the project bond initiative of the European Commission and the European Investment Bank, socially responsible investments (SRI), green bonds and sovereign wealth funds (SWF), are potential tools for supplying the needed funds.[14]

Designing actionable, credible and feasible green economy pathways can put Europe at the frontier of science and technology. But effecting the needed transitions will demand ingenuity, creativity, courage and a greater sense of urgency.

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Health and environment

The quality of Europe's drinking and bathing water have improved but air and noise pollution continue to cause serious health impacts. About 460 000 premature deaths were attributed to fine particulate matter in 2011. Further reductions in pressures may be offset by changing exposure patterns and vulnerabilities, linked to trends such as climate change, urbanisation and population ageing. This points to the need for more integrated approaches to addressing social, economic and environmental determinants of health.

Context

Good quality natural environments provide multiple benefits to health and well-being.[1] In contrast, air pollution, noise, poor quality water, chemicals, radiation, and environmental degradation cause diverse impacts on human health.

Understanding of the links between the environment and human health has evolved from perceiving them as isolated issues towards recognising the interdependencies between complex systems. Large-scale challenges such as climate change and biodiversity loss can have potentially wide-ranging, long-term, and irreversible effects on human health and well-being. Such challenges call for an approach that takes account of the linkages between human and animal health, environmental drivers, and the socio-ecological context of disease emergence.[1][2][3]

Europe's long-term policy increasingly adopts a more systemic perspective that links the environment, human health and well-being. The Roadmap to a Resource Efficient Europe, for example, includes targets on natural resources that provide for basic human needs.[4] Promoting good health and reducing inequalities is also an integral part of the EU's Europe 2020 growth strategy.[5][6][7]

One of the three thematic priority objectives set out in the EU's 7th Environment Action Programme is 'to safeguard citizens from environment-related pressures and risks to health and well-being'.[8] At the global level, the World Health Organization (WHO) and related United Nations (UN) processes address a range of environmental and climate-related challenges to health and well-being.[9][10][11][12][13]

Trends

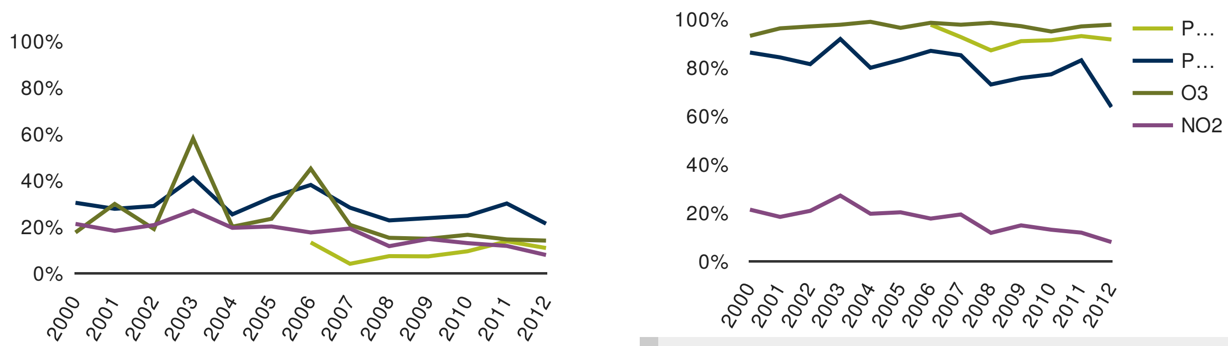
Knowledge gaps, uncertainties and shortages of data limit understanding of the complex interactions between human health, multiple environmental pressures, and social and demographic factors. This section focuses on some specific themes for which the EEA gathers information and has an assessment role, including air pollution, noise, and water quality. It concludes with a brief discussion of more systemic issues.

Air pollution

Air pollution remains a major environmental health risk in Europe, contributing to the burden of respiratory and cardiovascular diseases, lung cancer, and other health effects.[14][15]16] Despite improvements with respect to some pollutants, exposures to particulate matter, ozone and carcinogenic benzo(a)pyrene are of high concern. This is particularly evident using the estimates based on WHO air quality guidelines,[15] which are more stringent than EU air quality standards[17] (Figure 1).

In 2011, an estimated 458 000 premature deaths in 40 European countries were attributed to fine particulate matter.[18] There are no estimates of less severe but more widespread impacts of air pollution, such as use of medication or hospitalisations. Ambient air pollution, combustion processes, energy efficiency measures in buildings, consumer products, and human behaviour all affect the quality of indoor air. Since European citizens spend more than 90% of time indoors, coordinated efforts are needed to prevent the potential health effects of exposure to indoor air pollution.[19]

Figure 1: Urban population in the EU-28 exposed to air pollutant concentrations above selected EU limit and target values (left) and WHO air quality guidelines (right)



Data sources:
a. Eurostat. Gisco - Urban Audit 2012
b. EEA. AirBase - The European air quality database
c. EEA – Indicator CSI004

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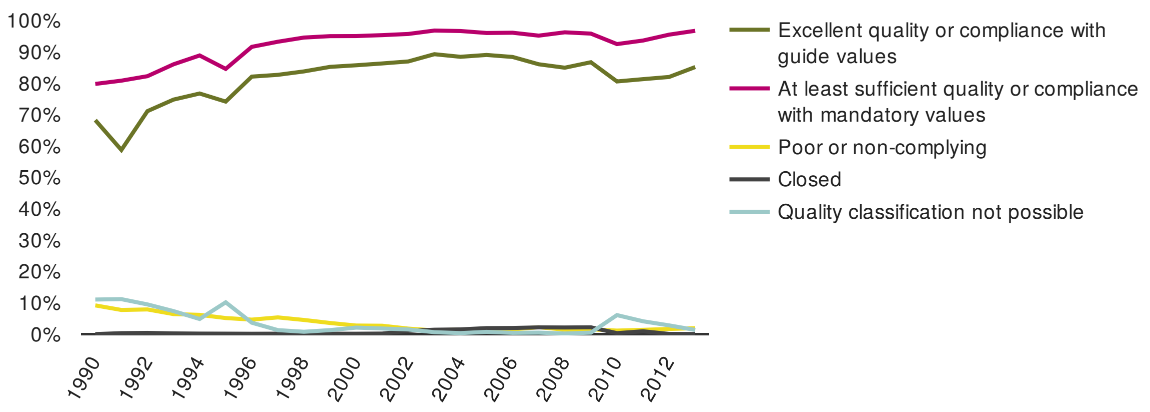
Note: For definitions of EU air quality standards and WHO guidelines, see CSI004.

Water quality

Progress in collecting and treating wastewater in the EU since the 1990s has contributed to a sizable improvement in bathing water quality (Figure 2), and reduced public health risks in parts of Europe.[20]

Figure 2: Quality of coastal bathing water in Europe



Data sources:EEA. Bathing Water Directive - Status of bathing water

Explore chart interactively

European Environment Agency

However, chemical pollutants, eutrophication, and harmful algal blooms continue to affect the quality of surface, ground, and marine waters,[21][22] potentially impacting human health. Water scarcity is also an emerging challenge. And both the quality and the quantity of water resources can be affected by climate change.[1][23]

Noise

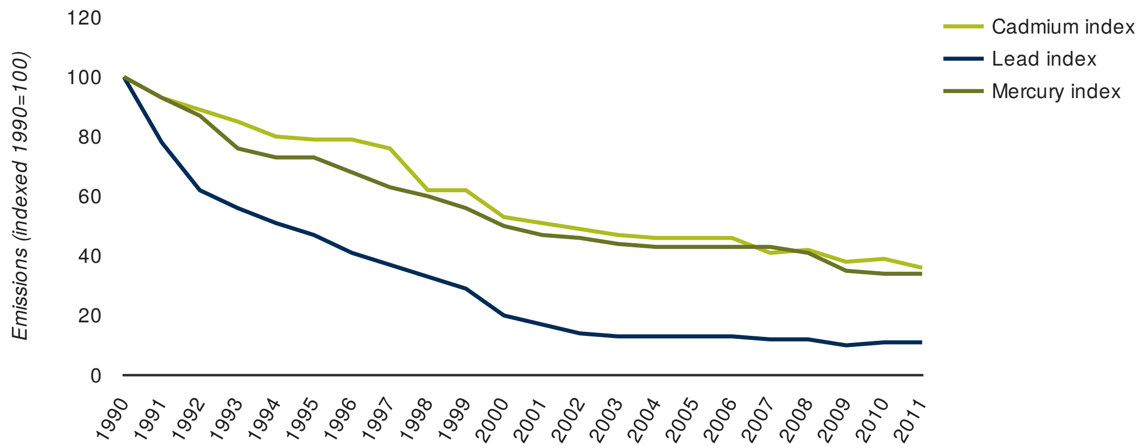
Environmental noise is a source of annoyance and has been linked to increased risk of cardiovascular diseases.[24][25] It is estimated that at least 125 million people in Europe were exposed to high levels of road traffic noise in 2011. And exposure to environmental noise has been estimated to contribute around 10 000 cases of premature deaths due to coronary heart disease and stroke each year, with almost 90% of the noise-related health impacts being associated with road traffic noise.[26]

Chemicals

European policy has been effective in addressing emissions and ambient concentrations of certain chemicals[27] (Figure 3), and horizontal chemical legislation (REACH)[28] aims to better protect the environment and human health. Persistent, bioaccumulative, and toxic chemicals are of particular concern, as are substances that can affect the hormonal system (endocrine disruptors).[1][29][30] The risks associated with pharmaceuticals in the environment, including antimicrobial resistance and endocrine disruption in wildlife and people, are increasingly recognised, with implications for precautionary action and wastewater treatment.[1][29][31][50]

Further efforts are needed to assess the health impacts of exposure to multiple chemicals from different sources, especially in vulnerable groups such as children. Current activities to streamline existing information on chemicals in the environment, including human biomonitoring data, should improve the knowledge base.[32]

Figure 3: Emission trends of heavy metals



Note: Data for Iceland, Luxembourg and Turkey was not reported.

Data sources:

a. EEA. National emissions reported to the Convention on Long-range Transboundary Air Pollution (LRTAP Convention)
b. EEA – Indicator APE005

Systemic issues

There is a growing recognition that major public health issues, such as cardiovascular and respiratory diseases, cancer, and obesity, result from the interplay of multiple factors, including environmental pressures.[1][33][34][35] The

European population's vulnerability and ability to adapt to environmental pressures depends on a variety of long-term trends.

For example, the population **age structure** shapes vulnerability to health risks. Although EU-28 average life expectancy at birth exceeds 80 years, the expected years lived without disability are below 62 years for both men and women.[36] The proportion of people aged 65 and over (EU-27) is projected to increase from 18% in 2011 to 30% by 2060,[37][38] further shifting disease burdens and increasing the contribution of disabilities.[39]

Another important trend is **urbanisation**. The proportion of Europe's population living in urban areas increased from 51% in 1950 to 73% in 2011, and is projected to reach 82% in 2050.[40] Environmental impacts on health and well-being may be particularly pronounced in urban settings, where multiple pressures coexist and affect large populations. Contrastingly, well planned urban areas that afford access to natural environments can deliver health and well-being benefits.[1] The EU Green Infrastructure Strategy[41] and improved spatial analysis can contribute to better urban development and spatial planning. Potential climate change impacts in urban systems also point to a need for dedicated adaptation measures.[42]

Health and well-being impacts of **climate change** are related mainly to extreme weather events and changes in the distribution of climate-sensitive diseases. Some regions and population groups in Europe are particularly vulnerable to these threats.[43][44] A very likely increase in the frequency and intensity of heat waves, particularly in southern Europe, is projected to increase heat-related deaths unless adaptation measures are implemented.[44][45] Heavy precipitation and flooding can have profound effects on mental health and welfare.[46] Anticipated climate change impacts on some diseases, including those transmitted by mosquitoes and ticks, highlight the need to improve response mechanisms.[47][48][49]

Prospects

Human health and well-being concerns are powerful drivers for environmental policy, but they are at present addressed in a dispersed way. Implementation of existing policies is likely to further reduce specific burdens, but broader and more integrated approaches to addressing social, economic, and environmental determinants of health are needed.[1]

Widening the policy focus to domains such as consumption and production, resource efficiency, natural capital, ecosystem services, and spatial planning would require a stronger multidisciplinary and multi-stakeholder dialogue to account for values and attitudes. Decision-making also needs a precautionary approach, which acknowledges uncertainties, especially for emerging issues such as nanotechnology.[50]

Human health and well-being ultimately depend on well-functioning ecosystems and the way we use natural resources.[9] The synergies and trade-offs resulting from close interdependencies between the core resources, such as food, water, energy and other materials indirectly affect human health and well-being, often through impacts on the environment.[51] In addition, the role of large-scale ecological and societal transitions for population health and well-being is increasingly recognised, influencing both health effects and the possibilities for public interventions to achieve a more sustainable society.[52]

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Hydrological systems and sustainable water management

Intensive agriculture, urbanisation, energy production and flood protection have altered European hydrological systems and freshwater habitats for decades. Climate change adds to these challenges (higher water temperature, more floods or water scarcity). Less than half of all water bodies have a 'good status'.

Full and coordinated implementation of water and nature legislation would restore aquatic habitats and foster water efficiency.

Context

Water bodies, their ecosystems and the land and terrestrial ecosystems within their catchments are intrinsically connected with each other and the downstream coastal and marine waters. Together they constitute a hydrological system which is exposed to any changes in water or land further upstream.

For decades humans have polluted and altered European inland waters to enable agriculture and urbanisation, produce energy, and protect against flooding. These activities resulted in poor water quality and altered habitats, with significantly severe impacts on the status of water ecosystems.

Objectives for water from the European Union's (EU) 7th Environment Action Programme (7th EAP),[1] together with those from its Biodiversity Strategy[2] and 'Blueprint to safeguard Europe's water resources',[3] are key components to maintain and improve the essential functions of Europe's water-related ecosystems including coastal and marine areas and to ensure they are well managed.

The natural capital of water ecosystems is highly intertwined and dependant on the way land and water is managed and how pressures from agriculture, energy, transport etc. are reduced within their respective policy areas or how adaptation to climate change is integrated into water management.

To meet the objectives of the Water Framework Directive (WFD)[4] (i.e. all water bodies to have good status by 2015), river basin authorities will have to address the pressures affecting water bodies. Reducing pressures will enable the freshwater ecosystems to recover and place them in a better position to cope with other challenges such as climate change.

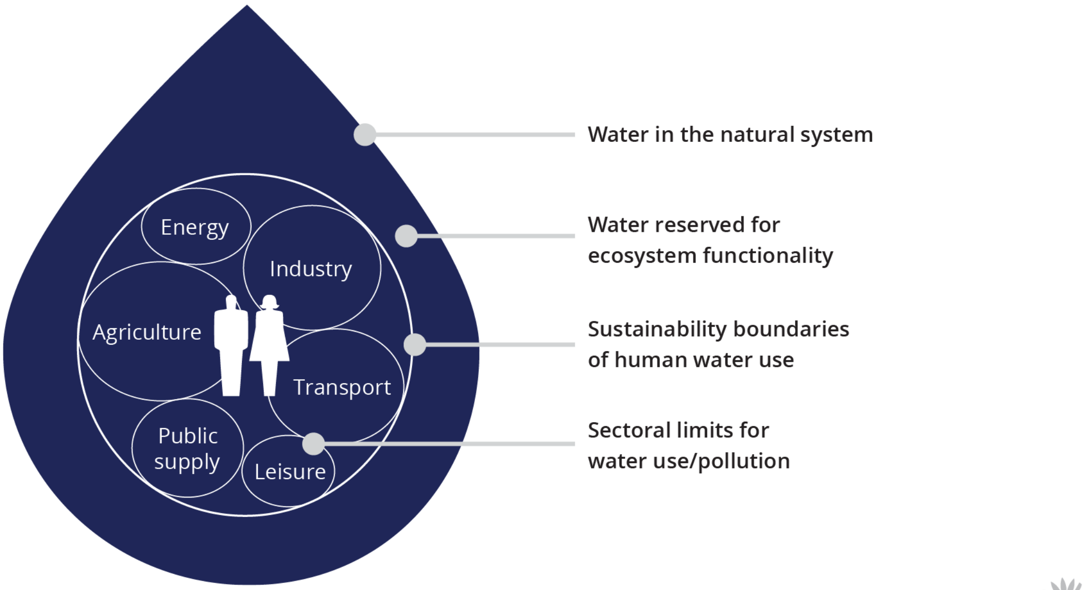
Key trends

Pressures from water pollution, over-abstraction and structural change all effect water ecosystems in a systemic way throughout the whole hydrological system. They are caused by activities in several economic sectors.

Agricultural production has become increasingly intensive with high inputs of fertilisers and pesticides. This in turn continuously results in pollutants loads to the water environment. Agricultural activities (irrigation, drainage etc.) are in many places altering freshwater ecosystems. Water storage and abstraction for irrigated agriculture have changed the flow regime of many river basins and lowered groundwater levels, particularly in southern Europe. In northern Europe, many lowland agricultural streams were straightened, deepened and widened to facilitate land drainage and to prevent local flooding.

Policies and demand for increased food production and bioenergy crops, including irrigated agriculture, increase the demand for water. Together with reduced water availability due to climate change, they also further worsen the extent and severity of water scarcity in some parts of Europe.

Figure 1: Sustainable water allocations to ecosystems and competing users



Previous reforms of the CAP[5] have resulted in a general decoupling of agricultural subsidies from production and the implementation of a cross-compliance mechanism. This mechanism means that farmers must comply with a set of statutory management requirements, including those that relate to the environment. A range of agricultural measures such as the improvement of manure storage, the use of cover crops, riparian buffer strips, and wetland restoration, will play a key role in addressing pressures from agriculture if widely implemented. The new reform of the CAP provides an opportunity to further strengthen water protection.[6]

Urban water management has over many years used rivers only as extensions of the sewage system. Urban rivers have been covered, river banks have been heavily developed, and lakes have been isolated or even filled. Impervious sewage collection systems have changed the water flow regime.

Flood protection and defences relied in the past mostly on 'hard' infrastructure including bank enforcements and dykes, water storage reservoirs, and drainage through straightening rivers and pumping canals.

Some activities related to **energy production** such as hydropower, use of cooling water and growing energy crops result in pressures on water management.

More than 25 000 hydropower plants in Europe have been identified as one of the main drivers affecting the status of rivers, resulting in the loss of connectivity, altered water flow and sediment transport.

In several EU Member States, an increase in hydropower generation is needed to achieve the 2020 Renewable Energy Directive[7] target of 20% of energy production based on renewables sources. This increase in generation can be achieved by increasing efficiency in hydropower generation at existing sites but also by building new hydropower plants. It is important to ensure that existing and forthcoming EU policies to promote hydropower are compatible with the WFD and clearly consider the impacts on freshwater ecosystems.

Around 40 000 km inland waterways play an important role in the transport of goods in central Europe. These waterways are generally seen as more environmentally friendly than road transport. However, navigation activities and/or navigation infrastructure works are typically associated with changes in the morphology (channel maintenance, dredging, channelisation and straightening, bank reinforcement) and hydrology, spread of invasive alien species and pollution (oil spills and anti-fouling paints and other substances used to prevent the attachment of unwanted organisms to ships).

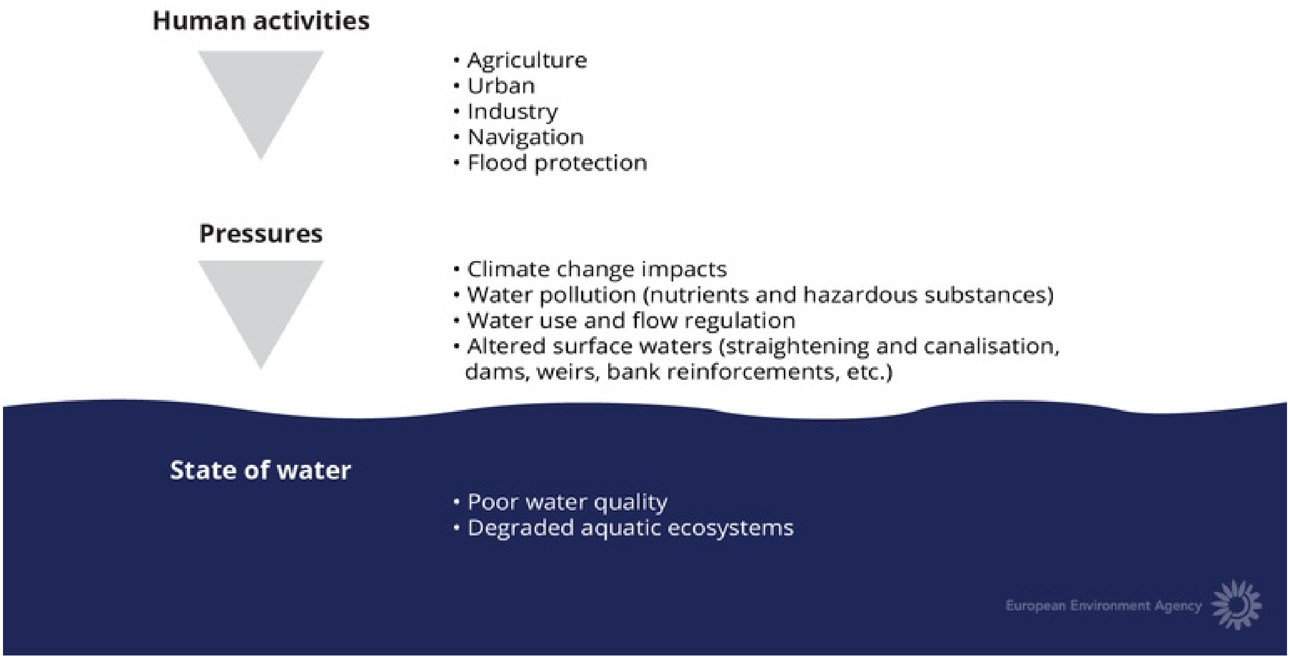
Thus, despite the advantage of these sectors and policies for society, there is a need to strike a balance between the benefits and the impacts on freshwater ecosystems.

Prospects

Until the last 20 to 30 years, the main focus of physical water management in many parts of Europe was on providing flood protection, facilitating navigation, and ensuring the drainage of agricultural land and urban areas. Nowadays, water management increasingly includes ecological concerns, working with natural processes.

This is in line with the objective of the 7th EAP 'to protect, conserve and enhance the Union's natural capital'. It is also consistent with Target 2 of the EU's Biodiversity Strategy that aims to ensure maintenance of ecosystems and their services by establishing green infrastructure and restoring at least 15% of degraded ecosystems by 2020. This target means that degraded freshwater ecosystems must also be restored.

Figure 2: Relationship between driving force, pressures and the state of water



Restoring freshwater ecosystems such as 'making room for the river', river restoration or floodplain rehabilitation has multiple benefits for the water ecosystems. The EU-wide Green Infrastructure strategy[8] includes rivers and floodplains as important elements.

The strategy aims to reconnect existing nature areas and improve the overall quality of ecosystems. It also includes natural water retention measures (NWRMs)[9] that aim to increase soil and landscape water retention and groundwater recharge. These measures help deliver equally the WFD objectives and the EU Biodiversity Strategy's restoration target.

Managing water in a green economy means using water in a sustainable way in all sectors and ensuring that ecosystems have the quantity and quality of water needed to function. It also means fostering a more integrated and ecosystem based approach involving all relevant economic sectors and society. This integration throughout the river basin is enhanced by, for example, public participation and stakeholder involvement.

Urban rivers have become increasingly important in the planning of urban ecology, green infrastructure and green areas in European cities in recent years. River and lake restoration, in connection with other projects like rainwater harvesting and wetland spaces for city development and urban planning, are offering situations with mutual benefits; improving flood control and ecological functions, while offering recreational value and raising the quality of life in urban areas.

To avoid negative impacts from future navigation activities, close cooperation between the navigation sector and water and nature managers is required. The European Commission has issued guidelines on inland navigation and nature protection to assist the sector in applying EU environmental legislation.[10]

The main challenge in managing water resources efficiently is to meet the reasonable needs of the different water users, while leaving enough water with the appropriate hydrological regime in the environment to conserve freshwater ecosystems (Eflows). Where water resources are overexploited or the hydrological regime is altered e.g. by dam operations, Eflow requirements impose a change of the hydrological regime and/or a reduction (a cap) for water abstractions by sectors. Together with the European Commission, the EEA is developing water accounts at the river basin level to inform the aspect of over abstraction and the need for the increase in water use efficiency.

In the coming years, climate change will increase water temperature and the likelihood of flooding, droughts and water scarcity. There are many indications that water bodies already under stress from pressures are highly susceptible to climate change impacts, and that climate change may hinder attempts to restore some water bodies to good status. Here the establishment of good ecological and healthy ecosystem conditions are extremely important. Good ecological status will also increase the resilience of the ecosystem, i.e. its capability to absorb additional adverse pressures.

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Industry

The environmental performance of European industry has improved in recent decades. However, the sector is still responsible for significant amounts of pollution to air, water and soil, as well as generation of waste.

While legislation has delivered concrete achievements in reducing pollution, a transition to a greener European industrial sector will require integrated approaches, with stronger control of pollution at source, incentives to change operating practices and use of innovative technologies.

Context

Industry is a key component of Europe's economy, but it is also a source of pollution. For many years, environmental regulation has limited the adverse impacts of this pollution on human health and the environment. The EU policies currently used to limit industrial pollution include the following:

- The **Industrial Emissions Directive** (IED)[1] defines the obligations for some 50 000 large industrial installations to avoid or minimise polluting emissions to the atmosphere, water, and soil. The IED also requires these installations to reduce waste.
- The **European Union's Emissions Trading System** (EU ETS)[2] reduces greenhouse gas (GHG) emissions from more than 12 000 power generation and manufacturing installations in 31 countries[3] as well as from aviation. The ETS covers around 45% of the EU's greenhouse gas emissions.
- The **Water Framework Directive**[4] requires Member States to progressively reduce water pollution from a family of pollutants defined as 'priority substances'. It also requires Member States to cease or phase out emissions, discharges, and losses of a more dangerous family of pollutants defined as 'priority hazardous substances'.
- The **Urban Waste Water Treatment Directive**[5] protects the environment from the harmful effects of discharges from urban wastewater and certain other industrial sectors.

Public access to information on industrial pollution has significantly improved in recent decades. In particular, the European Pollutant Release and Transfer Register (E-PRTR)[6] provides a comprehensive register of pollution released by more than 30 000 individual facilities across 33 European countries.

Key trends

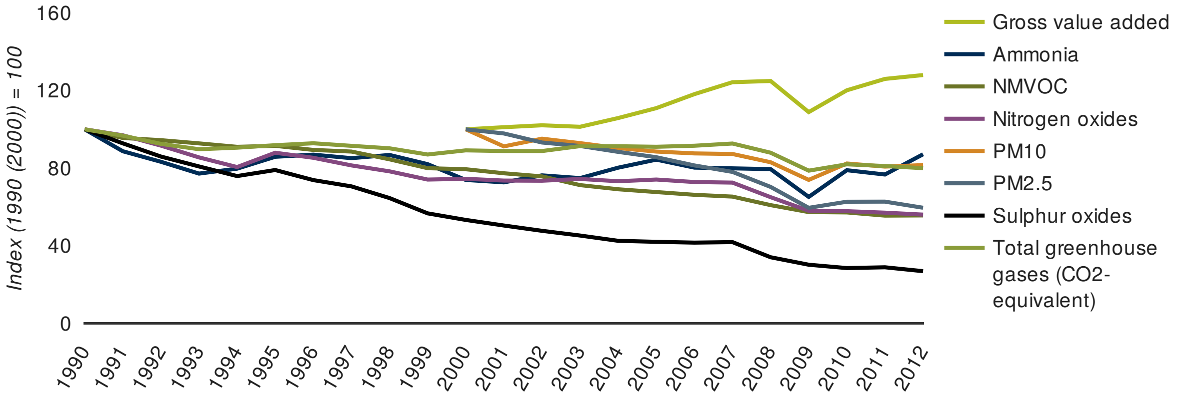
The environmental performance of European industry has improved in recent decades. However, the sector still remains a major source of environmental pollution.

Emissions of greenhouse gases and air pollutants

Industry contributes significantly to the emissions of many important air pollutants and greenhouse gases. In 2012, industry accounted for around 85% of sulphur dioxide emissions (SO_2), 40% of nitrogen oxide (NO_X), 20% of fine particulate matter ($PM_{2.5}$) and of non-methane volatile organic compound (NMVOC) emissions, and 50% of total greenhouse gas emissions in the EEA-33 countries.[8][9] Emissions of these pollutants by industry have decreased since 1990 (Figure 1), while the productive capacity of the industry sector — in terms of gross value added (GVA)

— has increased. However, emissions from industry are not fully decoupled from economic activity: for most pollutants, there was a significant decrease in emissions in 2009 corresponding to the global economic downturn that year.

Figure 1: Emissions of air pollutants and greenhouse gases, and gross value added (GVA) from European industry (EEA-33)



Note: Emissions included are from the energy production and distribution, energy use by industry, and industrial processes sectors. NMVOC: Non-methane volatile organic compounds; 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.

Data sources: a. Eurostat. National Accounts by 10 branches - aggregates at current prices
b. EEA. National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism

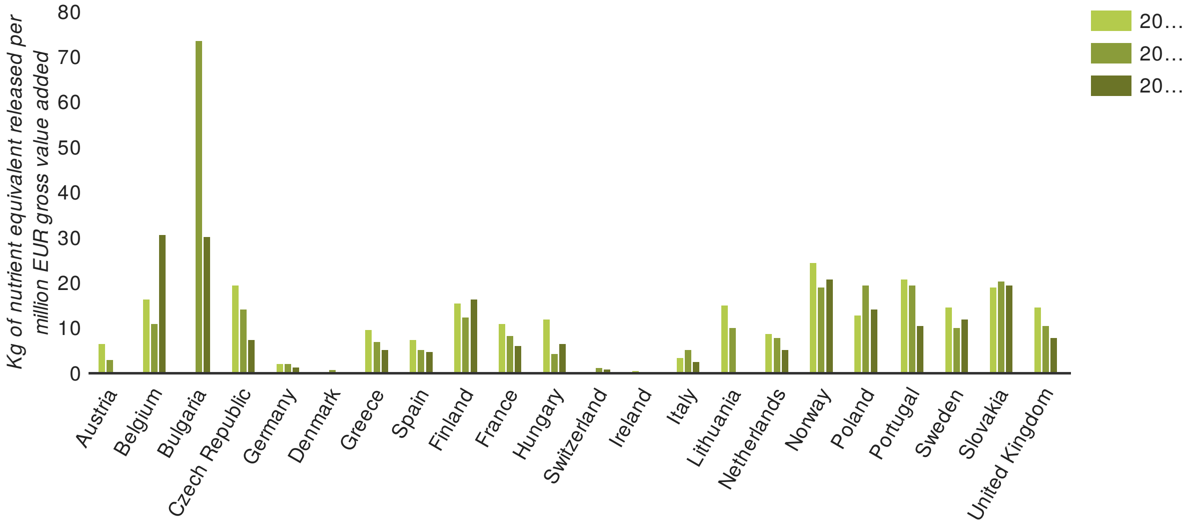
Emission reductions were driven by stricter environmental regulation, improvements in energy efficiency and pollutant abatement technologies, and a general tendency for European industry to move away from certain heavy and more polluting types of manufacturing. An example of improvements in pollutant abatement technology can be seen in the case of large combustion plants (LCPs). Emissions of SO_2, NO_X and dust per unit of energy input in large combustion plants under the EU LCP Directive[10] have reduced significantly, falling by 49% for SO_X, 25% for NO_X, and 54% for dust over the period 2004 to 2009.[11]

Between 2008 and 2012, the cost of damage to health and the environment from air pollution from the 14 000 most-polluting facilities in Europe was estimated at between EUR 329 billion and EUR 1 053 billion. A small number of facilities caused the majority of these damage costs: 50% of the costs occurred as a result of emissions from just 147 facilities (1% of these facilities).[12] Such air pollution-related damage costs do not include costs for all impacts caused by industrial pollutants. Small facilities can also be the source of significant adverse impacts at the local scale.

Releases to water

Industry, including manufacturing plants and wastewater treatment plants, is responsible for large pollutant loads discharged to water. Over the last 30 years, the amount of pollutants released from such sources to water has progressively decreased. However, pollution caused by inadequately treated wastewater is still an important source of pollution in some areas. Emissions to water include heavy metals, organic pollutants, suspended solids, and organic matter, all of which can harm the ecological and chemical status of water bodies. Figure 2 shows the varying 'emissions intensity' of nutrients released to water from manufacturing industries between 2004 and 2010.

Figure 2: Nutrient releases to water — emissions intensity of manufacturing industries



Note: Emissions intensity of nitrogen and phosphorus nutrients (NACE, division 10-33). Data from food industry is not included for Norway due to discrepancy between coverage for economic data (GVA) and emissions data for facilities where main activity is intensive aquaculture.

Data sources:

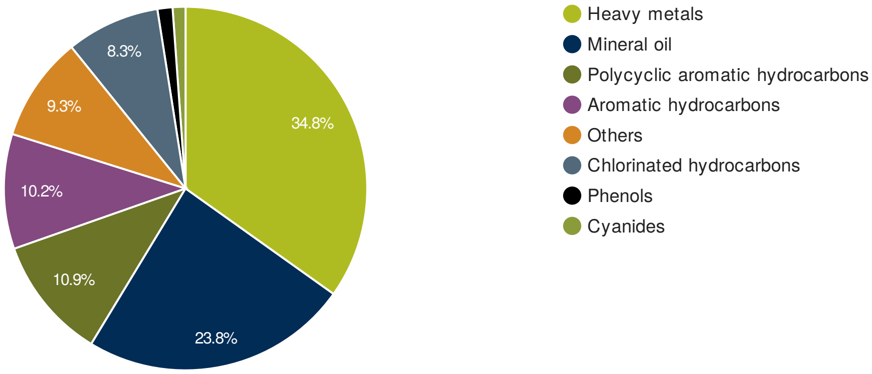
a. DG ENV. The European Pollutant Release and Transfer Register (E-PRTR), Member States reporting under Article 7 of Regulation (EC) No 166/2006

b. Eurostat. National Accounts by 31 branches - aggregates at current prices c. EEA – Indicator WREI003

Soil contamination from industry

Industry is a major contributor to soil contamination. There are an estimated 2.5 million contaminated sites across the 39 EEA member and cooperating countries. The manufacturing sector is responsible for around 60% of the contaminated sites.[13] Figure 3 shows the main contaminants affecting soil in and around contaminated sites across Europe.

Figure 3: Contaminants affecting the solid matrix (soil, sludge, sediment) (2011)



Data sources: a. JRC. Eionet NRC Soil data collection on contaminated sites b. EEA – Indicator LSI003

Explore chart interactively

European Environment Agency

Waste

The industrial sector in very broad terms (i.e. non-household sources) is responsible for about 90% of the 2.5 billion tonnes of waste generated (including mineral waste) every year in the EU. The most important sectors in terms of generation of industrial waste are: construction (34%), mining and quarrying (27%) and manufacturing (11%).[14]

Prospects

A future transition to a greener European industrial sector requires an integrated approach, which strengthens control of pollution at source, and provides incentives to change operating practices and to implement new innovative technologies.

Policymakers consider it a priority to improve Europe's knowledge base on industrial pollution. Consistent with the Aarhus Convention,[15] the 7th Environment Action Programme[16] includes an objective of making information better available on the implementation of pollution control legislation. The IED requires that Member States provide improved consolidated information on industrial installations.[17]

In the short term, strengthened legislation will help to better control emissions from industry. The IED will deliver more stringent controls on how industry can operate than the former Industrial Pollution Prevention and Control (IPPC) Directive. These controls will be based on the Best Available Technique (BAT) principle, and cover a broader range of industrial activities than the IPPC Directive. The IED has also identified as a priority the need to address previously unregulated sources of emissions. An example are medium-sized combustion plants (MCPs), which the European Commission's recently proposed Clean Air Policy Package for Europe[18] has now proposed to regulate.[19] The proposed MCP Directive should deliver significant annual emission reductions of the key air pollutants SO_2, NO_X and PM.[20]

There is also significant potential to reduce emissions of air pollutants from large combustion plants (LCPs). 2015 NO_X emissions could, for example, be 36% lower than in 2009 if all plants were to meet the new IED emission limit values, and could be 69% lower if LCPs were to achieve the more stringent BAT-associated emission levels.[21] SO_2 and dust emissions could also be significantly reduced if all LCPs met the new IED emission limit values.

For GHG emissions, the EU ETS was designed as a key tool to drive the introduction of low-carbon technology in the industrial sector (see SOER 2015 briefing on climate change mitigation). During the third phase of the EU ETS (2013–2020), the EU-wide cap will decrease to ensure that by 2020 GHG emissions from facilities covered by the scheme will be 21% lower than in 2005. Additional reforms to the EU ETS to drive further emission reductions beyond 2020 (phase 4) have also been presented.[22] These reforms would further decrease emissions of GHGs from installations to around 43% below 1990 levels by 2030.

In the longer term, the Commission's Roadmap to a Resource Efficient Europe[23] outlines how Europe's economy might become sustainable by 2050. It proposes ways to increase resource productivity and decouple growth from resource use, while avoiding 'lock-in' to any particular technology, providing a pathway to cut GHG emissions to 80% below 1990 levels by 2050.

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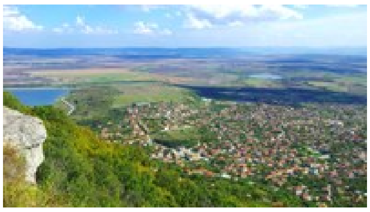
Land systems



'Land take' dominates in Europe, with artificial areas and agricultural intensification, resulting in land degradation, worsened by high fragmentation on 30% of land area. Conflicting demands on land impact significantly on the land's potential to supply key services.

Limiting 'land take' is already an important policy target at national or sub-national level. Balancing land-recycling, compact urban development, place-based management and green infrastructure will provide positive effects.

Context

Across Europe and the world, accelerating rates of urbanisation, changing demographic and diet patterns, technological changes, deepening market integration, and climate change place unprecedented demands on land. Yet the availability of land is finite. This imbalance is unsustainable. Land must therefore be 'governed' in such a way as to preserve its potential to deliver goods and services.

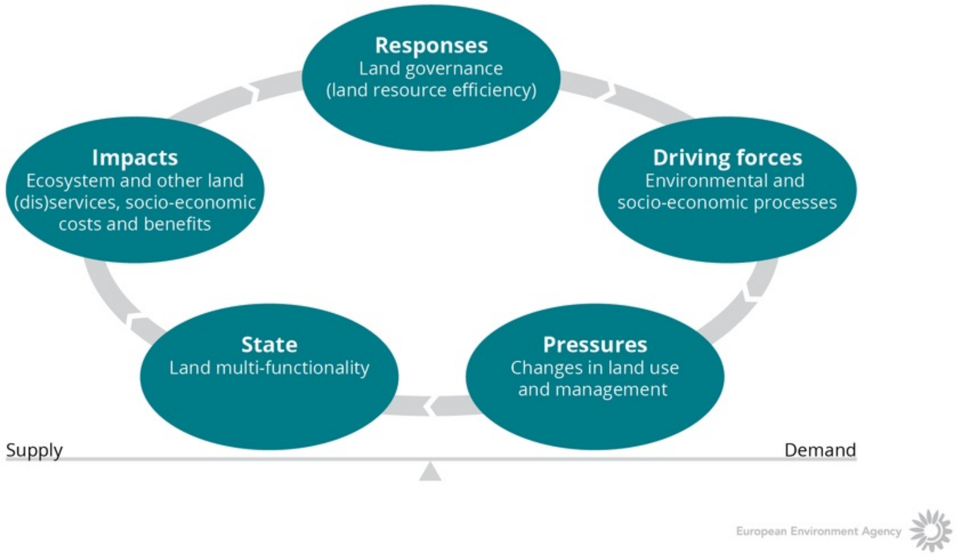
These services are lost or weakened (due to disrupted water and nutrient cycles) when land is sealed for the development of housing, industry, commerce, or transport infrastructure. Some forms of land use and management, e.g. driven by agricultural intensification and abandonment, result in degradation processes, like soil erosion, soil organic matter decline, habitat loss, or reduced nutrient cycling. Land fragmentation exacerbates these effects.

Such negative impacts can be referred to as dysfunctions and disservices and can further affect the economy or human health. They ought to be a cause of concern as the land medium integrates three spatial dimensions: the two horizontal ones of land cover/land use, and the third, the vertical one of soil and the underlying geology. Soil properties thus largely define the quality of land. The land system then embodies the relationship between human activities on land, socio-economic conditions, the natural environment, and the systems of governance that manage these interactions.[1] Linking its components through cause and effect, it thus refers to the chain of driving forces, pressures, state, impacts, and responses to which the land is subject (Figure 1).

Following this logic, land use (by sectors/policies), land management (indicating a different use intensity), and soil characteristics jointly define the land's functions.

Addressing the issues raised, the European Union's (EU) 7th Environment Action Programme (7th EAP)[2] aims to ensure that by 2020 land is managed sustainably. Concretely, this commitment requires coordinated governance and integration of environmental considerations (including water management and biodiversity protection) into territorial planning decisions on land use. Land policy targets would also help achieve this goal, and the 7th EAP specifically suggests a target of 'no net land take' by 2050. This resonates with the UN Rio+20 Summit[3] call for a land-degradation-neutral world in the context of sustainable development, a goal to which the EU has subscribed.

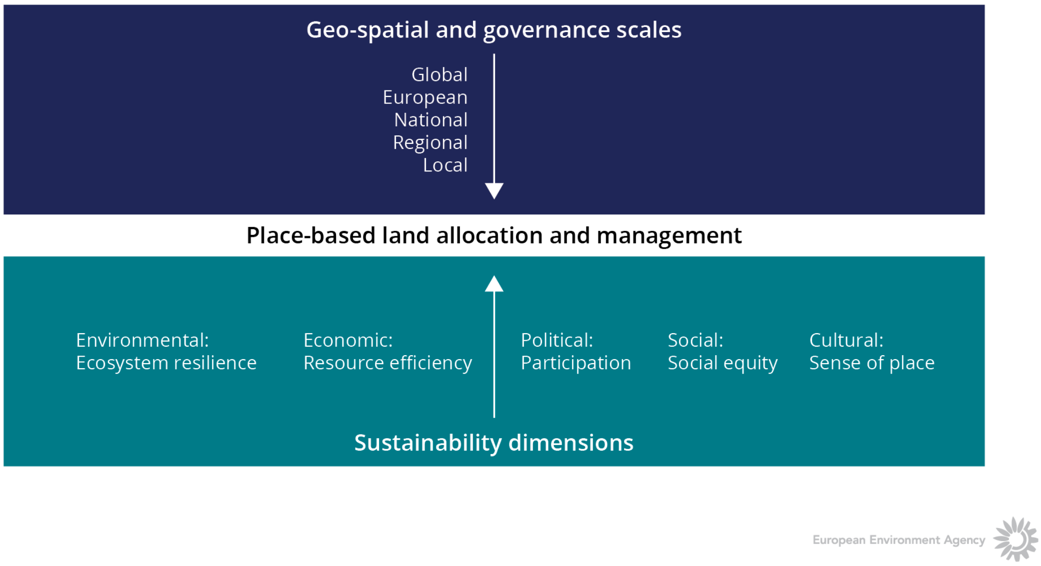
Figure 1: The land system



Place-based[4][5] land allocation and management is needed in order to integrate land functions across multiple sectors, sustainability dimensions, and governance levels (global, EU, national, regional and local) (Figure 2). Interaction between various actors is central to such a cooperative process, also a key driver for territorial cohesion as described in the Territorial Agenda of the EU.[6]

The EU policy agenda can thus set a frame to promote place-based planning and solutions that make the most of an area's inherent features. Land decisions should therefore reflect such solutions, while being adapted to the local conditions and assets, including soil, terrain, climate, and communities' knowledge.

Figure 2: Dynamics in the land system guiding land allocation and management



Key trends

Land-cover change in Europe is not dominated by agriculture demand as it is in other parts of the world.[7] Accounting of land in Europe based on the most recent full data set shows that artificial areas[8] gained most land between 2000 and 2006 (2.7%). On the other hand, semi-natural vegetation and wetlands, as well as agricultural land and open spaces/bare soils, showed slightly decreasing trends. Meanwhile, forested land and water bodies showed very small net increases.[9][10] Trends and figures obviously differ between countries (or other areas of spatial aggregation).

Land use and land management changes over the period 1990 to 2012 confirm these trends, even though the rate of increase in forest areas appears to have slowed down towards the end of this period.[11] Increasing management intensity, land use outside the EU (e.g. through consumption of imported goods[12][13]), and farmland abandonment are the main drivers.[11]

The increased share of artificial areas is essentially the result of 'land take',[14] close to half of which was driven by demand for housing, services, and recreation between 2000 and 2006.[10] While land thus provides space for human activities, land take also implies substituting the original (semi-)natural land cover to varying degrees with impervious surfaces. Thus, the connection with natural cycles is lost and the services delivered by soils, including those important in the face of climate change mitigation and adaptation, are curtailed (see also SOER 2015 briefing on soil). Between 2000 and 2006, almost half of the land take came at the expense of arable farmland and permanent crops (EEA Land take indicator). Land take thus also puts pressure on the biomass production potential of the land resource. Further, development of transportation infrastructure and built-up areas leads to landscape fragmentation. Fragmentation has a number of ecological effects, such as the decline and loss of wildlife populations, an increasing endangerment of species, changed water regimes, and a change in recreational quality of landscapes.[15]

General trends of annual land take[16] in Europe showed a slow-down in the periods 1990 to 2000 and 2000 to 2006: from 1 078 km^2/year to 914 km^2/year (based on data for 28 countries). A higher-resolution, new data source suggests that artificial surfaces are underestimated. For example, the change rate in impervious areas,[17] indicates an increase by 1 252 km^2/year between 2006[18] and 2009[19] for the same set of countries.[20] Even though not directly comparable, the land take data may indicate a slowdown of urban development on the outskirts of cities and the countryside, leading towards an increase in density in urban areas, suggested by the impervious area increase. This is an aggregated European trend, which hides diverging patterns between different territorial units. These patterns may reflect different approaches to spatial planning. European averages also obscure trends in sensitive zones: e.g. in coastal areas the annual rate of urban development (0.66%) was higher than the average for all areas (0.52%) between 2000 and 2006.[21]

Preliminary results for 20 countries indicate that, compared to 2000–2006, overall land cover change increased during 2006–2012. For the same countries, artificial surfaces increased faster than in 2000–2006, by 2.1%.[22]

Prospects

Limiting land take is already an important land policy target at national or sub-national level.[23] In order to avoid increases in land take, incentives for 'land recycling' are worth pursuing. Land recycling refers to regeneration of land that was previously developed, but is currently not in active use or available for re-development.[24] Between 1990 and 2000 2.5% of new artificial surfaces were created on land already used or destined for development (excluding construction sites) (based on data for 24 countries).[25] Between 2000 and 2006 this fraction decreased to 2.0%. However, these figures include densification of artificial land, rather than solely indicating recycling.

Potentially negative land-use impacts can also be mitigated: compact urban development and investment in urban 'green infrastructure'[26][27] have positive effects on the delivery of ecosystem services.[28] A study of this issue concluded that 'economic growth and Cohesion funds can, but do not necessarily have to be detrimental to the environment as long as smart spatial planning policies and recommendations are considered at different territorial scales, and more efficient land use and investment in green infrastructure is encouraged'.[28]

Moreover, in some cases, the many functions embedded in the land resource can be delivered simultaneously and lead to synergies. For example, extensively-managed permanent grassland not only supports nutrient cycling but can also reinforce existing connectivity between areas with biodiversity value. In other cases, alternative uses for the same piece of land have to be considered, leading to trade-offs. The competition for land between food and bio-fuel production has become a well-known example.

Land resource efficiency seeks an optimum level of land use and management in establishing appropriate shares between the different services provided by land. Policies and related targets would be helpful in making decisions to reach land resource efficiency, so as to strike a balance between the demand for — and supply of — the finite land resource. Accordingly, indicators underpinned by robust data collection are required to measure progress in resource efficiency.[29]

The estimates presented in this fiche are based on voluntary monitoring of pan-European data.[30] They therefore only give an aggregated representation of land issues and challenges in national or sub-national contexts on the one hand, and responses to these challenges and dysfunctions on the other hand. It is important to develop a consistent approach to monitoring the different dimensions of land in a timely manner. The resulting data sets should meet the requirements of both European and national levels (developing land strategies), and of local governments (implementing planning policies). The impact of European land use and management (whether driven by EU policies or not) on land take and degradation in third countries should also be considered.

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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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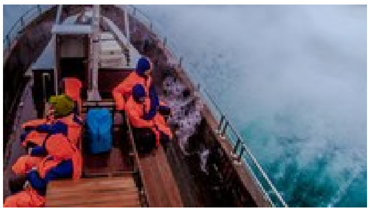
Maritime activities



Exploitation of European seas and coasts is increasing as new industries emerge and traditional ones move further off-shore. The main pressures include: extraction of species and genetic resources, seafloor exploitation, pollution and the spread of non-indigenous species.

In calling for an ecosystem-based approach, the EU's Blue Growth Strategy recognises the balance that must be achieved between 'use' of the sea and achieving the objective of 'good environmental status' by 2020.

Context

European marine regions range from open oceans to almost entirely land-locked seas. Each sea is shared by a great many people, cultures, and activities with dependencies that can stretch back for millennia. They are also the home to thousands of species of plants and animals.

Marine regions have long been drivers of economic growth, providing natural resources and access to trade and transport, opportunities for recreation, etc. Maritime activities today remain essential to the economy and to society in general, with high expectations for future growth.[1] The table on European maritime activities and potential environmental issues provides an estimate based on best available resources, but should be considered with caution given the significant uncertainties of the socio-economic data.

Preventing or reducing environmental damage and achieving sustainable use of the marine environment remain a challenge. Addressing it should be key for Europe's development given the services and benefits that healthy oceans can deliver.[2][3][4]

A number of European Union (EU) policy initiatives thus focus on the sustainable exploitation of marine resources. These include the Common Fisheries Policy (CFP) and the Integrated Maritime Policy (IMP). The IMP covers maritime spatial planning (MSP), which aims to provide a sustainable allocation and development of different sea uses bringing in line economic, social and environmental concerns (as covered by the recent EU Directive on MSP), and the EU's Blue Growth agenda. The Marine Strategy Framework Directive (MSFD) and its ecosystem-based approach to management provide a platform and guidance for balancing the use of the seas with the need to keep them healthy. The EU Biodiversity Strategy requires achieving healthy commercial fish stocks and avoiding significant adverse impacts on other stocks, species and ecosystems.

It is also recognised that EU coastal areas require attention in regard to adaptation to climate change in an effort to protect human welfare (EU Strategy on adaptation to climate change).

Key trends

The use of the seas and coasts has increased as traditional industries grow and as new industries emerge. These industries are essential to the European economy and society with an estimated gross value added (GVA) of at least EUR 460–485 billion and employ at least 6.6–7 million people (see table on European maritime activities and potential environmental issues).[5]

A number of maritime activities are in the early stages of growth including offshore renewable energy production (output increased by 21.7% (MW) between 2003–2008), installation of cables and pipelines, mineral mining and extraction of genetic resources.[5] Other more consolidated maritime activities are also experiencing growth. Maritime transport of freight is expected to grow between 3% and 4% for goods handled per annum. Industries such as shipbuilding and port operations are expected to grow in the next decade. Coastal tourism and recreation are important motors of the European blue economy, with significant added value and employment.[6]

Other maritime activities are experiencing a stable situation or decline, but remain important for the value and jobs they provide. Total catches in European fisheries have been decreasing from 6.9 million tonnes in 2001 to 3.5 million tonnes in 2011.[7][8] Important progress is seen in the number of fish stock fished at more sustainable levels in the North-East Atlantic and the Baltic Sea though unsustainable fishing practices like bottom-trawling remains.

Aquaculture production is levelling off in Europe. Oil and gas extraction is declining in the North Sea and it decreased by 4.8% GVA in the period 2003–2008 in Europe as a whole.[5] The sector remains a vital part of the economy, as new fields are discovered in the Barents Sea and Mediterranean Sea.

The main direct human pressures affecting European seas can be attributed to several of these activities and include: selective extraction of species (i.e. fisheries), seafloor damage, pollution by nutrient enrichment and contaminants, and the spreading of non-indigenous species.

Coastal eutrophication can result from excess nutrients from agriculture, forestry and municipal waste water discharge. A reduction in nutrient levels are being seen in the North-East Atlantic Ocean and the Baltic Sea.[9][10]

Contaminants are widespread in the marine environment, originating from untreated waste water, port activities and other areas. A downward trend is seen in the North-East Atlantic for lead and lindane, among others. An upward trend is seen in the Mediterranean Sea for mercury and lead.[11] The introduction of non-indigenous species is increasing in European seas through shipping, the Suez Canal and to a much lesser degree aquaculture.

Increasing amounts of marine litter — mostly coming from land-based sources — are ending up in the seas.[12] Underwater noise that results from activities such as the establishment of offshore construction or shipping is also of growing concern.

It is difficult to determine the whole range of specific interactions between these activities, their pressures and their cumulative impacts. However, evidence shows that they have induced large-scale changes on marine ecosystems, including areas with no oxygen, collapse of fish populations and loss of biodiversity.[13]

Climate change is the main indirect pressure on the marine environment leading to increased sea surface temperature and acidification. The combined effects of these physical impacts decrease the overall resilience of marine ecosystems and makes them even more vulnerable to other pressures, such as nutrient enrichment.[14]

Prospects

As land-based sources of natural resources are being depleted and available space on land is occupied, our attention increasingly moves towards the sea. This situation has created an opening for what the European Commission has referred to as Blue Growth. This concept acknowledges Europe's strong maritime heritage and will look to provide guidance and solutions to harness potential of the seas for jobs and economic growth.

The European Commission launched its Blue Growth Strategy in 2012 as a contribution to the Europe 2020 Strategy for smart, sustainable and inclusive growth. The Blue Growth Strategy will look towards collaboration between Member States and industry on the development of offshore renewable energy, coastal tourism, seabed mining and 'blue' biotechnology[1] along three components:

1. specific integration of policy measures, with focus on improving access to information about the sea, maritime spatial planning and maritime surveillance;
2. sea basin strategies to promote sustainable growth that take local factors into account;
3. a targeted approach towards specific activities to utilise their full potential.

Blue Growth may have great potential, but only if the right balance is given to sustainability challenges. This is especially true given the current levels of marine environmental degradation. The Blue Growth Strategy is recognising the dual challenge of supporting sustainable use of the sea alongside achieving a healthy status for the sea. For example, the need to reduce greenhouse gases has already steered the development of offshore renewable energy installations. However, as many activities are expected to increase significantly over the next decade it is important to better understand and account for the interactive and cumulative effects from past, present and future human activities acting upon the state of marine ecosystems.

A number of policy and societal sustainability challenges exist: How to achieve human exploitation within the sea's ecological limits in order to ensure long-term ecosystem health and resilience? How to move from prioritising short-term economic gains to sustainable resource use?

While climate change mitigation requires regional action and global cooperation, some of the remaining, more direct, sectoral or point source pressures can be addressed directly by the EU through its policies and legislation. However, sustainability challenges will remain unless smart and innovative solutions are developed and implemented at a rate that coincides with increasing exploitation of the seas. Solutions that require, as a pre-requisite, the implementation of the MSFD ecosystem-based approach to the management of human activities.

Future solutions will need to better acknowledge the connections between societies and marine ecosystems as well as between human well-being and ecosystem services across regional and European scales. They will have to take into account the cumulative pressures within and across sectors, while respecting the regional differences of our seas. Lastly, they will have to better recognise the multiple EU policy objectives influencing the use of and the health of the sea.

A key challenge in the coming decade will be to steer policy expectations for Blue Growth towards the EU policy visions of establishing a circular green economy and living well within the ecological limits of the sea. Ecological limits should be respected if the loss of biodiversity is to be halted and preserve marine ecosystems and the potential services we could derive from them 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]

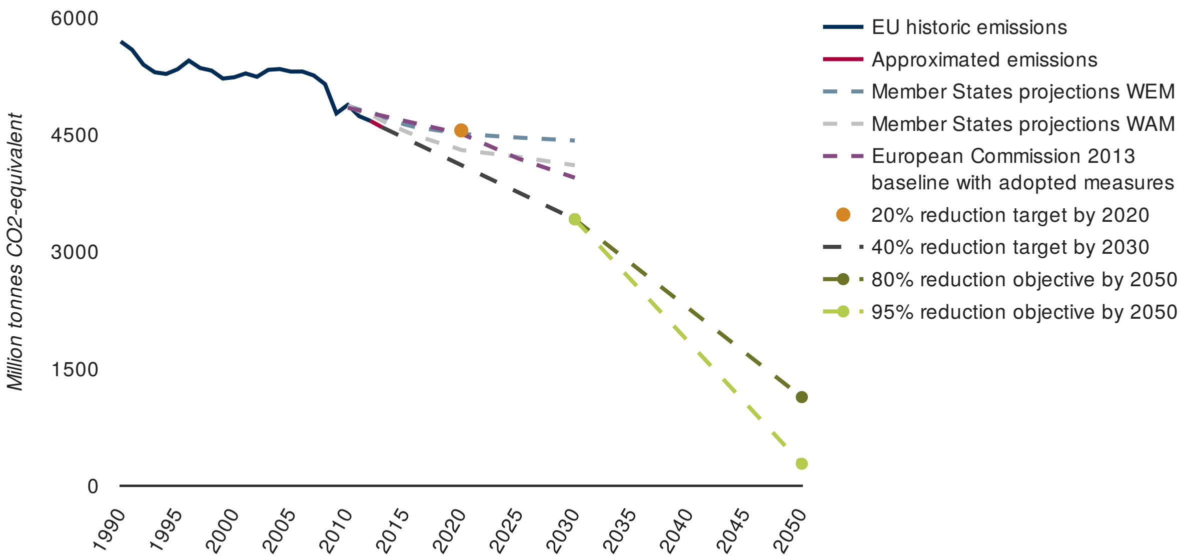
These commitments have been backed by concrete policies and measures to reduce GHG emissions in Europe. The EU implemented an Emissions Trading System (ETS) for industrial installations in power generation and manufacturing in 2005[9][10] and strengthened it in 2009 to help the EU achieve its 2020 objectives.[11] 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.

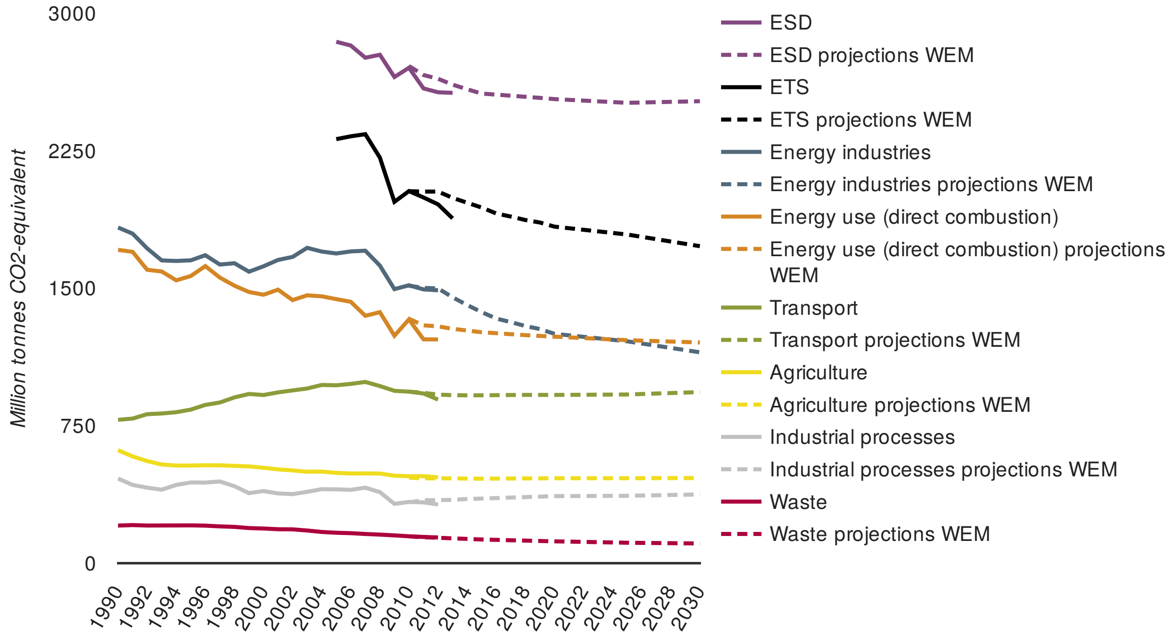
Data sources:

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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Natural capital and ecosystem services

Europe's natural capital is under growing cumulative pressure from intensive agriculture, fisheries and forestry, and urban sprawl. A substantial volume of relevant EU legislation already exists but lacks adequate integration in sectoral policies. Mismanagement of natural capital also persists because its full value is not reflected in socio-economic policies and choices despite its fundamental importance for society's welfare. Sustained efforts are needed globally to integrate it into national accounts.

Context

The emergence of the concept of 'natural capital' in recent decades reflects a recognition that environmental systems play a fundamental role in determining a country's economic output and social well-being — providing resources and services, and absorbing emissions and wastes.

According to this way of thinking, a nation's wealth is grounded in four core stocks of capital: manufactured capital (e.g. machines and buildings), human capital (e.g. people, their skills and knowledge), social capital (e.g. trust, norms and institutions) and natural capital (e.g. minerals and ecosystem services). In addition, financial capital plays an important role as a medium of exchange between the four underlying capital stocks and, sometimes, as a source of economic imbalances and instability.[1][2]

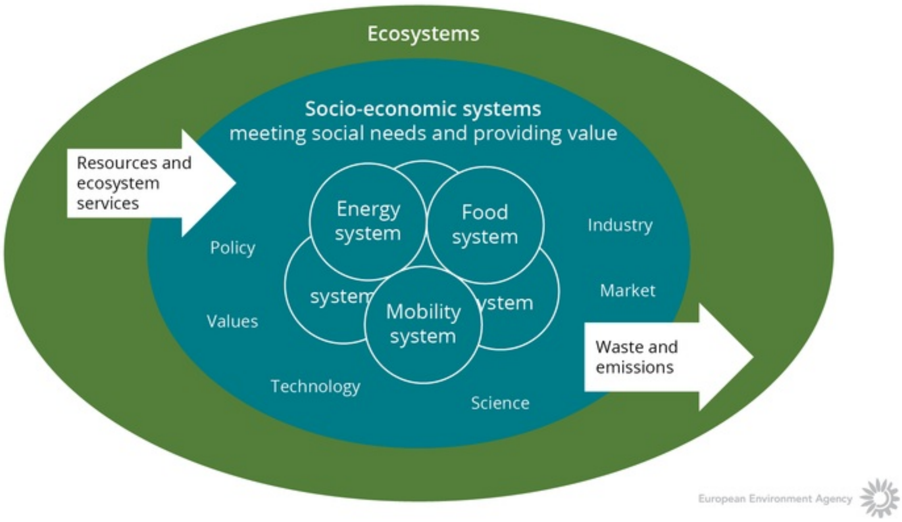
Natural capital is the most fundamental of the forms of capital since it provides the basic conditions for human existence, delivering food, clean water and air, and essential resources. It sets the ecological limits for our socio-economic systems, which require continuous flows of material inputs and ecosystem services (Figure 1 and Box 1). Yet, it is not accounted for in nations' wealth accounting systems.

Many aspects of natural capital such as biodiversity, clean air, land, and water are both limited and vulnerable. The complexity of natural systems and irreversibility of much environmental change mean that replacing natural capital with other forms of capital is often impossible or carries significant risks.

Mismanagement of natural capital often occurs because its full value is not reflected in policy trade-offs and economic choices. This problem pervades decision-making at all scales, from the microeconomic (e.g. via market prices that fail to reflect a product's full costs and benefits), up to the macroeconomic (e.g. in excluding environmental values from national accounts and shifting environmental impacts to other countries).

The European Union (EU) and many neighbouring countries have introduced a substantial volume of legislation to protect, conserve and enhance ecosystems and their services. Examples include the Water Framework Directive,[5] the Marine Strategy Framework Directive,[6] the Air Quality Directive,[7] the Habitats and Birds Directives[8][9] and the Landscape Convention.[10] A wider range of European policies affect natural capital and ecosystem services including the Common Agricultural Policy, the Common Fisheries Policy, cohesion policy and rural development policies.

Figure 1: Ecosystems underpin socio-economic systems of production and consumption



Source: based on EEA Multiannual Work Programme 2014–2018

Box 1: Natural capital and ecosystem services

Natural capital comprises two major components:

- Abiotic natural capital comprises subsoil assets (e.g. fossil fuels, minerals, metals) and abiotic flows (e.g. wind and solar energy).
- Biotic natural capital or ecosystem capital consists of ecosystems, which deliver a wide range of valuable services that are essential for human well-being.

Ecosystem capital is normally renewable if managed sustainably but can be depleted or degraded if mismanaged. A Common International Classification of Ecosystem Services (CICES) has been developed to support environmental accounting.[3] CICES takes the Millennium Ecosystem Assessment[4] classification of ecosystem services as a starting point but modifies the approach to reflect more recent research and does not include supporting services to reduce the risk of double-counting of benefits.

The three main ecosystem service categories under CICES are provisioning services (e.g. biomass, water, fibre); regulating and maintenance services (e.g. soil formation and composition, pest and disease control, climate regulation); and cultural services (the physical, intellectual, spiritual and symbolic interactions of humans with ecosystems, lands and seascapes).

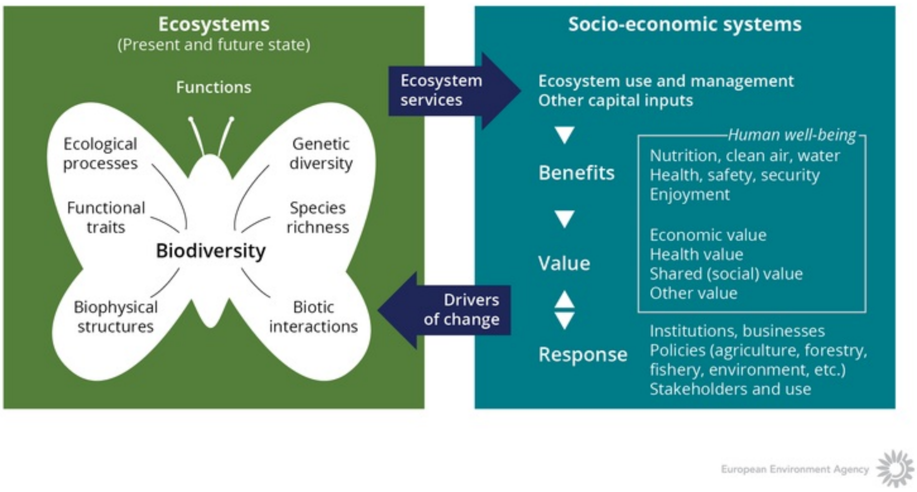
Key trends

Assessing the status and trends of natural capital, in particular ecosystem services, is a significant challenge in view of the enormous scale and diversity of environmental stocks and flows. The EU Biodiversity Strategy to 2020[11] is an important policy driver of improved knowledge of ecosystems and their services. Key actions include mapping and assessing ecosystems and their services by 2014, assessing the economic value of such services, and promoting the integration of these values into accounting and reporting systems at the EU and national levels by 2020.

Trends in ecosystems and their services

While a comprehensive assessment of the state and trends of Europe's ecosystems and related services has not yet been undertaken, important progress has been made. For example, the work under the Mapping and Assessment of Ecosystems and their Services (MAES) initiative will improve the knowledge base on ecosystems and their services in Europe (Figure 2).[12][13]

Figure 2: Conceptual framework for ecosystem assessments



Source: Maes et al.[14]

Information is already available for many ecosystem types and services. For example:

- 30% of the EU's land is highly fragmented affecting the connectivity and health of ecosystems and their ability to provide services as well as viable habitats for species;[15]
- only 53% of Europe's surface water bodies are likely to achieve good ecological status by 2015;
- despite progress in reducing pollution, more than 40% of rivers and coastal water bodies are affected by diffuse pollution from agriculture;
- emissions of air pollution have declined but the magnitude and risk of ecosystem eutrophication has only diminished slightly and transboundary effects remain a challenge;
- in the marine environment, the improving status of some commercially exploited fish stocks has enhanced provisioning services, yet many fisheries remain unassessed.

Climate change has already affected ecosystems and their services in Europe in diverse ways, including ocean acidification, increasing water temperatures, shifts in the timing of biological processes and increases in the frequency and intensity of droughts. Ecosystem service flows are mostly projected to decline in response to climate change although this varies by European sub-region.

Integrating the value of natural capital and ecosystem services into decision making

The UN System of Environmental Economic Accounting (SEEA) provides an international framework for developing integrated physical and monetary environmental-economic accounts. Within this context, the EU Regulation on European environmental-economic accounts provides a legal basis for harmonised collection of comparable data from countries.[16]

The Regulation was amended in 2014 and accounting modules now include both physical accounts (addressing air emissions, material flows and physical energy flows) and monetary accounts (addressing environmental taxes, environmental protection expenditure and environmental goods and services sectors).

There is not yet an agreed methodology or statistical standard for ecosystem accounting — although a framework for experimental ecosystem accounting has been developed as part of the UN system (SEEA). Within this context the EEA is developing Ecosystem Capital Accounts, which are foreseen as the approach to delivering ecosystem accounts for Europe. They record changes in the extent and condition of ecosystems and some of the services they provide, as indicated by physical land, biomass carbon and water accounts.

In terms of monetary valuation of ecosystem services and the underlying natural capital stocks, a diverse mixture of techniques exists for estimating values. Approaches are also available to enable values generated in one location to be applied elsewhere or at broader scales.[16][17] While there are many uncertainties and difficulties in applying these valuation methods, they can offer insights and play a role in communicating the value of nature and in designing environmental policy and tools.

Prospects

While Europe has undoubtedly made progress in preserving and enhancing its natural capital in certain areas, overall degradation of ecosystems persists. In addition, abiotic resources and ecosystem capital are under significant pressure across the world and demographic and economic projections suggest that these pressures are likely to grow.[18]

Policy and management

In recent years, EU environmental policies such as the 7th Environment Action Programme (7th EAP)[15] and the Biodiversity Strategy to 2020[11] have shifted towards a more systemic perspective on the managing the environment, explicitly addressing natural capital. For example, a priority objective of the 7th EAP is 'to protect, conserve and enhance the Union's natural capital'. There are many synergies and co-benefits to a more integrated management approach. Implementation of ecosystem-based management approaches that consider the entire ecosystem, including humans, offers much potential. Adopting this approach in the management of human activities in the aquatic environment and in developing green infrastructure development will provide important evidence and learning.

Natural capital accounting

The 7th EAP states that 'further efforts to measure the value of ecosystems and the cost of their depletion, together with corresponding incentives, will be needed to inform policy and investment decisions. Work to develop a system of environmental accounts, including physical and monetary accounts for natural capital and ecosystem services, will need to be stepped up. This supports the outcome of Rio+20, which recognises the need for broader measures of progress to measure well-being and sustainability to complement GDP.'

EU bodies, Member States and researchers are responding to this challenge and developing more comprehensive environmental accounting systems, including approaches for measuring the condition of ecosystems and their services. This supports the EU's current efforts to develop new more inclusive indicators of social, economic and environment progress via the 'Beyond GDP' initiative.[19][20]

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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.

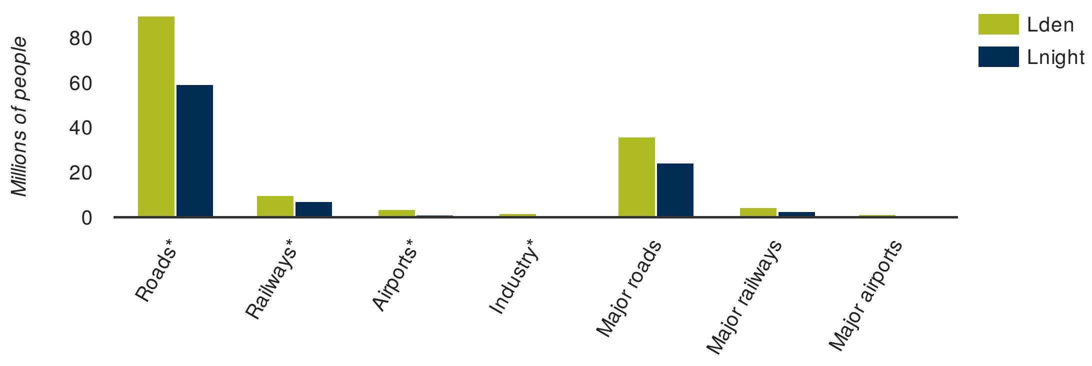
Since the implementation of the END, research has suggested that levels of 50 dB L_{den} may be more representative of annoyance,[4] while for sleep disturbance the WHO has set a night noise guideline (NNG) for Europe of 40 dB L_{night}. Where this is not achievable in the short term, the WHO recommends 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



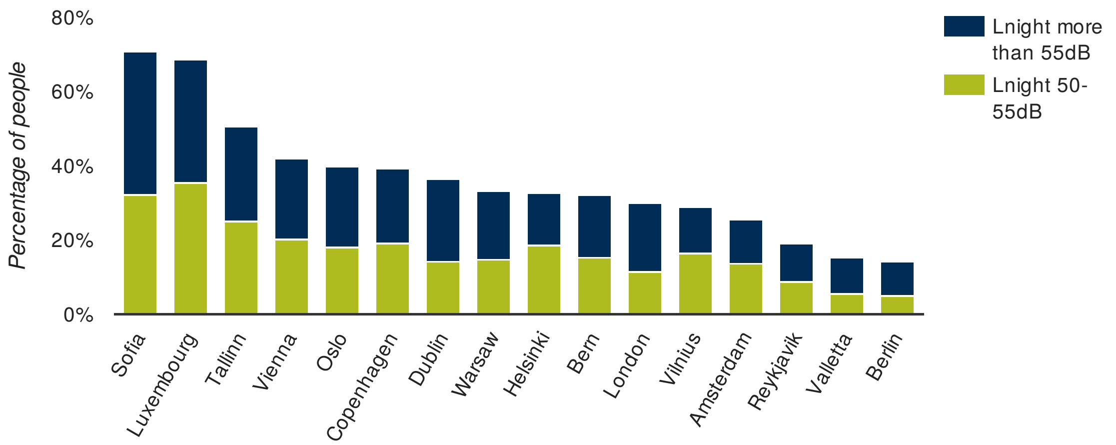
Note: * Noise sources within urban agglomerations. L_{den}: Environmental Noise Directive indicator for day, evening and night level, L_{night}: Environmental Noise Directive indicator for night level. Based on data reported by countries by 28 August 2013. Noise mapping and assessment methods may differ 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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Resource efficiency

EU-28 domestic material consumption declined by 10% between 2000 and 2012, despite a 16% increase in economic output. Environmental pressures such as waste generation and harmful emissions were also reduced. Policies have contributed to this decoupling but Europe's economic downturn since 2008 also played a role. Achieving sustained reductions in environmental pressures will require coherent policy approaches aimed at fundamentally transforming Europe's systems of production and consumption.

Context

In the context of escalating global environmental pressures, it has become increasingly clear that Europe's prevailing model of economic development — based on steadily growing resource use and pollutant emissions — cannot be sustained in the long term. Already today, Europe's ecological footprint is double its land area and the European Union (EU) is heavily reliant on imports of resources. In 2011, the EU imported almost 60% of its fossil fuel and metal resources.[1]

At the most basic level, resource efficiency consists of 'doing more with less'. It captures the relationship of society's burden on nature (in terms of resource extraction, pollution emissions, ecosystem pressures) to the returns generated (e.g. gross domestic product (GDP) or sectoral output) (Box 1).

Resource efficiency has a vital role in facilitating economic development within environmental boundaries, but it also offers broader social and economic gains. These include sustaining non-market ecosystem services (such as purifying air and water), securing supplies of critical resources, increasing competitiveness, and stimulating innovation and job creation.

Europe's medium- and long-term strategic planning recognises the fundamental importance of resource efficiency. For example, the EU's 7th Environment Action Programme (7th EAP)[2] identifies as one of its priority objectives the need to 'turn the Union into a resource-efficient, green, and competitive low-carbon economy.'

Similarly, the EU's Roadmap to a resource-efficient Europe[3] includes a vision for 2050, wherein 'the EU's economy has grown in a way that respects resource constraints and planetary boundaries, thus contributing to global economic transformation.'

Key trends

While the notion of 'doing more with less' is conceptually very simple, quantifying resource efficiency is more complex in practice. Resources differ hugely: some are non-renewable, some renewable; some are depletable, others are not; some are hugely abundant, some extremely scarce.

The environmental impacts of resource use can also vary greatly depending on the timing and location. For these reasons, producing meaningful estimates of the environmental burden associated with economic activity simply by calculating the ratio of resource use to economic output can be problematic.

The EU's Resource Efficiency Scoreboard,[4] which is being developed pursuant to the Roadmap to a resource-efficient Europe, therefore offers a diverse mixture of perspectives on resource efficiency trends. It establishes 'resource productivity' (i.e. the ratio of economic output to material consumption) as its lead indicator, on the basis that materials are the primary link between the economy and the environment.

But it also includes other 'dashboard indicators' on carbon, land and water, as well as 'thematic indicators' on economic and environmental topics.

Box 1: Resource efficiency and decoupling

The resource efficiency challenge is often framed in terms of 'decoupling' economic output from environmental inputs.

Figure 1: Decoupling demystified

Decoupling demystified

Decoupling can take several forms:

- **Relative decoupling** is achieved when an environmental pressure (e.g. resource use or emissions) grows more slowly than the related economic activity (e.g. sectoral gross value added (GVA) or national GDP).
- **Absolute decoupling** is achieved when an environmental pressure remains stable or decreases while economic activity increases.
- **Impact decoupling** is achieved when environmental impacts decline relative to resource use and economic activity.

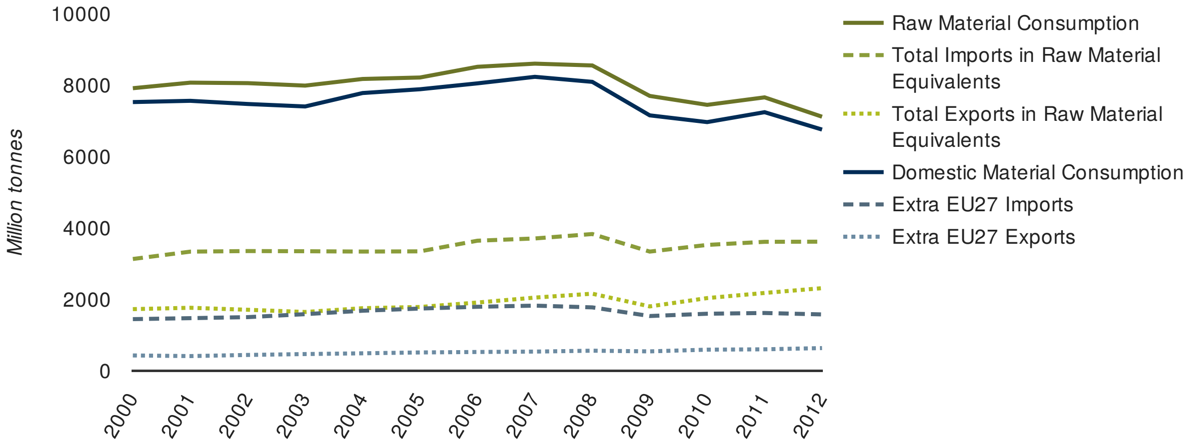
Increases in resource efficiency will always imply some decoupling of economic activity from environmental pressures. But they do not necessarily indicate absolute or impact decoupling.

Material resource productivity

Resource productivity is defined as the ratio of GDP to domestic material consumption (DMC), i.e. the total amount of materials directly used by an economy, including all physical imports and excluding exports.[5] Eurostat is developing an additional indicator for the EU as a whole, raw material consumption (RMC), which provides a better indication of Europe's resource demands from overseas by including the materials used in producing traded goods and resources. Although the trade flows calculated via this method are much larger, the overall effect on estimates of total EU resource consumption is quite small (an increase of about 5%).

EU-28 resource productivity (GDP/DMC) stood at EUR 1.73/kg in 2012, compared to EUR 1.34/kg in 2000. Despite this improvement, there is little evidence that European resource use has decoupled from economic growth in absolute terms. Although EU-28 total DMC declined between 2000 and 2012, from 7.6 billion tonnes to 6.8 billion tonnes, this was largely due to the economic problems since 2008. Between 2000 and 2007, EU-28 total DMC actually increased by 10%, indicating growing resource use.

Figure 2: EU-27 domestic and raw material consumption



Note: RMC data are only available for the EU-27. For comparability, the DMC data in this figure covers the same countries.

Data sources: a. Eurostat. Material flow accounts

b. Eurostat. Material flow accounts in raw material equivalents - modelling estimate

Explore chart interactively

Resource productivity varies significantly across Europe, ranging from EUR 0.2/kg in Bulgaria to EUR 3.6/kg in Switzerland in 2012. There was little evidence of convergence of resource productivity rates between 2000 and 2012. Some of the countries that started with the lowest resource productivity rates recorded negligible improvements or declines during that period. Contrastingly, some of the countries with the highest resource productivity in 2000 recorded the largest percentage increases over the next 12 years. These differences are largely explained by construction sector activity, which dominates resource use in many countries.

Other resource efficiency trends

Turning to the other indicators in the Resource Efficiency Scoreboard, there is evidence that some environmental pressures are decoupling from economic output growth in relative or absolute terms (Box 1). Yet even in cases where pressures are declining, the burden on natural capital often remains excessive, threatening the delivery of the ecosystem services that underpin social and economic development. For example:

- EU-28 greenhouse gas emissions declined by 19% between 1990 and 2012, implying a 38% reduction in emissions per EUR of GDP. Despite these improvements, the EU remains far from the 80–95% reduction by 2050 seen as necessary for developed regions.
- Water use is decreasing for most sectors and in most regions but agricultural water use, in particular in southern Europe, remains a problem.
- Biodiversity faces reduced pressures from acidifying emissions but nitrogen surpluses remain high and landscape fragmentation has increased.
- The waste intensity of manufacturing and service sector economic output has declined since 2004, as has the municipal waste intensity of household spending. However, municipal waste generation has hardly changed in absolute terms.
- Air pollutant emissions have decreased in many parts of Europe but human exposure to harmful air quality remains a challenge, especially in urban environments.

Prospects

Europe's systems of production and consumption continue to impose considerable demands on the environment. Meanwhile, global megatrends such as population growth, urbanisation and the emerging 'consumer middle class' in many developing countries are expected to drive steady growth in global competition for resources in coming decades.

Addressing these challenges will require fundamental changes in Europe's systems of resource use and economic growth. One essential aspect of this change will be a shift away from a linear (take-make-dispose) model of resource consumption, towards a **circular economy** where nothing is wasted.

Waste prevention and management are clearly important in creating a circular economy but factors such as product design and choice of material inputs also have a major influence. EU policy has already driven improvements in recycling of certain waste streams, yet substantial increases are possible and could greatly reduce reliance on virgin resources. **Eco-innovation** also has a crucial role, enabling producers to reduce their resource use or shift to less harmful or scarce substitutes (for example in the transition from fossil fuels to solar or wind power).

There is evidence, however, that isolated resource efficiency improvements are often insufficient to guarantee a decline in environmental pressures because the benefits are offset by increasing consumption and lifestyle changes (a phenomenon known as the '**rebound effect**'). For example, fuel consumption and CO^2 emissions from private cars have increased markedly in the last two decades, despite improved fuel efficiency, because Europeans are driving more.

These realities point to the need for more fundamental adjustments to the systems that meet society's demand for goods and services, addressing production and consumption concurrently. **New business models** that move away from individualised ownership towards service provision and shared consumption of products have an important role here.

Tackling the 'rebound effect' and effecting systemic change in systems of production and consumption will require a smart policy mix, including market-based instruments, regulations, voluntary agreements and labelling approaches. A review of national experience in policy implementation shows that there is no one 'right' combination of policy approaches and instruments. The successful policy mix will be determined by local conditions and will need to address priority concerns first.

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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.

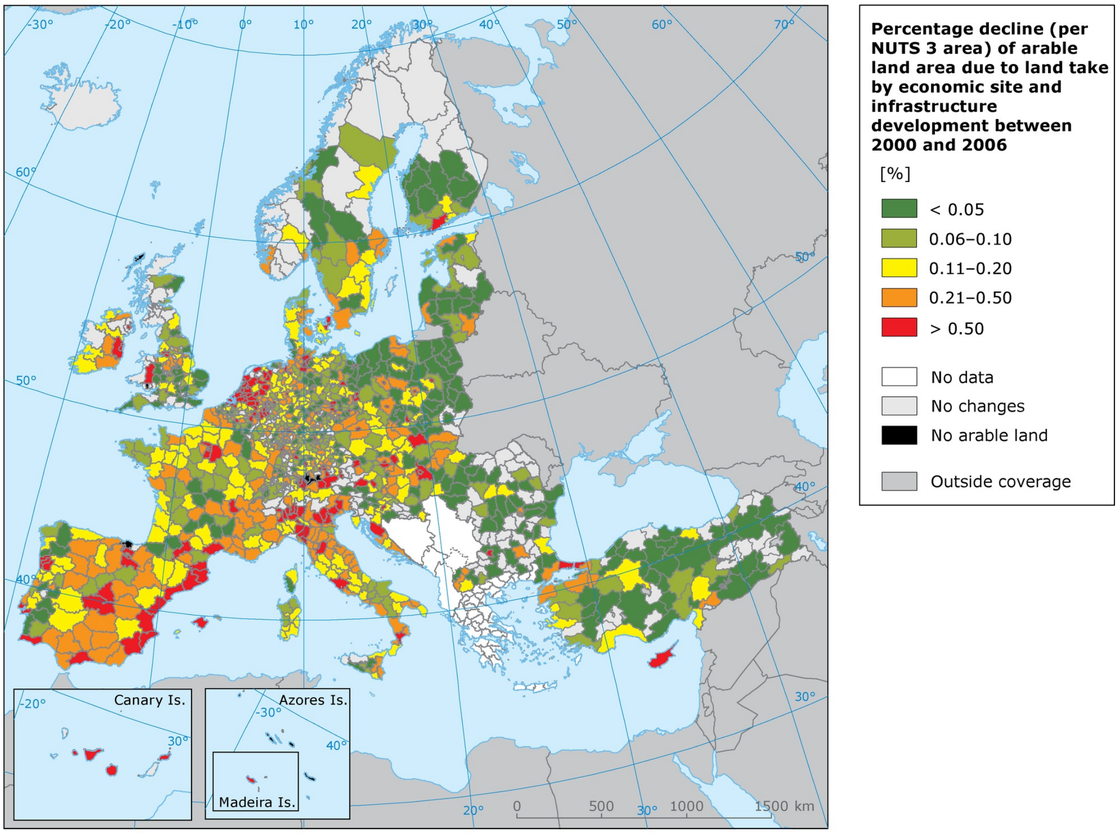
Biomass production as a provisioning service of soil

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.

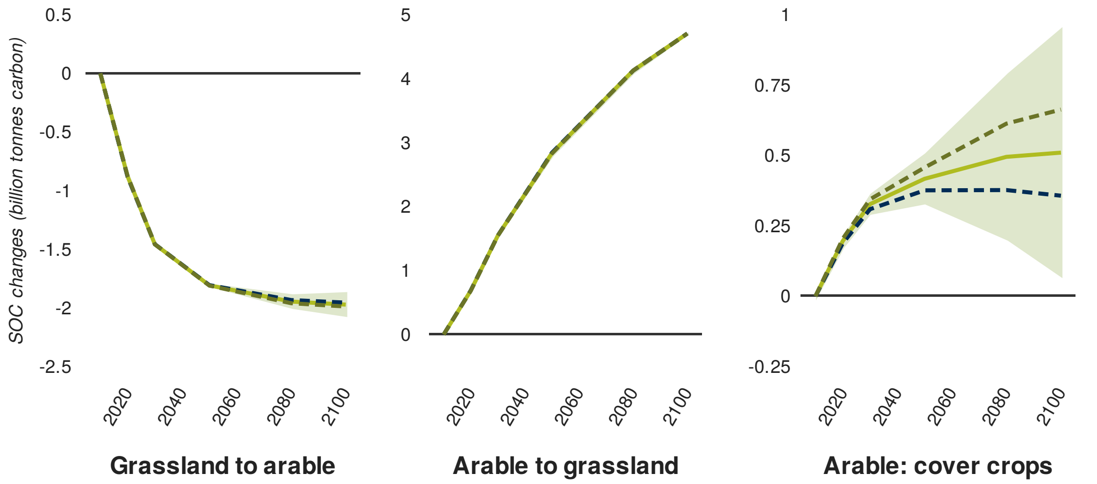
The intensity of soil use can considerably influence soil organisms, which in turn drive nutrient cycling.[27] High-intensity arable land results in lower diversity and biomass of soil organisms compared to land that is less-intensively cultivated or under permanent grassland.[28]

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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The air and climate system

Scientific understanding of the interaction between air pollution and climate change has improved over the last two decades. In particular, there has been a greater realisation that some air pollutants also act as short-term drivers of global warming.

Although air pollutants and greenhouse gases often come from the same sources, international agreements generally treat them separately. One way that European policy seeks to connect climate and air quality policies is through the inclusion of methane and black carbon (short-lived climate pollutants) in the proposed EU Clean Air Policy Package.

Context

The layer of air surrounding our planet, better known as the atmosphere, contains water vapour, aerosols, clouds, and many different gases. The dry atmosphere (excluding water vapour) consists mainly of nitrogen (78.1%), oxygen (20.9%), argon (0.93%), and a large number of trace gases such as carbon dioxide and ozone (0.035%).

The air and climate system is the product of interactions between our atmosphere and our climate. Changes in this system are to an important extent driven by the emission of air pollutants and greenhouse gases (GHGs). These air pollutants and greenhouse gases have a wide range of impacts on health, ecosystems and climate. However, the precise nature of these impacts depends on the location of emissions; chemical reactions of the emitted gases; the atmospheric dispersion of these gases; and their deposition on the earth's surface.

Our understanding of the interaction between air and climate has improved over the last two decades, helped by better knowledge of the role played in this interaction by GHGs and air pollutants. In particular, there has been a greater realisation that some air pollutants act as so-called 'short-lived climate-forcing pollutants' (SLCPs).[1] Taken together, this improved understanding has led to a growing scientific consensus that it is best to approach air pollution and climate change mitigation as an integrated whole.

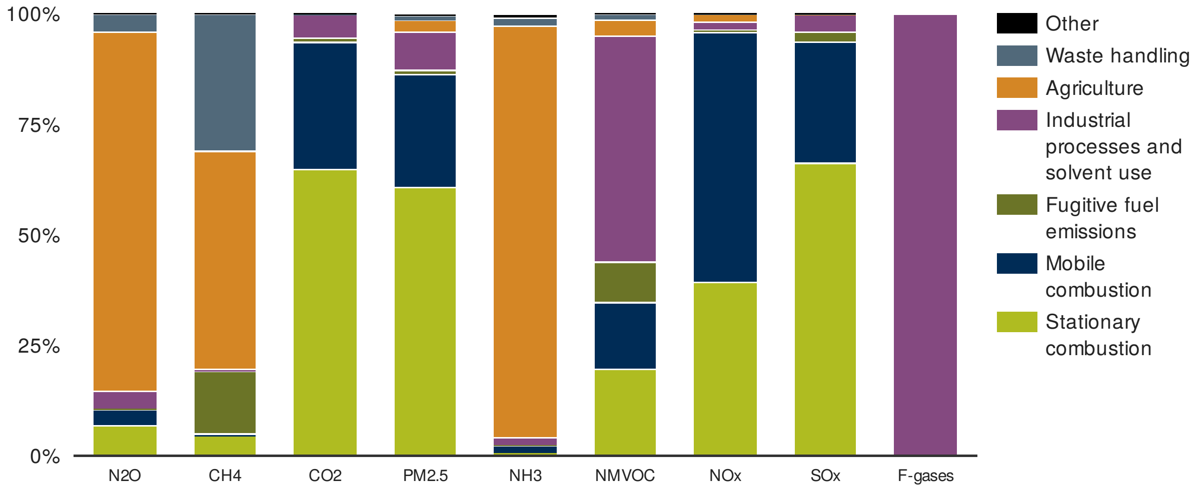
Addressing the air and climate system is a challenge for policymakers for a number of reasons. Firstly, complex atmospheric modelling systems are needed to understand the interactions of air pollutants and GHGs. Secondly, international agreements (such as the Montreal Protocol, Kyoto Protocol[2] and the LRTAP Gothenburg Protocol[3]) treat air pollutant emissions separately to GHG emissions, even though GHGs and air pollutants are often emitted from the same sources. Thirdly, policy responses in this area can have complex effects. For example, some policies will lead to 'co-benefits' (where policies to reduce air pollution also reduce GHG emissions and vice versa), whereas other policies will lead to trade-offs. These complexities are described in greater detail below.

Key trends

Emissions of air pollutants and greenhouse gases

In Europe, over the last 20 years, emissions of both air pollutants and GHGs have decreased. It is important to emphasise that many air pollutants and GHGs share the same emission sources (Figure 1), and that thematic mitigation policies can simultaneously impact emissions of both GHGs and air pollutants.

Figure 1: Contribution of anthropogenic sources to total emissions of selected air pollutants and greenhouse gases in the EU-28, 2012[4][5]



Note: $PM_{2.5}$: particulate matter with a diameter of 2.5 µm or less; NMVOC: non-methane volatile organic compounds; F-gases: fluorinated gases.

Data sources:

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

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

Emissions as drivers of atmospheric composition change

Across the world, emissions of air pollutants and GHGs are changing the composition of the earth's atmosphere. At the global scale, the concentration of the six greenhouse gases included in the Kyoto Protocol has reached 446 ppm CO_2-equivalent, an increase of around 60% compared to pre-industrial levels (CSI013). Changes in land-use and the combustion of fossil fuels from human activities are largely responsible for this increase. In addition, global background ozone pollution levels are increasing as a consequence of the increase in ozone precursor emissions in various parts of the world. Ozone is both a GHG and an air pollutant. Finally, the impacts on European air quality of atmospheric transport of air pollution can also be significant.[6]

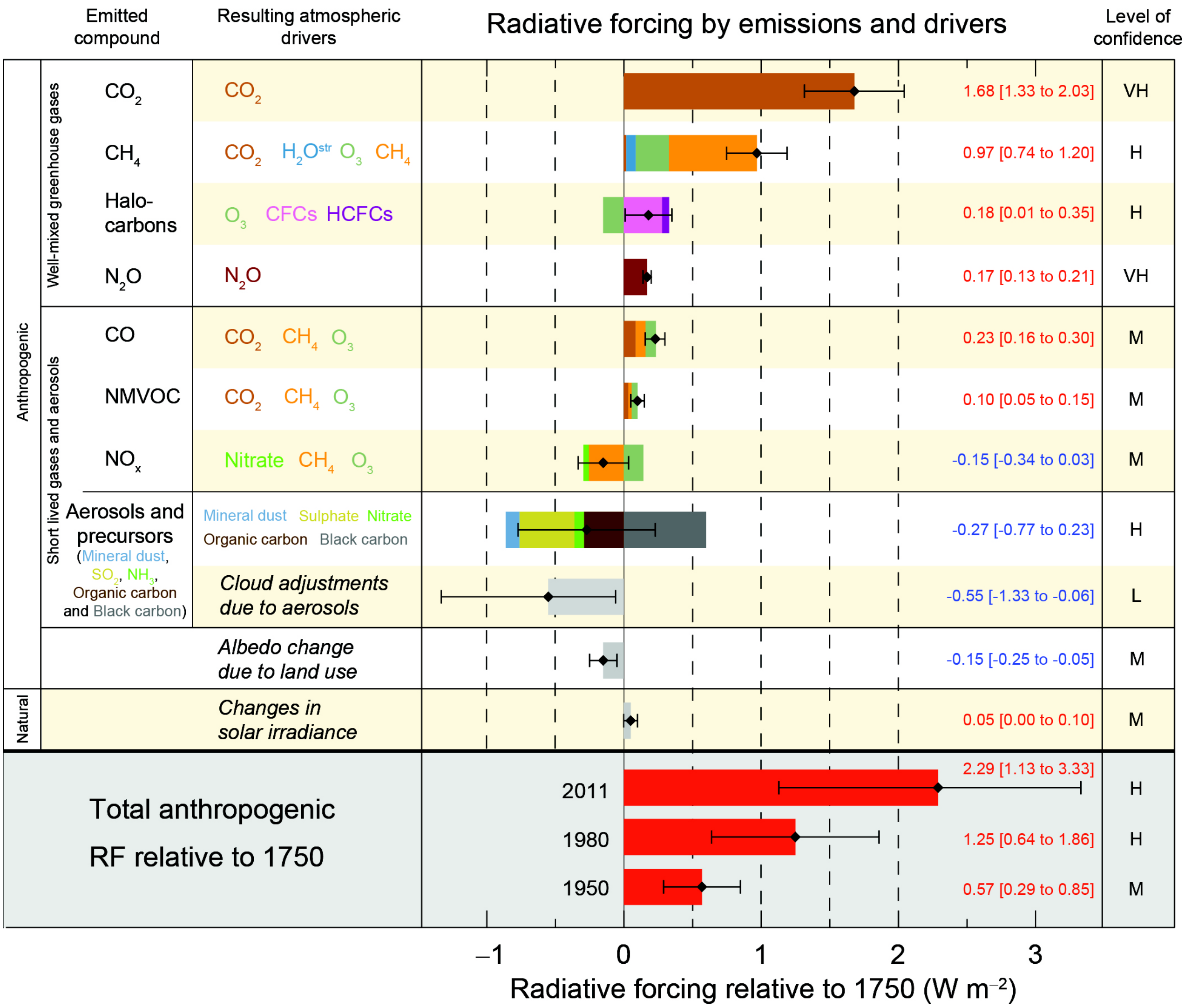
> In Europe, air pollutant concentrations are much lower today than 20 years ago and many countries have achieved the emission reduction targets as set under the NEC Directive of 2001 and the Gothenburg Protocol of 1999. But in spite of this improvement, a large percentage of the EU urban population is still exposed to dangerous air pollution from particulate matter and ozone.

Emissions as drivers of climate change

According to the IPCC (2013),[7] the increase in CO_2 emissions and the resulting increase in the atmospheric concentration of CO_2 is the most important driver of the increase in radiative forcing (RF) between present-day and pre-industrial conditions (Figure 2). Also the air pollutants (CO, NMVOC, NO_X, SO_2 and aerosols) and the other greenhouse gases (CH_4, N_2O and F-gases) have an impact on RF.

Radiative forcing (RF) is the change in the balance between incoming and outgoing radiation flux (expressed in W/m^2) at the top of the atmosphere due to changes in concentrations of greenhouse gases such as CO_2, incoming solar radiation and changes in the extent the atmosphere and earth are reflecting solar radiation through clouds and reflective land surfaces (albedo). An increase in RF leads to additional warming of the atmosphere, whereas a negative RF results in a cooling of the atmosphere.

Figure 2: Radiative forcing estimates in 2011 relative to 1750 and aggregated uncertainties for the main drivers of climate change



Source: IPCC (2013)[7]

It can be difficult to assess the RF effects of GHG and air pollutant emissions. This is because RF is not always the direct effect of the atmospheric concentration of these air pollutants and GHGs, but also the result of their indirect interactions in the atmosphere. These indirect effects include both chemical reactions (ozone formation) and physical reactions (cloud formation and cloud composition) by the air pollutants and GHGs.

In spite of these difficulties, quantitative estimates of these indirect effects can be made, and a recent example of such an estimate is shown in Figure 2. It shows that there is a difference in the scientific understanding of different RF effects and that emissions can result either in an increase or a decrease in RF at the global scale. Over the past 260 years, emissions of CO_2, CH_4, N_2O, F-gases, black carbon, CO, and NMVOC all resulted in an increase in RF. Emissions of SO_2, organic carbon and mineral dust all contributed to a decrease in RF. Emissions of halocarbons had both a positive and negative impact on RF. Also, the emissions of NO_X and NH_3 have had both a positive and negative RF effect, but with a negative net impact on RF. Figure 2 further highlights that interactions between aerosols and clouds resulted in a negative RF, but that the contribution of individual emitted compounds within mixes of aerosols is unknown.

Impact of climate change on air quality

Climate change could impact future air quality in various ways. One way is through higher temperatures leading to increased ozone formation. Another potential way that climate change can impact air quality is through a change in weather patterns creating 'stagnation events'. In such events, an absence of wind leads to high ozone and PM concentrations. A third possible way that climate change can affect air quality is through a potential change in patterns of hemispheric transport of air.[8]

Prospects

Emission levels can be affected both by policies that seek to mitigate climate change and by policies that seek to mitigate air pollution. These changes in emission levels can lead to both a decrease or increase of RF over time, and they can have both short-term and long-term effects on climate change. This variety of effects of air policies has been recognised by policy initiatives such as the Climate and Clean Air Coalition (CCAC),[9] which focuses mitigation efforts on those air pollutants that have a clear warming effect such as black carbon and methane (as shown in Figure 2). At the EU level, the first attempts are now being made to connect the air-pollution and climate-change policy areas through the inclusion of the SLCPs methane and black carbon in the EU Clean Air Policy Package.[10]

However, the current policy focus on black carbon and methane is only one part of the story for future policy. As shown in Figure 2, some emission reductions will contribute to an increase in RF (SO_2, CO) or will have a mixed RF effect (Halocarbons, NO_X, NH_3), and for a large component of the air and climate system (aerosol-cloud interaction) it is not known what the effect will be. This poses significant scientific and policy challenges to identify those measures that will address air quality but not at the cost of climate change mitigation and vice versa.

Several studies have highlighted the positive effects of climate-change mitigation policies on atmospheric composition change. Not only will these climate-change mitigation policies result in reduced fossil fuel combustion and associated greenhouse gas emissions, they will also reduce air pollutant emissions, their impact on human health and ecosystems, and some of the costs associated with air pollution abatement technologies.[11][12][13] On the other hand, some climate mitigation measures at present can have a negative effect on air pollution and will continue to do so in their present form. For example, the dieselisation of the European vehicle fleet was the result of policies designed to encourage greater use of diesel vehicles in part because they had lower CO_2 emissions per kilometre compared to gasoline vehicles. However, diesel vehicles generally emit more PM and NO_X per kilometre than gasoline cars, and in some cases this has led to high concentrations of NO_2 measured close to traffic in cities.

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Tourism

Largely due to its combined natural and cultural attractiveness, Europe is the world's primary tourism destination and tourism generates 10% of EU GDP. New types of tourism and increased frequency of holidays have serious environmental impacts at regional and local level. A damaged environment could undermine tourism in the future.

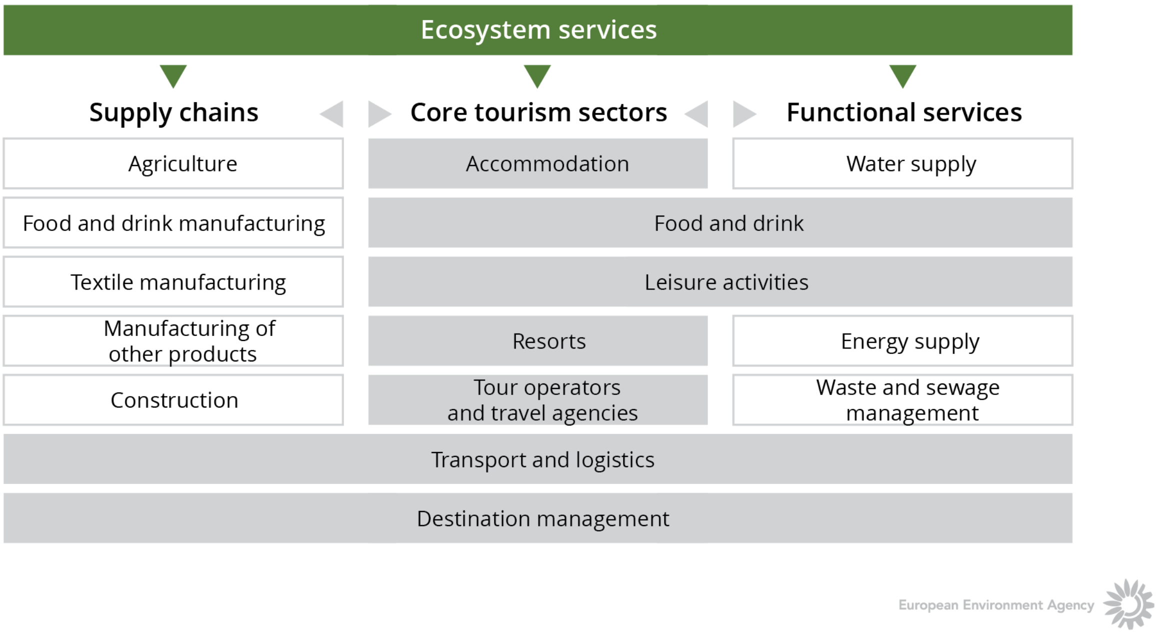
Responses to sustainability challenges are dispersed across EU legislation and policies, while the evidence base to track progress is still fragmented.

Context

Europe is the world's number one tourist destination. In 2013, France, Spain, Italy, the United Kingdom and Germany were among the world's top 10 destinations for holidaymakers.[1] As a result, in 2010, this industry became a key sector of the European economy, generating over 10% of EU GDP.[2] Thus tourism also contributes to regional and potentially sustainable development, while shaping a European identity and awareness on natural and cultural heritage.

The European Union (EU) aims to promote tourism in order to maintain the region's position as a leading destination, and maximise the industry's contribution to growth and employment.[3] The 2010 European Commission communication, 'Europe, the world's No 1 tourist destination — a new political framework for tourism in Europe', is the most recent general policy reference and establishes main priority actions for the sector.[4]

Figure 1: Components of the tourism system



The tourism industry is composed of many different sectors, including transport, agriculture, and energy (Figure 1). Because of this, policy responses to the sustainability challenges[5] are fragmented across large areas of EU legislation.[6] A comprehensive policy reference specifically for tourism does not yet exist.

This policy fragmentation leads to problems of data availability for the sector as a whole, especially with regard to environmental impacts. As a result, the European Commission encourages a coordinated approach for EU initiatives[7] in order to consolidate the whole knowledge base (such as through the European Tourism Indicators system) and to increase sustainable growth (as recalled in the European Commission communication, 'A European Strategy for more Growth and Jobs in Coastal and Maritime Tourism').

Key trends

In recent decades, tourism within Europe has changed greatly in terms of seasonality, forms and frequency of trips. It has also changed in terms of demography and preferred destinations.[8][9]

Peak periods have traditionally led to high environmental pressures especially in islands, coastal and mountain regions, while new trends are constantly emerging, with tourism taking place throughout the year, during the off-season, or in some cities that experience consistently high levels of visitors. This is due to globalised trends in culture and communication, an internet-based economy, and the increasing affordability of travel for ever-larger sections of the population.[10] Europe has also become the world's largest 'source region' of tourists taking trips elsewhere in the world.[11][12]

Key trends in tourism volume (demand and supply) and intensity[13] at country level

In 2012, within the EU-28, 51.3% of the population[14] made at least one trip of four overnight stays during the year as a tourist.

More than half (57.4%) of the nearly 545 000 accommodation establishments active in 2012 were concentrated in four EU Member States: Italy, Spain, Germany and the United Kingdom.

In 2012, Spain was the most common tourism destination for non-residents, followed by Italy and France, which together accounted for 48.7% of the total nights; this needs to be seen in connection with the rapid growth in secondary homes (Box 1). As for tourism intensity in 2012, the Mediterranean destinations of Malta, Cyprus and Croatia, as well as various destinations within Austria were the most popular.[15]

Key trends in tourism density demand and intensity across EU regions[16]

Tourism intensity within a certain destination shows the huge importance of tourism to many of the EU's coastal regions and, even more so, to its islands and most of the Alpine region. In the context of the sustainability of tourism, this relationship can also be seen as an indicator of potential tourism pressure in the 20 top regions[17] that together accounted for 38.6% of the total overnight stays[18] in 2011.

Also tourism density[19] is particularly concentrated in coastal, mountain, and lake areas, where an increase in building and infrastructure has increased environmental pressure on protected and other natural and semi-natural territories.

Especially in the Mediterranean, tourism infrastructures and activities often have irreversible effects on natural areas rich in biodiversity and results in habitat deterioration for both terrestrial and aquatic plant and animal communities.[20]

Tourism impacts on environment and health

Despite the difficulties of quantifying the real impact of tourism on the environment, any increase in the number of tourists undoubtedly has an impact on environmental variables such as waste generation and energy consumption (in terms of volume and local level).

A tourist consumes 3 or 4 times more water per day than a permanent resident, with non-tourist water use ranging between 100 and 200 litres per person per day across Europe.[21] Necessary investments in the sewage system and wastewater treatment have taken place and have led to Europe's bathing waters being much cleaner today than they were 30 years ago. In 2013 more than 90% of bathing areas were judged as having good water quality.[22]

In Torremolinos (Spain), electricity consumption (of which tourism accounts for about 40%) increased by 160% between 1989 and 2008, while several studies have reported increases in municipal solid waste (MSW) as the seasonal tourist population rises. This has particularly been the case in small islands which are environmentally more vulnerable to the MSW growth and where any negative effects on health may spread more quickly.[23] In Menorca, during the period 1998 to 2010, the daily average of MSW generated in August by tourists is higher than that from residents, while a Maltese resident generates a daily average of 0.68 kg of MSW compared to a daily average 1.25 kg by a tourist in a hotel.[24]

Tourist transport by car causes the largest impacts on air quality[25] whereas air transport accounts for the largest share of tourism-related GHG emissions (80% in 2000) in the EU-25. Rail, coaches and ferries account for almost 20% of all tourism trips, but are responsible for a very small percentage of environmental impacts.[26] The most emission-intense[27] mode of transport per kilometre travelled is cruise ship: direct air emissions of 0.330 kg CO_2 per ALB KM[28] have been estimated.[29] Furthermore, most cruises start with flights to reach harbours, adding between 10% and 30% to the total emissions caused by the cruise.[30]

The increasing speed and scale of global human movement[31] has also enhanced opportunities for the spread of disease. In 2011, Europe was the main source of importation for measles into the USA, while several mosquito-transmitted diseases[32] have expanded their range and locally occurred in northern Italy in 2007 and southeast France in 2010.[33]

Response and prospects

Recent EU surveys[34] show that the predominant factors in choosing holidays destinations continue to be the quality of natural features and landscape, especially in coastal areas. That confirms the importance of 'natural capital' for the health of the tourism sector that is becoming more environmentally conscious due to actions, some external, such as progressive policies, fiscal measures, and the highest number of 'green' certification schemes in the world (such as eco-labelling). However, many of these certification schemes are still showing limited effectiveness in terms of cost savings or increased consumers demand. More coherence should be provided across them, while also improving consumer confidence.

By 2020 the car is still expected to account for the largest share of trips by tourists, while air travel will account for the largest share of kilometres travelled compared to today. Europe will also continue to lead the world in international arrivals, which are expected to increase from 57 per 100 of the population to 89 per 100 in 2010–2030.[35] Globally, air passenger/km are expected to rise from 5 billion to more than 13 billion over the period 2010 to 2030, while intra-Europe travel is projected to remain among the world's top five travel patterns between 2030 and 2040.[36]

Box 1: Environmental impacts from second homes

Rapid growth of second homes during the 1990s increased pressure on the environment, especially in coastal and mountain zones. This caused negative impacts such as land uptake, transportation to and from the homes, wildlife disruption, disposal of human waste and visual pollution.[37][38][39]

High densities of second homes can increase competition between their owners and locals for shared natural resources, resulting in huge pressures on infrastructures such as water supply, sewage, and roads.[40]

However, second homes made out of renovated rural stocks, instead of large scale tourism development, may also positively contribute to local communities.[41]

In Europe many second homes are owned by people resident in other countries. For example, the breakdown of the location of second homes owned abroad by residents of the United Kingdom is 27% in Spain, 26% in France and 23% in the rest of Europe.[42]

Efforts exist to regulate construction of second homes. In Switzerland, with some exceptions, the construction of second homes is banned in areas where they already account for more than 20% of all homes.[43][44]

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Transport

The economic recession led to reduced pollutant emissions by lowering transport demand. Transport is still responsible for 25% of EU greenhouse gas emissions, and contributes significantly to air pollution, noise and habitat fragmentation.

While progress has been made in meeting certain policy objectives, including efficiency and short-term greenhouse gas reduction targets, major challenges remain toward meeting longer term objectives. The European Commission's target of a 60% reduction in greenhouse gas emissions by 2050 will require significant additional measures.

Context

Transport is highly dependent on oil. 95% of all kilometres travelled (both passenger and freight) in the EU are powered by oil derived fuels (TERM 2014 report).[1] The combustion of this oil releases pollution in the form of emissions, which place significant burdens on human health and the environment. In 2012, the transport sector (including bunker fuels) accounted for 24.3% of total EU GHG (greenhouse gas) emissions.

Emissions of air pollutants from transport have generally declined over the past two decades. However, around 90% of city dwellers in the European Union (EU) are still exposed to air pollutants at levels deemed harmful to health by the World Health Organization (WHO), and transport is a large contributor to this. Transport also causes noise impacts. Road traffic exposes more people to harmful levels of noise than any other source, followed by rail and aircraft (see SOER 2015 briefing on noise). Data also show that fragmentation due to transport infrastructure and urban sprawl constitutes a growing threat to many wildlife populations via reduced connectivity among habitats, becoming increasingly isolated.

Transport demand, fuel consumption, and transport-related GHG emissions have all increased since 1990. They peaked around the beginning of the economic crisis and have shown unstable trends since.

EU measures to reduce transport emissions have included the introduction of fuel-quality standards and exhaust-emission limits for air pollutants and CO_2. They have also included the incorporation of the transport sector into national emission-limit calculations for both air pollutants[2] and GHGs (under the EU Effort Sharing Decision).[3]

The European Commission's White Paper on Transport[4] is a further political response to these issues. It was designed to guide future policy developments in the transport sector over the next decade and in accordance with the long-term EU objective to reduce GHG emissions by 80–95% by 2050.[5] The White Paper calls for a reduction of CO_2 from transport of at least 60% by 2050 from 1990 levels. It envisages the target being met by a combination of new technology and more efficient use of existing technology.

Key trends

Transport demand

Transport volume growth and associated environmental pressures generally follow economic development (see Figure 1). International aviation has experienced the largest percentage increase in passenger kilometres from 1995 levels (+ 66%). Aviation in the EU showed annual increases of up to 7.5% until 2007, growing again by 10% between

2010 and 2011 and stabilising in 2012. Car travel has increased significantly in the last decades, but has remained below its 2009 peak in 2012. In recent decades, the growth in transport demand has often negated or limited many of the environmental benefits brought by improved technology. Europe's challenge is therefore to achieve future economic development without increasing pressures on the environment.

Figure 1: EU transport demand by mode compared with GDP

Data sources: a. Eurostat. GDP and main components - volumes
b. DG Mobility and Transport. Performance of passenger and freight transport

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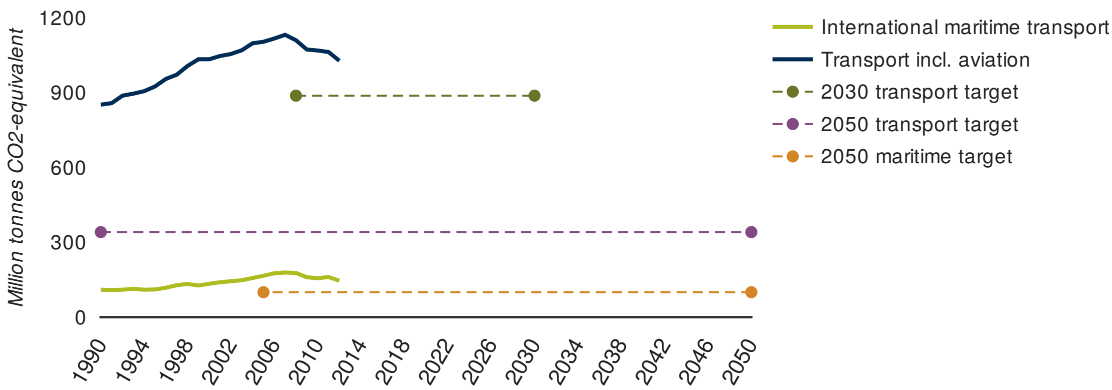
Greenhouse gases

EU transport (including international aviation but excluding international maritime) GHG emissions are currently 20.5% above 1990 levels (Figure 2). Transport is the only sector of the economy to have seen such a large increase in emissions in this period. Emissions from international aviation in the EEA-33 countries have more than doubled since 1990, while international maritime emissions increased by 34%, and road transport emissions increased by 20%. Rail transport and inland navigation are the modes of transport to have seen a decrease in GHG emissions compared to 1990, falling by 46% and 17% respectively in the EEA-33 compared to 2012.

Figure 2: EU transport emissions of greenhouse gases



Notes:
2030 transport target: 20% transport GHG reduction on 2008, 2050 transport target: 60% transport GHG reduction on 1990, 2050 maritime target: 40% maritime GHG reduction on 2005.
Overall transport GHG emissions, including aviation but excluding international maritime, are represented by a blue line.
International maritime transport GHG emissions are shown in green.

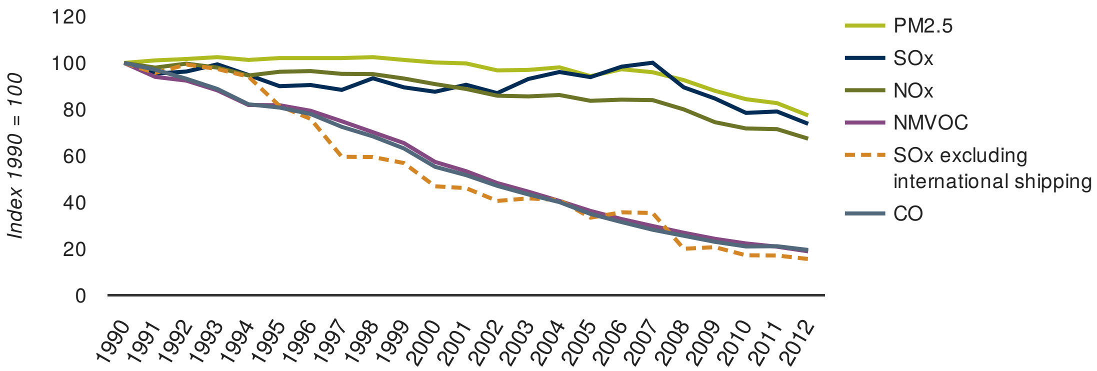
Data sources:
a. EEA. National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism

On a more positive note, the transport sector shows progress towards the goal of achieving a 10% share of renewable energy by 2020 in each Member State. The average EU-28 share of renewable energy in transport increased from 3.4% in 2011 to 5.1% in 2012.

The use of renewable electricity in road transport has also increased, but remains marginal compared to the amount of biofuels consumed. Pure electric vehicles currently comprise only 0.04% of the total fleet and the latest data show that their share in EU-27 new car registrations is only 0.22%.

The efficiency of new cars has also improved, encouraged by EU regulations.[6] The average CO_2 emissions level of a new car sold in 2013 was 127 g of carbon dioxide per kilometre, significantly below the 2015 target of 130 g. However, manufacturers will have to keep reducing emissions levels to meet the target of 95g CO_2/km by 2021.

Figure 3: Trend in emissions of air pollutants from transport (EEA-33)



Note: $PM_{2.5}$: particulate matter with aerodynamic diameter of 2.5 µm or less. NMVOC: non-methane volatile organic compounds; SO_X: sulphur oxides. NO_X: nitrogen oxides. CO: carbon monoxide.

Data sources:

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

b. EEA – Indicator TERM003

Air pollutants

Unlike the trend for GHGs, emissions of the main air pollutants from transport have generally declined over the past two decades (Figure 3). However, the decreases for certain pollutants (SO_x, NO_x and PM), are much less when emissions from international shipping are taken into account. The introduction of catalytic converters, progressively stricter Euro emission standards, and increasingly strict fuel quality standards are the main factors behind past reductions.

A less positive development is the increase in the fraction of NO_x emitted as NO_2 by diesel vehicles, leading to exceedances of NO_2 values in many European cities. Increasing traffic volumes, coupled with the promotion of diesel vehicles in many EU Member States, have thus become one of the main reasons why countries do not meet EU air quality regulations.

To make matters worse, NO_x emissions from diesel vehicles under real-world driving conditions often exceed the test-cycle limits specified in the Euro emission standards, a problem that also affects official fuel consumption and CO_2-emission values. In general, an average diesel car emits more PM and NO_X than petrol, but less CO_2. Recent data show that the CO_2 difference is decreasing.

Prospects

Before the economic crisis, Europeans were travelling more than ever before (see SOER 2015 briefing on tourism). Based on past trends, the European Commission's 60% transport GHG reduction target by 2050 will not be met. Meeting these targets will therefore require fundamental transitions in the European transport sector.

One of these transitions is the shift to alternative fuel vehicles. However, too few alternative fuel vehicles (electric, plug-in hybrid and hydrogen vehicles) are currently being sold. Consumers are reluctant to purchase these vehicles, and manufacturers are deterred from investing further in them. The European Commission has recently submitted a proposal to significantly develop the infrastructure for alternative fuels as a way of addressing the problem of low uptake of vehicles and lack of infrastructure.[7] As well as delivering clear environmental benefits (reducing average CO_2 emissions and reducing air pollutant emissions etc.), the uptake of new technologies will also reduce Europe's dependency on oil.

However, changes in the transport sector — such as renewing an entire country's fleet of vehicles — require time to take effect. Delivery of benefits from an uptake of new vehicle technologies also depends on developments in other sectors, such as clean electricity production to cope with increasing demand (while complying with the Emissions Trading System (ETS) agreements). Moreover, alternative fuel vehicles will not on their own solve other existing problems such as congestion levels, accidents and road safety, or noise levels. For this reason, additional fundamental changes in the way Europe transports passengers and goods are needed.

These additional changes include avoiding the use of transportation where possible; shifting necessary transport from environmentally harmful modes to more environmentally friendly modes; and improving the efficiency of all modes of transport. It is essential for the public to accept the need for these changes. Public acceptance is critical to overcoming the two main barriers for implementation of these changes: lack of political will and lack of funding.[8]

Fortunately, signs of a potential cultural change have already been identified in recent research. In countries such as Germany, the United Kingdom, Australia, Japan and the USA, car travel demand appears to be decreasing, remaining at the same level, or growing only slowly.[9][10][11] A number of reasons have been suggested for this change, including improved public transport, fuel prices, and changes in the symbolic value attached to vehicles.[12][11][13]

Aviation is another source of environmental pressures, and there has been extensive debate in recent years over whether international aviation should be included in the EU ETS. ICAO, the UN agency responsible for International Civil Aviation, recently agreed to develop by 2016 a global market-based mechanism to tackle emissions, to come into force in 2020. Nevertheless, the aviation sector remains exempt from fuel taxation, and ticket purchases are not subject to VAT, neither of which helps to address aviation transport demand.

> In the longer-term, Europe will need a coordinated approach, which integrates all of the above policy measures: alternative-fuel vehicles, transport avoidance, shifting to less environmentally damaging modes of transport, new infrastructure, and financial measures. In order to gain public support, this coordinated approach must aim to address not just the environmental impacts of the transport system. It must also create better health and improved quality of life for Europe's citizens.

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Urban systems

75% of Europeans — and more in the future — live in or around cities. The quality of life therein depends much on the environmental conditions. Insufficiently managed urbanisation leads to an increase in 'land take', soil sealing, fragmentation of habitats and health-related issues. European cities are dense but are becoming less so, urban sprawl thus continues.

The role of cities is critical in achieving Europe's objectives for a low carbon, resource-efficient and ecosystems resilient society.

Context

Today, 72% of the total population of the European Union (EU) live in cities, towns and suburbs.[1] The environmental dimension of urban living is crucial for the health and well-being of their residents as well as the quality of the surrounding territories.[2] The 'Urban Audit'[3] data base and the 'Urban Atlas'[4] provide detailed information on major urban areas.

Figure 1: The urban system

urban system

Various concepts have been coined to describe how complex interactions can impact on urban living (Figure 1).

- The 'urban metabolism' refers to the flows necessary to satisfy the needs of those living in cities.
- 'Grey infrastructure', such as roads, metros, railways, buildings and utilities, determines a city's layout. Yet without integrated urban planning, this urban 'engineering' generates soil sealing, fragments natural systems, increases mobility and associated pollution, energy and material consumption.[5][6]
- 'Green infrastructure' is a way to work with nature to provide social, ecological and economic benefits to the urban population such as air filtration, temperature regulation, noise reduction, flood protection and recreational areas.[7][8][9][10]

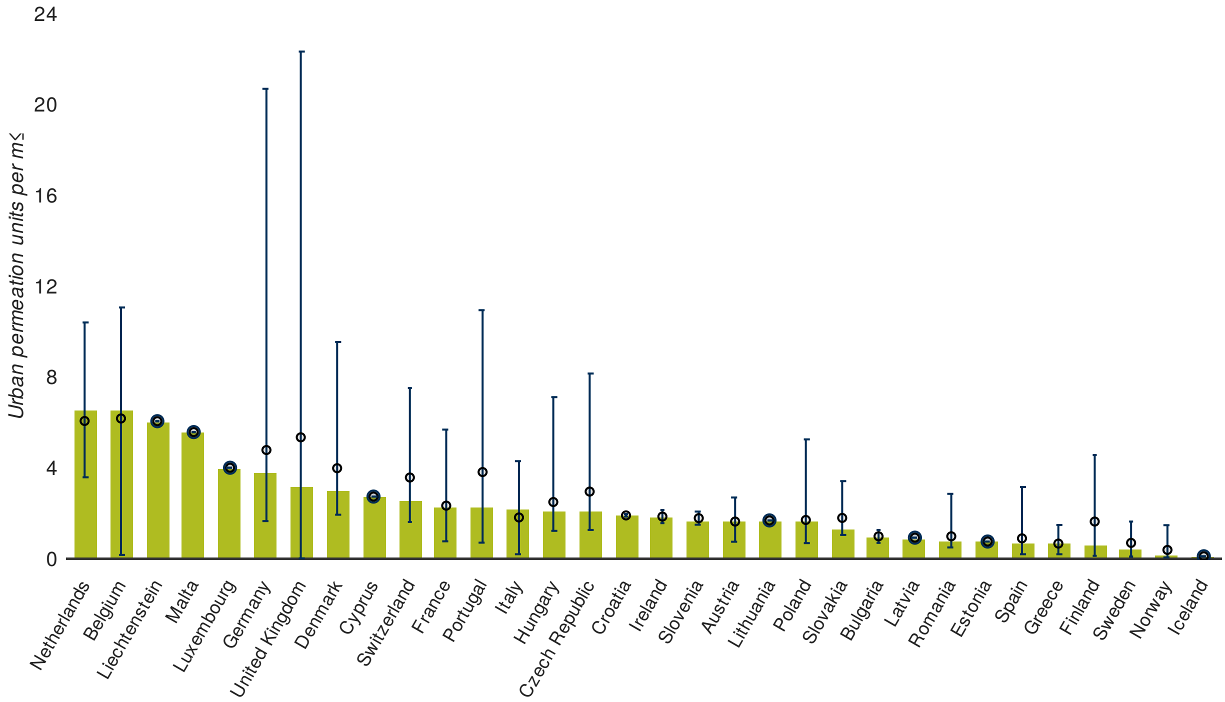
The high concentration of people and economic activities in cities cause environmental pressures. Yet cities can be planned, designed, managed and governed in an increasingly efficient way.

The EU has had a substantial impact on the development of cities over recent decades through its cohesion policy and sectoral policies (e.g. water, waste, noise, air). The Thematic Strategy on the Urban Environment[11] and the recent 7th Environment Action Programme (7th EAP)[12] promote integrated urban policy.

This could also apply for the principles of urban development in the EU as expressed in its 'Territorial Agenda of the European Union 2020'.[13] An intergovernmental process, coupled with the practical experiences gained through the European Regional Development Fund (ERDF), has led to clear principles of urban development. This is known as the *acquis urbain*.[14]

Key trends

Figure 2: Urban sprawl by country and within countries (2009)[15]



Note: There are large differences between various NUTS2 regions within each country. The thin line shows the urban sprawl within countries, NUTS2 regions (maximum and minimum). The dots show the mean values.

Data sources: Jaeger, Soukup, Orlitova, Schwick, Hennig, Kienast (2014) ongoing. Calculation done by ETC/SIA for EEA and FOEN. Calculations are based on Copernicus HRL Imperviousness 2009

Explore chart interactively

European Environment Agency

Cities depend on their neighbouring areas for supply and disposal services. The densification of urban areas is viewed as a way to reduce their spatial growth and the associated environmental impacts.

Urban sprawl versus urban density: Between 2000 and 2006 about 1 000 km^2 of land[16] was covered every year by artificial surfaces.[17] Re-using land (e.g. rehabilitating industrial sites or contaminated land), which had previously been developed but is currently not in active use, is a way to further reduce land take. Around 2.5% of the increase in artificial surfaces[18] created between 1990 and 2000 came about through the recycling of already developed land.[19]

Typically, European cities are dense but they are becoming less dense at their boundaries. Emissions of greenhouse gases (GHG) are higher in commuter towns not only because of car dependency but also due to the characteristics of the buildings. This is because high energy housing, such as detached and semi-detached dwellings, is dominant.[20] Nevertheless some European urban areas continue to expand. There are large differences in the level of sprawl both between and within European countries (Figure 2).[21] The more areas are built up and the lower their intensity of use, the higher the degree of urban sprawl.

The challenges of health and well-being: Up to one third of Europeans living in cities are exposed to levels of air pollutants[22] exceeding EU air quality standards, in particular for particulate matter (PM) and ozone (O_3),[23][24] road transport being a significant source. Half of the EU's urban population is exposed to traffic noise levels above 55dB.[25] In the dense urban environment green spaces, correctly planned and managed, can contribute to improve the air quality and to reduce excessive heat.[7][10][26]

Resource-efficient cities: Total municipal solid waste has decreased by 2% between 2004 and 2012. Significant progress has been made in recycling glass, paper, cardboard, metals and plastic.[27] Thanks to better municipal waste management, life-cycle GHG emissions from municipal waste were cut by 57 million tonnes CO_2-equivalent during the period 1990-2012.

Urbanisation leads to an increase in land take and soil sealing. This permanent covering by impermeable artificial material, such as asphalt and concrete, affects, inter alia, food production, water absorption and filtration.[5]

Cities need adequate amounts of water. They compete with agriculture, industry and tourism and this situation will be exacerbated with climate change. The largest cities are already transporting water over distances ranging from 100-200 km.

Cities emit 69% of Europe's CO_2.[28] It is critical for cities to reduce GHG emissions and to enhance resilience to potential impacts from climate change.

Box 1: A city with no clear limit

Cities are characterised by the concentration of people, buildings and activities. However, at the outskirts of cities built-up areas become diluted and mixed in with rural areas. This area can be referred to as transitional. Cities become less dense (i.e. fewer people, buildings and infrastructure) the further away one is from the city centre.

An EEA analysis of this dilution involving taking individual bands of 1 km width measured from the city centre to its edge. Some interesting results: in London 75% of the 1 km band 15 km from the city centre is built-up. For Paris this was 65% and Brussels 35%. The mean for the EU is 12%.

The transitional area, neither city nor countryside, is home to a range of functions including agricultural, residential, recreational, and energy production (e.g. windmills). The governance of these less dense areas is complicated by the fact that a number of administrative areas are involved in the decision-making process.

With the development of mobility, the urban structure has increased in complexity. Increasingly development is happening at the outskirts of cities. These areas are becoming minor urban hubs in their own right. Therefore, most of the biggest cities are embedded into a larger interconnected metropolitan area.

Prospects

The role of cities is critical in a transition towards a low carbon, resource-efficient and ecosystem-resilient society.[29] The cities of tomorrow have the potential to be healthier, denser, greener and smarter through better urban planning and governance.

Adapt to climate change now and at lower cost: Climate change will expose cities to more frequent and prolonged heatwaves, flooding, water scarcity and forest fires.[26] Cities need to build climate change resilience through strong local and regional planning and investments to maintain the functioning of urban infrastructure and services (such as buildings, roads, railways, energy grids and sewage systems) and develop green infrastructure. The European Climate Adaptation Platform, Climate ADAPT[32], launched by the European Commission's Directorate General for Climate Action (DG CLIMA), aims to support countries in adapting to climate change.

Modernising 'grey' infrastructure: Without renovation and restructuring, infrastructure that sustains everyday life — related to energy and water supply, waste management, housing and transport systems — can lead to overuse of resources and energy.[33]

Smart urban design influences transport demand. Local authorities can encourage the use of sustainable forms of transport by providing efficient, reliable and affordable collective transport and convenient walking and cycling infrastructure.[34]

Developing multifunctional green infrastructure: Cities are dependent on ecosystems inside as well as outside the city's limits. In built-up cities green spaces, from trees to large parks, improve the health and well-being of residents. Green infrastructure is seen as a cost-effective and efficient tool to combat the impacts of the climate change, to build disaster resilience and to deliver health-related benefits.[8][9][10]

Smarter cities: Smart technologies and services, that often rely on information and communication technology, offer huge opportunities to make urban environments cleaner and healthier to live in. Eco-innovations[35] can be used in many domains such as recycling, monitoring, renewable energy, transport, etc.[36][37]

Engaging society: The transition to urban sustainability requires behavioural changes that need to be accepted by society. Municipalities can raise citizens' awareness, generate fruitful participation and support citizen initiatives such as car-sharing, urban gardening and collaborative consumption initiatives. It is now possible to empower citizens and generate communities through ICT-enabled solutions.

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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

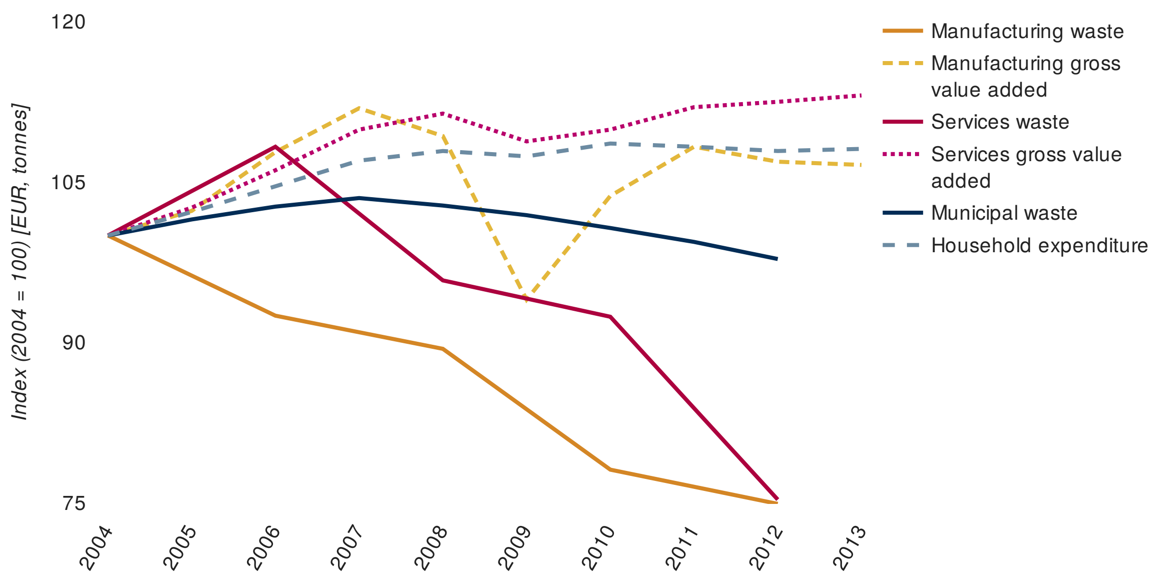
In broad terms, Europe has shifted waste management up the waste hierarchy in recent years. Although differences in national waste definitions and data processing methodologies introduce some uncertainties into an analysis of European trends, there is evidence that less waste is being landfilled as a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

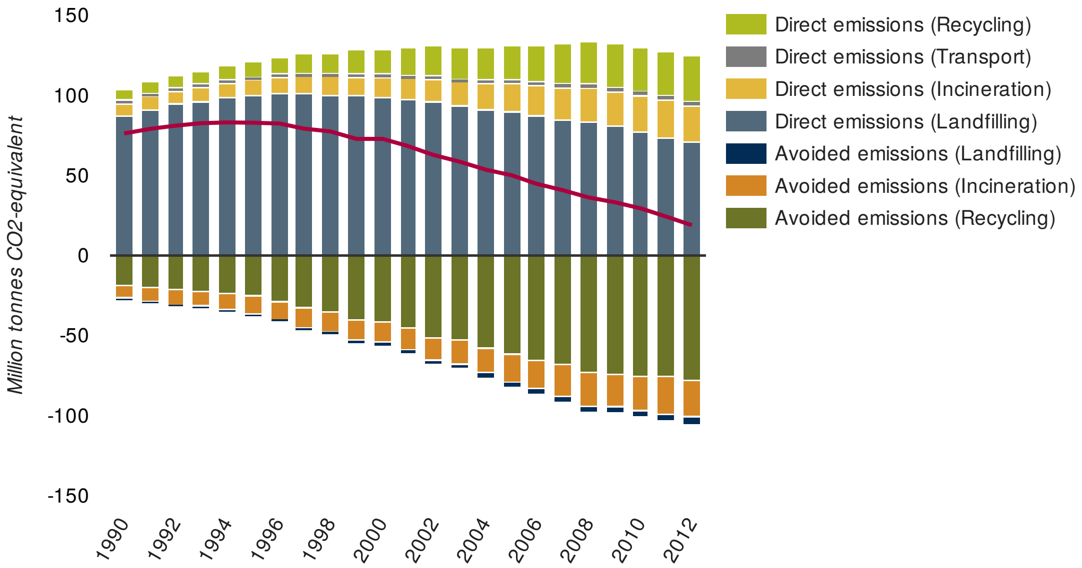
Driven by EU trade legislation and recycling targets — along with escalating resource demand in fast growing Asian economies — exports of waste from EU Member States have grown significantly. Exports of waste iron, steel, copper, aluminium and nickel doubled between 1999 and 2011. Waste precious metal 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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