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Europe has strong environmental governance structures and mechanisms in place. In particular, the European Union (EU) has been implementing robust environmental policies over the last four decades. Regular monitoring, reporting and assessment required by legislation is an integral part of EU environmental governance, helping to inform policy makers whether policies are effective, and to identify emerging issues. This concept has already or is being emulated in neighbouring countries and, although to a lesser extent, through the pan-European Environment for Europe ministerial process that was initiated in 1991. Moreover, since the 2002 Earth Summit in Johannesburg, the EU’s agenda has been increasingly oriented to external multilateral policies.

Both EU and non-EU European countries are also well on track to meet their own Kyoto targets. European countries are implementing climate-related policies ranging from carbon taxes to emissions trading schemes, stimulating renewable energy systems and local voluntary efforts by municipalities. More recently, climate change adaptation strategies are being developed. Large-scale reductions in anthropogenic greenhouse gas emissions can only be achieved through a tightly coordinated combination of different policies targeting different economic sectors and sources of emissions. The EU, with some of its neighbouring countries, is also a major donor to various global efforts to combat climate change.

Across most of Europe, many aspects of air quality have improved in recent decades, although problems still remain, particularly related to urban air quality, human health and ecosystem degradation. The pan-European scientific monitoring network of the Convention on Long Range Transboundary Air Pollution has been pivotal in building credibility, shaping policies and monitoring air quality trends. A variety of policies, often mutually enforcing, are being applied at regional, national and local scales. Tools cover both obligatory and voluntary implementation mechanisms, and many are being replicated elsewhere in the world, or have the potential to be.

Freshwater policies have been implemented successfully through a mix of policy instruments, often directed through strong umbrella legislation, but challenges such as overuse of water and water pollution persist in parts of Europe. The transboundary nature of most European rivers calls for close international cooperation, and integrated water resources management is increasingly the guiding mechanism for implementation. River basin management plans have shown potential for transfer and use throughout the region, water pollution from non-point sources has been effectively reduced through broad clusters of policies that complement each other, and water metering and water pricing have stimulated more responsible use of water.

Prevention, reuse and recycling of municipal wastes are among the most regulated activities in
the region. Comprehensive legislation supported by monitoring networks is helping to ensure compliance with regulations, but waste volumes continue to grow. In Eastern Europe, a legacy of industrial wastes from the socialist period still poses ecological problems. Policy focus is shifting towards producers’ responsibility by encouraging innovative approaches such as eodesign, new business models and changing life styles. The EU legislation on Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH), which replaces a patchwork of previous directives and regulations, looks promising for the regulation of chemicals in coming years.

The European region is at the forefront of multinational biodiversity conservation efforts. Networks of protected areas have been successfully established through Natura 2000 and comparable efforts outside the EU, also stimulating an improved knowledge base for preserving and monitoring biodiversity. However, due to landscape, ecosystem and habitat degradation both within and outside protected areas, the overall conservation status of habitats and species is showing no sign of improvement. Through national initiatives for sustainable forest management and payments for ecosystem services, the challenges of biodiversity conservation, climate change and protection of freshwater resources are being addressed in an integrated way, and are already showing positive results.
**INTRODUCTION**

The pan-European region is very diverse, with its 37 different national languages spoken in the 50 European countries (Table 11.1) (Nations Online 2011) and its range of socio-economic and political systems, as well as in its varied physical environment and means of environmental governance. Europe’s land area of 23 million km² (GEO Data Portal 2011; FAO 2010) is characterized by a great variety of (agri)cultural landscapes, urban agglomerations, extensive coastal zones, forests and undisturbed pristine areas. Of the nearly 833 million Europeans, about half live in Western Europe, while some 72 per cent of the entire region’s population resides in urban areas (GEO Data Portal 2011; UNDESA 2010).

Conversion to and intensification of agriculture along with increasing demand for greater mobility and urban space have transformed a majority of European landscapes over the past 100 years, causing fragmentation and loss of natural and semi-natural habitats with an associated decline in biodiversity (Chapters 1, 3, 5 and 7) (EEA 2010h; COE 2000). However, exposure of Europe’s population to multiple air, water and chemical pollutants has generally declined, and both the European Union (EU) and most non-EU European countries are on track to meet their Kyoto targets (Chapters 1, 2, 4, 6 and 7) (EEA 2010h).

Indeed, considerable progress has been made in meeting environmental targets, with the situation improving in many areas. Nonetheless, concerns about long-term threats to the environment and human health persist, the latter especially for Europe’s large urban population (EEA 2010h). Despite some successes in decoupling environmental pressures from economic growth, Europe’s environmental footprint remains disproportionately high. This is due to the continued unsustainable use of natural resources both within and outside the region to satisfy the high production and consumption level of its inhabitants (Chapters 1–7) (EEA 2010h).

These trends are increasingly linked and complex, and require an integrated policy approach for which strong governance mechanisms need to be in place. Given that Central and Western Europe in particular have a dense network of political boundaries, a regional focus to tackle environmental issues is necessary. A major attribute of the pan-European region is its economic and political interconnectedness, combined with

| Table 11.1 Country groupings used in various environment-related reporting and policy initiatives in Europe |

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<tr>
<th>EEA and EU country groups</th>
<th>UNEP GEO-5 country groups</th>
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<tr>
<td><strong>Sub-regions</strong></td>
<td><strong>Countries</strong></td>
</tr>
<tr>
<td>EEA member countries (EEA-32*)</td>
<td>Iceland, Liechtenstein, Norway, Switzerland</td>
</tr>
<tr>
<td>European Free Trade Association (EFTA) countries</td>
<td>EU-15 Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom</td>
</tr>
<tr>
<td>European Union member countries (EU-27)</td>
<td>EU-12 Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia</td>
</tr>
<tr>
<td>EU candidate countries</td>
<td>Croatia, Former Yugoslav Republic of Macedonia, Turkey*</td>
</tr>
<tr>
<td>EU potential candidate countries</td>
<td>Albania, Bosnia and Herzegovina, Montenegro, Serbia</td>
</tr>
<tr>
<td>Partner countries of the EU European Neighbourhood Policy</td>
<td>Armenia, Azerbaijan, Belarus, Georgia, Israel, Jordan, Lebanon, Libya, Republic of Moldova, Morocco, Occupied Palestinian Territory, Syria, Tunisia, Ukraine</td>
</tr>
</tbody>
</table>

* Turkey is already an EEA member country (and thus part of EEA-32).

Source: UNECE 2012; EEA 2010h; UNEP 2007b
well-established and strong formal governance mechanisms and structures to address environmental issues at (sub-)regional level. This has made Europe a leader in transboundary as well as global environmental decision-making. In particular, the EU has more than four decades of experience in developing environmental policies: the first Environmental Action Programme (EAP) was adopted in 1972 while the sixth ends in mid-2012. EU legislation is implemented at a national level within EU Member States, with forceful implementation control by EU institutions. The legislation is also used in non-member European states on a case-by-case and voluntary basis.

Policy approaches have evolved over time, using policies and single-issue instruments in the 1970s and 1980s, followed by policy integration and raising public awareness in the 1980s and 1990s and thereafter (EEA 2010h; Hey 2004). An integral part of EU environmental governance is the regular monitoring, reporting and assessment required by EU legislation; these activities help to inform policy makers about effectiveness and also help to identify emerging issues. Since the early 2000s, European environmental policy has increasingly been guided by the fact that well-designed, coherent policies that integrate different sectoral policy domains can provide greater benefits at lower costs than several single policies. As a result, Europe’s natural resources are used with increasing efficiency (EEA 2010h).

This concept is already being emulated in EU neighbouring countries and in the pan-European Environment for Europe ministerial process that was initiated in 1991. In September 2011, for example, the Seventh pan-European Environment for Europe Ministerial Conference focused on the sustainable management of water and water-related ecosystems and on greening the economy including mainstreaming the environment into economic development.

The countries of Eastern Europe also have well-developed formal environmental policies and regulations, although the implementation and enforcement of these has often tended to lag. In the early 1990s, following the collapse of industry in Eastern Europe, environmental pressures dropped substantially in many countries, giving the public and authorities a false sense of security. The focus of attention shifted towards more urgent needs related to economic restructuring and development, with an inclination to make the economic transition easier by reducing environmental regulation. At first this strategy worked, but later, when countries regained their economic strength, it began to backfire.

A new wave of improved environmental legislation and policies can now be expected in the non-EU part of Europe, the current global financial crisis notwithstanding. Promising policies include, for example, integrated river basin management and cross-boundary biodiversity conservation. Another example is the Inter-Parliamentary Assembly of the Commonwealth of Independent States (IPA CIS), with its consultative and informative role. It has a Permanent Commission on Agricultural Policy, Natural Resources and Ecology, which advises the parliaments of CIS countries and suggests sample legislation on environmental issues. Practically all aspects of modern environmental policy are covered, ranging from environmental security, environmental insurance and strategic environmental assessments to environmental monitoring, energy conservation and environmental education (IPA CIS 2011).

**POLICY APPRAISAL**

For this chapter, five key challenges/priority issues were identified for Europe, in no particular order, during a GEO regional consultation held in September 2010:

- climate change;
- air quality;
- freshwater;
- chemicals and waste; and
- biodiversity.

At the GEO Regional Consultation, five international environmental goals related to the key challenges were identified, and regional-level goals were added later where applicable. The group then selected promising policies that have already shown some degree of success in helping to speed up meeting the globally and regionally agreed environmental goals (Table 11.2).
<table>
<thead>
<tr>
<th>Themes and international goals</th>
<th>Policy cluster/approach</th>
<th>Regional goals/targets</th>
<th>Policy options</th>
<th>Examples of success</th>
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<tr>
<td><strong>Climate change</strong>&lt;br&gt;United Nations Framework Convention on Climate Change (UNFCCC 1992) Articles 2 and 4.8</td>
<td>Combating climate change by creating and using markets</td>
<td>EU 20-20-20&lt;br&gt;- Reduce EU greenhouse gas emissions to 20% below 1990 levels by 2020 (30% if other industrialized countries make similar commitments and developing countries contribute adequately)&lt;br&gt;- Lower EU energy consumption by 20% compared with projected levels for 2020, through increased energy efficiency&lt;br&gt;- Meet 20% of EU energy needs from renewable sources by 2020 (EC 2009a)&lt;br&gt;- Have EU national adaptation strategies in place by 2015 (ECouncil 2007)</td>
<td>EU Emissions Trading System</td>
<td>Pledges for post-2012 period (Box 11.1)</td>
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<td></td>
<td>Adapting to climate change by working with the public and private sectors, and through command-and-control regulation</td>
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<tr>
<td></td>
<td>Integrated air quality management with the public and private sectors, command-and-control regulations, using markets, creating awareness and voluntary actions</td>
<td>EU by 2020&lt;br&gt;Reduce, compared to 2000:&lt;br&gt;- number of years of life lost due to particulate matter by 47%:&lt;br&gt;- number of premature deaths due to ground-level ozone by at least 10%&lt;br&gt;- forest area affected by ozone by 15%&lt;br&gt;- forest area affected by acidification by 74%&lt;br&gt;- freshwater area affected by acidification by 39%&lt;br&gt;- area affected by eutrophication by 43% (EC 2005)</td>
<td>EU fuel and vehicle standards</td>
<td>Adopting European fuel standards (Figures 11.4 and 11.5)</td>
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<td></td>
<td>Reducing emission levels through command-and-control regulations and by using markets</td>
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<tr>
<td><strong>Air quality</strong>&lt;br&gt;Agenda 21 (UNCED 1992) Chapter 9 Paragraph 27</td>
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<td><strong>Freshwater</strong>&lt;br&gt;Johannesburg Plan of Implementation (IPOI) (WSSD 2002) Paragraph 26</td>
<td>Integrated water management through command-and-control regulations, with the public and private sectors and by using markets</td>
<td>EU overall goal&lt;br&gt;- Get all water, including lakes, rivers, streams and groundwater aquifers, into a healthy state by 2015 (ECouncil 2000) By end 2012&lt;br&gt;- Specific targets for 2020 adopted in the EU 2012 Blueprint to Safeguard Europe’s Water Resources (EC 2011a)</td>
<td>River basin management plans&lt;br&gt;Policy mixes to reduce non-point sources of water pollution</td>
<td>Tisza River Basin Management Plan (Box 11.5)</td>
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<td>Denmark’s accounting system for nitrogen use in agriculture (Box 11.6)</td>
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<td>Water metering and pricing</td>
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<tr>
<td><strong>Chemicals and waste</strong>&lt;br&gt;Johannesburg Plan of Implementation (IPOI) (WSSD 2002) Paragraph 23</td>
<td>Reducing the amount of waste produced through command-and-control regulations and by using markets</td>
<td>EU by 2020&lt;br&gt;- Recycle 50% of annual municipal waste and 70% of annual construction waste in the EU by 2020&lt;br&gt;- By 31 May 2013: companies must register chemical phase-in substances manufactured or imported in the EU of 100 tonnes or more per year&lt;br&gt;- By 31 May 2018: companies must register chemical phase-in substances manufactured or imported in the EU of 1 tonne or more per year (ETC/SCP 2010)</td>
<td>Waste prevention&lt;br&gt;Preparing for reuse&lt;br&gt;Preparing for recycling&lt;br&gt;Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH)</td>
<td>Extended producer responsibility (Box 11.8)</td>
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<td>Comprehensive legislation on chemicals through command-and-control-regulations</td>
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<td><strong>Biodiversity</strong>&lt;br&gt;Convention on Biological Diversity (CBD 1992) Articles 8, 10 and 11</td>
<td>Expanding and strengthening ecological networks through legislation and action plans</td>
<td>EU by 2020&lt;br&gt;- At least 15% of degraded ecosystems restored&lt;br&gt;- Forest management plans in place for all publicly owned forests and forest holdings above a certain size that receive EU Rural Development Policy funding (EC 2011c)</td>
<td>Transboundary EU Natura 2000 network and national non-EU country networks</td>
<td>National ecological network of Ukraine (Box 11.9)</td>
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<td></td>
<td>Integrated management of forest resources and farm land with high nature value through voluntary action and payment for ecosystem services measures, working with both the public and private sector</td>
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Table 11.2 Selected themes, goals and policy options and examples of success
The Introduction to GEO-5 explains the methodology applied in this appraisal in more detail. It is acknowledged that:

- recent, innovative policies do not have a long enough track record to be selected for this appraisal, though some promising emerging policies are included in the conclusions at the end of this chapter;
- even where actual evidence of policy effectiveness does exist, such environmental improvements cannot usually be directly linked to one single policy or cluster of policies because of impacts from other sectoral policies, economic developments or political restructuring; and
- there are certainly other priority issues in parts of the region – such as the marine and coastal areas surrounding large parts of Europe, a new energy mix, land-use change and land degradation, or developments in Europe’s mountainous areas – but these were not among the maximum of five key challenges/priority issues selected for this analysis by the GEO regional consultation.

Climate change

In terms of the total reduction in greenhouse gas emissions, European countries are leading the global climate change mitigation effort by a wide margin. Other large advanced economies have either not ratified the Kyoto Protocol (United States), are failing to meet their Kyoto targets (Canada) or are allowed to increase their emissions (Australia). Japan, with its 6 per cent reduction target, is the main exception. Figure 11.1 presents current emission data and trends for the main sectors in the EU-27, clearly illustrating the dominant role of energy (Chapters 1, 2 and 3).

The EU-15 is well on track to meet its Kyoto target; indeed, overcompliance may even be achieved when the Clean Development Mechanism, Joint Implementation mechanism, and carbon removals such as forestry activities, are factored in (EEA 2010j). None of the Central and Eastern European countries have faced any problems in meeting their Kyoto Protocol obligations as their targets were set before the fall in emissions associated with the collapse of the Soviet bloc. In addition, regional emission targets for the post-2012 period have been set (Box 11.1).

Box 11.1 Greenhouse gas reduction pledges for the post-2012 period

In March 2007, the EU-27 unilaterally committed itself to reducing its greenhouse gas emissions by at least 20 per cent by 2020 compared to 1990, and to increase this commitment to 30 per cent if other industrialized countries commit to comparable emission reductions and developing countries contribute adequately according to their capabilities. These commitments were renewed by the EU-27 in the Copenhagen Accord in 2009. Similar pledges have been made by other advanced European economies, notably Iceland, Monaco, Norway and Switzerland. The EU has further declared that it will seek to achieve reductions of the order of 80–95 per cent by 2050 (EEA 2010j). In the Copenhagen Accord, the Russian Federation pledged to reduce its emissions by 15–25 per cent by 2020 and 50 per cent by 2050 compared to 1990, and Ukraine by 20 and 50 per cent respectively. Belarus, Croatia, the Former Yugoslav Republic of Macedonia, Moldova and Montenegro have also formally pledged to reduce their emissions. The United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties in Cancún in December 2010 formally put those pledges into UN documentation, and the UNFCCC Secretariat will monitor progress (CG 2011).

Figure 11.1 Sectoral trends and projections for EU-27 greenhouse gas emissions, 1990–2020

![Figure 11.1](https://via.placeholder.com/150)

Note: Greenhouse gas emission projections are shown as dashed lines under existing policy measures and black dotted lines with additional measures.

Source: EEA 2011b

A recent report by the EU calls for the total elimination of fossil-fuel-powered cars in cities by the year 2050. © Robert Bremec/Stock
Large-scale reductions of greenhouse gas emissions can only be achieved, however, through a tightly coordinated and coherent combination of different policies targeting different economic sectors and sources of emissions. Only then can efficient synergies be achieved.

In 2009, the EU formally adopted its climate and energy package, an integrated approach with binding legislation to implement the EU’s three main climate and energy targets:
- reduce EU greenhouse gas emissions to 20 per cent below 1990 levels by 2020;
- reduce EU energy consumption by 20 per cent compared with projected levels by 2020 through increased energy efficiency; and
- meet 20 per cent of EU energy needs from renewable sources, including biofuels, by 2020 (EC 2009a).

These commitments together have been labelled the 20-20-20 targets, which are being implemented through an array of policies ranging from carbon taxes and emissions trading schemes to local voluntary efforts by municipalities (EC 2009b). Two of the most promising policies are discussed below.

**European Emissions Trading System**

The EU Emissions Trading System (EU ETS) was launched in 2005 as a cornerstone of EU climate policy and the key tool for reducing industrial greenhouse gas emissions in a cost-effective manner. It is the first and largest international scheme for trading emission allowances, and is open to non-EU countries on the condition that they meet the strict standards of the EU ETS.

The EU ETS covers about 40 per cent of EU greenhouse gas emissions. For 2009, the EU carbon trading market was estimated to be worth nearly US$118.5 billion per year, compared to a

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**Figure 11.2 EU Emissions Trading System cap, 2005–2050**

![Linear reduction factor](chart.png)

Scope changes

-71% compared to 2005

- Linear reduction factor

- EU ETS cap phase 1 and phase 2

- EU ETS cap phase 3 (which ends in 2020) and beyond, based on an annual linear reduction

Source: EEA 2011b
global carbon credit market worth an estimated US$143.75 billion. In 2009, the volume of emissions covered by the system reached 6.33 billion tonnes compared to 41 million tonnes covered by the Chicago Climate Exchange (CCX) (Kossoy and Ambrosi 2010).

Falling prices of carbon credits in the first (2005–2007) and second (2008–2013) phases of the EU ETS, although caused by different factors, demonstrate the crucial requirements of the supply of accurate, reliable and constantly updated figures on energy consumption and emissions, verified by strict monitoring (Morris and Worthington 2010; Ellerman 2008). The Third Trading Period (from 1 January 2013) will implement several important changes such as inclusion of airline emissions, increased auctioning of allowances, and an ambitious EU-wide cap instead of national caps. The EU ETS cap will decrease continuously from 2013 onwards using a linear reduction factor (Figure 11.2).

The EU ETS is an attractive option for European countries outside the EU. Iceland, Liechtenstein and Norway are already covered by it through their membership of the European Economic Area Agreement, while Switzerland will be the first non-EU country whose national emissions trading system is linked to the EU ETS (Bart 2007; Ellerman and Buchner 2007) and Australia is exploring this possibility as well (Planet Arc 2011).

**Feed-in tariffs for renewable energy systems**

Feed-in tariff schemes were elaborated as the main support mechanism for renewable energy systems. Its goal goes far beyond reducing carbon dioxide (CO₂) emissions only; it also takes issues such as energy security, independence from conventional fuel price volatility or decentralization of energy into account (Blanco and Rodrigues 2008).

The policy offers long-term contracts to renewable energy producers, typically based on the cost of generation of each technology with two basic pricing models: a market-independent fixed price, applied by Germany’s Renewable Energy Source Act (EEG 2009), and a market-dependent premium price model, used, for example, by Spain (Mendonça et al. 2009; Klessmann et al. 2008). The German Renewable Energy Feed-in-Tariff (REFIT) scheme, launched as early as 1991, is a successful example (Box 11.3). Spain is another positive example, as the country has established a dynamic, export-oriented and job-creating renewable energy sector even if it has not succeeded in other areas of climate policy (Sills and Roca 2010; Bechberger 2009; del Rio Gonzalez 2008). About two-thirds of EU Member States have now built up renewable energy capacity using feed-in tariffs (Figure 11.3) (Weidner and Mez 2008; Busch 2003).

At least 17 developing countries and emerging economies, including Brazil, China, India, Kenya, Nicaragua, South Africa and the Republic of Tanzania, have feed-in tariff schemes in place, most of which have been implemented within the last five years through, among others, the Global Energy Transfer Feed-in-Tariff for Developing Countries (GET FIT) programme (Box 11.2) (REN21 2010). About 60 per cent of projects that have been registered under the Clean Development Mechanism or are in the pipeline for 2012 are for renewable energy, showing that development of this has become the most attractive climate policy option for developing countries (UNFCCC 2011; UNEP Risoe Centre 2010).
Part 2: Policy Options

Climate adaptation policies
When floods caused serious human and material damage in Central Europe in the summer of 2002, the European Commission (EC) reacted immediately by proposing the use of existing funds in a flexible way to respond to the urgent needs of the people affected. By mid-November 2002, an EU Solidarity Fund (EUSF) had been launched to finance short-term responses such as reconstruction of damaged or destroyed infrastructure, and to secure protective infrastructure such as dams and dykes. As the EUSF is restricted to the uninsured sectors of public infrastructure, it should be supplemented with a unified, innovative insurance system, being developed across Europe, which has the power to transfer risks from the local level to national and even global insurance markets through primary insurance and re-insurance (Box 11.3) (EC 2004).

Another tool to assist in preparing for the impacts of climate change is the 2007 EU Floods Directive, under which draft national flood risk maps had to be submitted in 2011, with final versions to be ready by 2013 and final adaptation plans by 2015 (ECouncil 2007). More recently, the EU White Paper on Adaptation to Climate Change (EC 2009b) has moved beyond short-term disaster responses, outlining key steps towards a European framework for long-term adaptation measures and policies to increase resilience, to be implemented at national and local levels. Top-down strategies are envisaged for mainstreaming adaptation into sectoral policies, focusing on sectors such as land-use planning, agriculture, water management and biodiversity/nature conservation. Bottom-up activities focus on building adaptive capacity and implementing action at municipal level (EEA 2010h). In addition, a new EU Clearinghouse on climate change impacts, vulnerability and adaptation was put in place with the first stage of the strategy to run until 2012 (EC 2010c).

Air quality
Although many aspects of air quality across Europe have improved in recent decades due to emission reductions from industry and transport (Chapter 2), air pollution continues to pose a threat to human health, especially in urban areas (EEA 2010h). For example, exposure to fine particulate matter (PM$_{2.5}$) was estimated to have caused 5 million lost life years in 2005 in the EEA-32 (EEA 2010h). Similarly, other air pollutants continue to cause environmental damage to ecosystems, with 10 per cent of the EEA-32 natural ecosystem area still subject to acidifying pollutant deposition caused by sulphur dioxide (SO$_2$) and nitrogen oxides (NOx) (EEA 2010h), and more than 40 per cent of sensitive terrestrial and freshwater ecosystems still subject to eutrophying atmospheric nitrogen deposition in the form of nitrogen oxides and ammonia (NH$_3$) (EEA 2010h). Despite declining peak ground-level ozone (O$_3$) concentrations, background levels are steadily rising, also leading to ecosystem damage (UNECE 2010).

The Convention on Long Range Transboundary Air Pollution (CLRTAP) of the United Nations Economic Commission for Europe (UNECE) has been pivotal in providing the scientific evidence that has underpinned efforts to shape air quality policy. CLRTAP’s Flagship 1999 Gothenburg Protocol (UNECE 1999) promotes an integrated multi-pollutant, multi-effect approach to optimize efforts to improve air quality across Europe. It is comparable to the 2001 EU National Emission Ceilings Directive, which establishes legally binding pollutant-specific emission ceilings for nitrogen oxides, non-methane volatile organic compounds, sulphur dioxide and ammonia for the EU-27.

### Box 11.2 The German Renewable Energy Feed-in Tariff scheme

Between 2000 and 2010 under the REFIT scheme, the share of electricity in Germany produced from renewable sources increased from 6.3 to about 17 per cent. In 2010, investments in Germany’s renewable energy sector amounted to about US$3.5 billion and employed around 370 000 people (Jänicke 2011). The equivalent of 5.8 per cent of Germany’s CO$_2$ emissions in 2009 was thus avoided (AGEE-Stat 2010). The Deutsche Bank Climate Change Advisors established the Global Energy Transfer Feed-in Tariff for Developing Countries (GET FIT) programme, which envisages a REFIT premium for individual producers to be paid by both the national government and the GET FIT fund. The concept of a global fund similar to the GET FIT has already found its way into the footnotes of the climate negotiations in the context of the Nationally Appropriate Mitigation Action (NAMA) programme (UNFCCC 2009).

### Box 11.3 Transferring innovative climate insurance schemes

Many European insurance companies such as Swiss Re, AXA, Allianz, Munich Re, MicroInsure and Zurich have helped pioneer index-based weather risk transfer instruments in low-income countries. For example, Swiss Re started its index-based weather insurance scheme in India in collaboration with a micro-finance institution and a local insurer in 2004, since when a total of 350 000 policies have been sold to smallholder farmers in India. Similar solutions have been successfully deployed elsewhere: in 2007, Swiss Re designed and implemented index-based weather risk transfer instruments for three village clusters in Sauri (Kenya), Tiby (Mali) and Koraro (Ethiopia), protecting 150 000 farmers against drought risk. The innovation is that insurance pay-outs are based on the performance of the weather index rather than on actual damage incurred or losses suffered. One of the advantages is that pay-outs can be calculated and disbursed quickly and automatically without the need for households to file a claim formally (Warner and Spiegel 2009).
2008 Clean Air for Europe (CAFE) Directive merges much of the existing air quality legislation to develop long-term, strategic and integrated policy advice.

Such European approaches have been instrumental in providing the impetus for the development of a suite of air quality policies through the establishment of binding emission and air quality standards. Three outstanding environmental success stories are described here: vehicle emissions and fuel standards, the EU Industrial Emissions Directive and local air quality management policies.

**European vehicle emission and fuel standards**

Historically, road transport has contributed substantially to atmospheric pollution by producing emissions of lead (Pb), nitrogen oxides and particulate matter (Chapter 2). Reduction of these emissions has been achieved through the establishment of EU directives controlling both fuel and vehicle emissions, with fuel policy focused on banning lead and limiting sulphur content (ECouncil 1999, 1998). European Vehicle Emission Standards (Euro standards) control exhaust emissions of nitrogen oxides, non-methane volatile organic compounds and total hydrocarbons, carbon monoxide and particulate matter from new vehicles sold within the EU. Since the establishment of the Euro 1 standards in 1992, more stringent ones have been introduced, tightening controls on different pollutants, vehicle categories, weights and classes, engine volumes and fuel types; Euro 5 standards have been in force since 2007. Figure 11.4 shows the vehicle stock allocated to the Euro standards that have been established to date. Figure 11.5 shows the timeline for the introduction of increasingly stringent Euro standards in the EU and their transferability through the subsequent adoption of these standards in many Asian countries. They have also been adopted in parts of Latin America and Eastern Europe (PCFV 2011b; OECD 2007b).

Harmful air pollutants can be transported across countries, continents and even oceans, affecting air quality far from the original source.

© Jarek Szymanski/iStock
Despite a 26 per cent increase in fuel consumption across the entire transport sector between 1990 and 2005, actual pollutant emissions in 2005 were significantly lower than a theoretical no-new-policy scenario assuming conventional technologies and no introduction of Euro standards: in the EEA-32, nitrogen oxide was 40 per cent lower than the scenario figures; carbon monoxide 80 per cent, non-methane volatile organic compounds 68 per cent and particulate matter 60 per cent lower (EEA 2010d). Lead emissions from road transport alone decreased by 99 per cent (EEA 2010c) and sulphur dioxide emissions by 92 per cent between 1990 and 2008 (EEA 2010e). Additional benefits of the Euro standards include increased engine lifetime and lower maintenance costs due to the removal of sulphur (PCFV 2007), better fuel economy and reduced greenhouse gas emissions (ICCT 2007).

The implementation of cleaner fuel policies involves costs related to fuel switching, such as replacing lead with other fuel additives and shifting to producers of low-sulphur crude oil, improving engine technologies and upgrading refineries (PCFV 2007). However, the benefits of lead phase-out and desulphurization in terms of human and ecosystem health in general exceed the costs (Blumberg et al. 2004; Lovei 1998). The EU, Japan and the United States lead the world in desulphurization policies (PCFV 2011a) and by 2011, vehicle fuel in the European region was lead free (PCFV 2011c).

The time lag in the effectiveness of vehicle emission policy depends on the average age of the vehicle fleet and the affordability of new vehicles. Awareness raising, product labelling, enforcement and regular control of fuel quality, now considered essential for vehicle policies to reach their full potential, have ensured successful implementation of these policies (PCFV 2007).

**EU Industrial Emissions Directive**

The 2010 EU Industrial Emissions Directive is designed to consolidate seven existing EU directives that have evolved since the early 1980s and have been instrumental in reducing industrial sulphur dioxide emission. The new directive will combine proven policy measures including technical emission controls, best available techniques, fuel switching and reduced sulphur content in liquid fuels.

Implementation of these measures has resulted in a clear reduction in sulphur dioxide emissions across Europe over recent decades (Figure 11.6), effectively decoupling them from industrial activities, especially in Western Europe (EEA 2010e). To some extent these reductions were aided by socio-political and economic changes between 1990 and 2000 in former socialist Eastern Europe. The reduction of total anthropogenic sulphur dioxide emissions in the EU-27 – by 80 per cent between 1990 and 2009 (EEA 2010e) – has led to substantial declines.
in acidification rates as exceedances of critical loads across Europe have been reduced. The implementation of the measures did, however, involve additional costs, requiring investment from the private and public sectors. The new EU Industrial Emissions Directive aims to reduce these costs by streamlining and enhancing cost efficiency and effectiveness (ECouncil 2010). Many control technologies have proven transferability, having been adopted in many Asian countries where they are of particular relevance since 80 per cent of Asia’s energy demand is met by coal-fired power. Enhanced penetration of measures across Asia could yield further substantial improvements in sulphur dioxide emission reductions (Klimont et al. 2009).

Local air quality management policies
Under the 2008 Clean Air for Europe (CAFE) Directive, local authorities are obliged to prepare air quality management plans to ensure compliance with air quality standards. Many policy measures have focused on urban transport since this sector generates 70 per cent of air pollutants in urban areas (Chapter 1) (EC 2007a). Perhaps the most influential of these policy measures have been low-emission zones that limit or ban the most polluting vehicles from entering urban areas and encourage faster renewal of the vehicle fleet in line with vehicle emission standards. Around 100 low-emission zones in ten European countries have either been established or are in the process of being established (Box 11.4) (LEZ 2011). Other measures include congestion charging, expansion and improvement of public transport and cycling infrastructure, car pooling and cycle sharing systems, renewal or retrofitting of municipal vehicle fleets, and traffic and green areas management. Air quality management plans also require the public dissemination of current information detailing ambient air pollution and exceedances of air quality standards (ECouncil 2008a), with citizens and legal entities having the right to go to court in cases of non-compliance with standards. However, individual lawsuits for breaches of air quality standards are rarely pursued due to costs, time-consuming procedures and low awareness (ECouncil 2008a). Besides, many urban areas in Europe are not compliant with current European air quality legislation (EEA 2010i). To be really successful, local air quality management plans require
Part 2: Policy Options

EU water legislation by non-EU countries. This understanding, and is a useful tool for assisting in implementing a common platform for both EU and non-EU European countries to exchange and transfer knowledge and create common sustainable use of water resources. The Water Convention offers and water-dependent ecosystems, and to ensure long-term availability, a trend that is likely to be exacerbated by climate change. In addition, both point and diffuse sources of pollution are still significant in parts of Europe, as a result of which some health risks remain (Chapter 4) (EEA 2010h). Europe's water challenges are driven by competing demands for water by agriculture, industry, public water supply and tourism, and further complicated by the transboundary nature of many European freshwater resources. Addressing these challenges calls for strong environmental governance structures, with a focus on coherent and integrated efforts and regional cooperation (Chapters 1 and 16).

The EU Water Framework Directive (ECouncil 2000) and pan-European UNECE instruments such as the Convention on the Protection and Use of Transboundary Watercourses (Water Convention) provide the basis for solving major water issues in the region. The Water Framework Directive brings the many isolated policies that have been developed in the EU since the mid-1970s together into one coherent legal framework for water policy decision-making within the river basin context. Its main goal is to protect and enhance the status of all EU waters, including groundwater, rivers, lakes and coastal waters, and water-dependent ecosystems, and to ensure long-term sustainable use of water resources. The Water Convention offers a common platform for both EU and non-EU European countries to exchange and transfer knowledge and create common understanding, and is a useful tool for assisting in implementing EU water legislation by non-EU countries.

Three specific policy instruments with some history of effective implementation have been selected for further appraisal: integrated management of transboundary river basins; policy mixes to address non-point sources of pollution; and water metering and volume-based pricing.

Integrated management of transboundary river basins
Water does not stop at administrative or political boundaries, making regional cooperation crucial between countries that share the natural geographical and hydrological unit of a river basin. The overarching approach of integrated water resources management has proven to be an effective policy for valuing, managing and protecting water-related ecosystems (UNECE 2011a). The development of river basin management plans is one of the main tools for implementing the Water Framework Directive, which focuses on pollution prevention and control, greater public participation in water management, and economic analysis of water use. The plans require the integration of industrial, agricultural and rural development, nature conservation and forestry programmes at the river basin scale and, in many cases, transboundary collaboration and coordination through river basin commissions. Progress in cooperation in the region is varied, however.

The first river basin commission in Europe – the International Commission for the Protection of the Rhine – celebrated its 60th anniversary in 2010, and has registered numerous successes over the years. Similar commissions have been established since for many European rivers, gradually moving eastwards despite the fact that in non-EU countries a comprehensive and strong legal basis for cooperation is often still lacking (UNECE 2011b). As many water bodies are shared by EU and non-EU countries, adequate monitoring and information systems and appropriate institutional mandates for local authorities.

Freshwater
In large parts of Europe demand for water often exceeds local availability, a trend that is likely to be exacerbated by climate change. In addition, both point and diffuse sources of pollution are still significant in parts of Europe, as a result of which some health risks remain (Chapter 4) (EEA 2010h). Europe’s water challenges are driven by competing demands for water by agriculture, industry, public water supply and tourism, and further complicated by the transboundary nature of many European freshwater resources. Addressing these challenges calls for strong environmental governance structures, with a focus on coherent and integrated efforts and regional cooperation (Chapters 1 and 16).

Box 11.4 Stockholm’s air quality management policies in a low-emission zone

Stockholm’s low-emission zone was launched in 1996 and initially targeted heavy-duty vehicles entering the city centre. Vehicles complying with Euro 1 standards were allowed to enter freely while those more than eight years old had to be retrofitted or issued a permit. Enforcement was carried out by police inspections leading to an overall compliance rate of around 90 per cent within a few years (Burman and Johansson 2001). Actual air pollution concentrations in 2000 were down by 0.5–2 per cent for nitrogen oxides and by 0.5–9 per cent for particulate matter compared to the theoretical values calculated for a no-policy situation (Burman and Johansson 2001).

Then in 2007, following a successful trial period in 2006, a variable congestion tax was launched for vehicles entering Stockholm’s city centre on weekdays during working hours. Clean vehicles running on electricity and biofuels were exempt from the tax. Burman and Johansson (2010) found that:
• the number of trips and the distance travelled in the inner city decreased in 2006 by 100 000 per day and 8.5 per cent respectively;
• the share of clean vehicles in the private fleet increased from 5 per cent in 2006 to 14 per cent in 2008;
• average pollutant concentrations decreased in the inner city by 10 per cent for nitrogen oxides, 15 per cent for carbon monoxide and 15–20 per cent for particulate matter.

Both air quality management policies were found to be even more effective if supported by additional measures such as green area networks, clean fuels, clean vehicles, extension of public transport and promotion of cycling and walking. Nonetheless, the congestion tax has been shown to generate a net social benefit of around US$95 million (€70 million) per year in the form of shorter and more reliable travel times, reduced greenhouse gas emissions, health and environmental benefits, greater traffic safety, increased public transport and higher government revenue (Eliasson 2009).
non-EU nations, countries are encouraged to jointly prepare river basin management plans: the Tisza River Basin Management Plan provides a recent example of such cooperation across EU borders (Box 11.5).

By sharing the benefits and responsibility of sustainably co-managed water resources, economic development is fostered, establishing a connection between economic activities and the environment. River basin management plans also encourage public participation in working and expert groups. However, this approach still faces serious limitations due to the magnitude and complexity of the problems it seeks to address and the significant number of stakeholders who need to be involved (Figure 11.7) (Sendzimir et al. 2008).

**A mix of policies to address diffuse sources of water pollution**

Eutrophication, predominantly caused by sewage discharges and agricultural run-off, is a major threat to European freshwater resources. Policies to reduce the flow of nutrients from point sources are well known and have proved to be successful, provided that sufficient funding is allocated to construct and manage water treatment systems. Tackling the problem of diffuse sources of freshwater pollution is much more challenging (DEFRA 2002).

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**Box 11.5 Integrated Tisza River Basin Management Plan**

The Tisza River, which flows through parts of Hungary, Romania, the Republic of Serbia, the Slovak Republic and Ukraine, is the largest tributary of the Danube. The main pressures threatening the region are pollution from nutrient, organic and hazardous substances and both floods and droughts. The countries of the Tisza Basin have prepared an integrated river basin management plan, formally adopted in April 2011, in which the steps and long-term action needed to reach the required improved water status for the basin by 2015 are outlined. The plan attempts to deal with the complex links between different, potentially or actually conflicting, objectives and actors in integrated management (Figure 10.7). Experience gained in developing the plans can be transferred to other basins shared by EU and non-EU countries (UNDP and GEF 2011).

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**Figure 11.7 Complex links between objectives and actors involved in managing the Tisza Basin**

Source: Adapted from Sendzimir et al. 2008
There is significant experience in Europe of applying mixes of policies to reduce diffuse nutrient run-off, including accounting systems for the use of nitrogen in agriculture (Box 11.6), regulations on livestock density and the use of animal manure, purchase of nitrogen quotas, taxes on fertilizers, and compensation for converting agricultural land into wetlands or forest (OECD 2007a). Denmark, for example, has applied a large cluster of such mixed policies since the late 1980s, taking their synergistic effects into account, while avoiding disproportionate burdens on any particular stakeholder (Petersen and Knudsen 2010; Jacobsen 2004). As a result, the application of nutrients in Denmark has steadily decreased since the early 1990s (Figure 11.8).

**Box 11.6 Nitrogen accounting in Denmark**

A cornerstone in Danish policies addressing nutrient run-off is an obligatory, detailed nitrate accounting system introduced in 1993. Under this system, a preliminary, yearly nitrogen quota is calculated for each farm, depending on the area of arable land, the crops planted and the soil type. The accounting system is combined with other obligations, such as regulations on the use of animal manure and limits on livestock density in compliance with the EU Nitrates Directive (91/676/EEC). To reduce administrative costs both for public authorities and for farmers, the Danish authorities developed software in 2005 with pre-filled nitrogen accounts on the basis of information collected in previous years, and further information on, for example, feed and fertilizer wholesalers and slaughterhouses (OECD 2007a).

**Figure 11.8 Agricultural use of nitrogen (N), phosphorus (P) and potassium (K) in Denmark, 1960–2007**

Water metering and volume-based pricing

Europe has relatively high water consumption due to high agricultural and industrial demand (Chapter 4). In addition, considerable losses often occur in the supply chain, aggravating shortages in already water-scarce regions. In some countries up to 40 per cent of the total amount of water transported may be lost before it even reaches the consumer, while in others it can be below 10 per cent (EEA 2010h). Metering, cost recovery tariffs and proper pricing structures stimulate more responsible water use, at the same time generating funds for the maintenance of the supply system.

While water metering is a common policy tool in many counties of Western Europe, Central and Eastern European countries are still in the process of transition from a flat-rate price charged per person to a system of volume metering. Various studies reveal that on average, if individual metering systems are in place, reductions of 10–40 per cent can be achieved in household water use (Inman and Jeffrey 2006; Scheuer 2005).

In addition to metering, several Western European countries apply cost recovery tariffs and have introduced site-specific pricing structures. An increasing block rate creates the strongest incentive for conservation, applying a user-pays principle, under which the unit rate for water increases with water use, keeping the price for basic water needs relatively low (Figure 11.9). This system is becoming more common in both households and commercial sectors in Western European countries (OECD 2009). Applying this experience in Central and Eastern Europe would not only reduce inefficient water consumption, but also generate funds for modernizing the water sector, increasing the reliability of water services delivery (Box 11.7).
By the late 1990s, the water sector in Armenia was severely degraded due to poor maintenance and a failure to invest, with non-revenue water use amounting to around 70 per cent nationwide. Less than 15 per cent of the utility costs were recovered, compared to an average of 30–40 per cent among newly independent countries (OECD 2007a). In 1999, the Armenian government launched the following measures to reform the water supply and sanitation sector:

- reduce sector dependence on state subsidies and donor assistance;
- raise revenues from increased collection of water payments based on metering; and
- restructure water utility debts (OECD 2008).

Soon after the reforms took place, average water use decreased three to four times compared to the use based on flat-rate calculations. The massive process of introducing individual metering became a trigger for a chain of water sector improvements, all backed by a legal, regulatory and institutional framework that enabled private sector involvement accompanied by investment and management efficiencies. As a result, the quality and reliability of water delivery improved.

This policy, however, faces several limitations. The costs of meter installation could be too heavy a burden for poor households (Melikyan 2003), conflicting with the Millennium Development Goal (MDG) 7c of halving, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation (UN 2000). Also, water pricing should not result in a situation in which personal hygiene and health are compromised in order to pay a water bill (EEA 2009b). To become successful, water pricing and meter installation require a good understanding of relationships between price and use in each sector, taking local conditions into account. Special subsidy schemes could be introduced for providing free meter installation for poor families, gradual repayment terms, and special provisions for writing off vulnerable families’ accumulated water debts.

### Chemicals and waste

Both in the EU and in Eastern Europe, issues related to chemicals and waste have always been of primary importance. The EU’s waste policy consists of three levels of legislation. The first, so-called horizontal, level defines overall requirements for all waste types and consists of the 2008 Waste Framework Directive, which is the cornerstone of current EU waste policy (ECouncil 2008b), and the 2006 Waste Shipment Regulation. The second level of legislation deals with waste installations and includes the Waste Incineration Directive, the 1999 Landfill Directive and the 2000 Port Facilities Directive. In addition, the 2010 Industrial Emissions Directive also defines requirements for some waste installations. Finally, the third level deals with specific waste streams such as waste containing polychlorinated biphenyls and terphenyls (PCBs/PCTs), waste oils, sewage sludge, electrical accumulators like batteries, and packaging waste. One example of such regulation is the Waste Electrical and Electronic Equipment Directive, which deals with the collection and recycling of such waste (ECouncil 2002b). It also includes the Restriction of Hazardous Substances Directive, which bans the use of certain hazardous substances in electrical and electronic products (ECouncil 2002a).
A basic principle of the EU Waste Framework Directive is the hierarchy of waste management originally established in the 1996 Waste Strategy (Shinn 2005). It states that, in order to better protect the environment, Member States should take measures for their waste treatment in line with the hierarchy shown in Figure 11.10, which is listed in descending order of priority.

One of the EU’s major aims has always been waste reduction, but this goal has so far not been achieved (EEA 2010h). On the contrary, the amount of waste has been growing; notable examples including construction and demolition waste, packaging, hazardous and municipal waste, and sewage sludge (EEA 2010h). This trend has to be reversed, particularly as resource efficiency is one of seven flagship initiatives of the EC’s Europe 2020 Strategy (EC 2011b, 2011c), which is reflected in the EU goals of decoupling resource use from economic growth, measured as lower resource use per unit of gross domestic product (GDP), and of minimizing waste. In addition to reducing waste generation, it is important to improve waste recycling. Current EU data indicate that only 38 per cent of total waste is reused or recycled (EEA 2010h).

Even though radioactive waste is not a subject of the waste hierarchy, it has important implications for both safety and energy production. On 19 July 2011, the European Council adopted the Radioactive Waste and Spent Fuel Management Directive, which sets standards for the safe disposal of spent fuel and radioactive waste from nuclear power plants as well as from medicine or research. This was a major achievement achievement for nuclear and environmental safety in the EU.

Other non-EU European countries also face significant challenges in waste policy. For example, Belarus, the Russian Federation and Ukraine all have large amounts of industrial waste in landfills as well as mining waste, with few or no financial incentives to recycle them. This is the result of many Soviet-era waste management and reuse practices being abandoned without alternative schemes being introduced (Devyatkin 2009).

**Waste prevention**

The EU Waste Prevention Directive of 2008 is based on definitions laid down in the Waste Framework Directive, in which prevention has been given the highest priority. Article 3.12 of the directive demands waste prevention through measures taken before a substance, material or product has become waste, by reducing:

- the quantity of waste, including through the reuse of products or the extension of the lifespan of products;
- the adverse impacts of the generated waste on the environment and human health; or
- the content of harmful substances in materials and products.

Waste prevention should also incorporate such aspects as ecodesign, life-cycle approaches, changing business models and consumption patterns (Box 11.8; Figure 11.11).

**Box 11.8 Extended producer responsibility**

The concept of extended producer responsibility in Europe widens a manufacturer’s responsibility across a product’s life cycle from its sale to its disposal, creating an incentive to avoid unnecessary waste and encouraging recycling and recovery. One example of this is the Green Dot system, which puts a levy on producers for the collection and recycling of waste components of their packaging (EC 2010b). If well designed, this practice provides significant incentives to introduce waste prevention mechanisms and to consider the entire life cycle of the product (EC 2010b).
The practical outcomes of this policy can be achieved through a number of instruments, including legal provisions, voluntary agreements, economic instruments and incentives, and communication strategies.

**Reuse and recycling**

The Waste Framework Directive also encourages reuse, recycling and recovery, providing a range of options for the recycling of various materials including promoting the establishment of recycling targets, which can be material-specific. The figures show that the average amount of waste per citizen in the EU is approximately 6 tonnes per year. Municipal solid waste alone increased from 468 kg per person in 1995 to 524 kg in 2008, an increase of 12 per cent, caused by the increasing adoption of Western consumption habits in the new Member States (EEA 2011c). However, EU countries have made measurable progress in the efficient use of resources and management of waste, as illustrated by the fact that municipal waste recycling more than doubled between 1995 and 2008, rising from 17 per cent to 40 per cent (Figure 11.12) (EEA 2011c, 2010g).

Despite such advances, the EU is still not a recycling society, given that as of 2008, the share of municipal waste disposed of in or on land still exceeded 40 per cent (Figure 11.12) (EEA 2010g). Based on various macro-economic scenarios, it is estimated that by 2035 total waste generation in the EU-27 will have increased by 60–84 per cent compared to 2003 levels, although these figures could be significantly revised due to the current economic crisis (EEA 2010h).

Eastern Europe shows quite a different picture. In the Russian Federation with a population of nearly 143 million, the total
amount of waste generated annually is larger than that of the entire EU with a population of 502 million (3.4 billion tonnes and 2.6 billion tonnes respectively) with 90 per cent of waste originating from the mining industry (Eurostat 2011; Devyatkin 2009). On average, however, only about 26 per cent of waste is recycled. Of this recycled waste, 35 per cent is accounted for by industrial waste and only 4–5 per cent by domestic waste. All the other types of waste are effectively not recycled at all (Devyatkin 2009).

A life-cycle approach to waste management could significantly reduce Europe’s dependence on imports of raw materials and energy consumption for manufacturing new materials. More significant gains can be made, but only through full implementation of the EU’s waste directives and in particular the EU Landfill Directive. Reuse and recycling would also require significant changes in consumer behaviour, which could be helped by information and education campaigns.

Chemicals policy
The most profound and ambitious piece of legislation regulating chemicals in Europe entered into force on 1 June 2007 (EC 2007b). This legislation deals with the Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH), and replaces a patchwork of previous directives and regulations. The seven objectives that are essential for achieving a sustainable REACH framework are:

- the protection of human health and the environment;
- the maintenance and enhancement of the competitiveness of the EU chemical industry;
- the prevention of fragmentation of the EU’s internal market;
- increased transparency;
- the integration with international efforts to regulate the use of chemicals;
- the promotion of non-animal testing; and
- conformity with EU international obligations under the World Trade Organization (WTO) (EC 2007b).

One of the most important elements of REACH is the registration of chemicals. REACH requires companies that make and/or import chemicals to submit registration dossiers to the European Chemicals Agency (ECHA). The 2010 registration deadline was related to bulk chemicals supplied in quantities of more than 1 000 tonnes per year and very hazardous chemicals; by the REACH deadline of 30 November 2010, the agency had received 24 675 registration dossiers for 4 300 substances. Despite significant concerns raised by the chemicals industry about the unprecedented burden REACH placed on companies and some initial technical difficulties, the overall registration process was a success (ECHA 2010). The future deadlines in 2013 and 2018 cover chemicals supplied in smaller quantities (EC 2007b). Additionally, REACH includes some limited provisions for the integrated assessment of cumulative risks from multiple substances and other stressors.

It is expected that implementation and compliance with this legislation will lead to more predictable markets and a reduction in companies’ liabilities, especially by providing a level playing field for all market players.

Among new developments is the new EU Toy Safety Directive (2009/48/EC), with Member States expected to have had the new measures under way as of July 2011, and further parts of the directive coming into force in July 2013. Toys come under REACH regulations, and the new safety directive focuses in particular on limiting the amounts of certain chemicals that may be contained in materials used for them. Additionally, in 2013, the EU will implement the new regulation on chemical substances in cosmetics (1223/2009/EF), aimed at simplifying procedures and streamlining terminology. It will also include new provisions for nanomaterials and endocrine-disrupting substances.

The limitations of all these policy options are partly related to difficulties in obtaining information on the environmental and health risks of chemicals, especially new ones for which the risks are unknown. As there may be business issues related to the cost of filling knowledge gaps and clarifying uncertainties, there could be substantial additional advantages in sharing information between the European Chemicals Agency and its counterparts in transitional European and developing countries.

Biodiversity
Europeans are at the forefront of establishing multi-national conservation efforts (Pullin et al. 2009). A wealth of biodiversity conservation policies and tools, including various regional conventions, have been applied to European terrestrial and marine ecosystems. At supra-national level, biodiversity conservation is mainly driven by such EU legal instruments as the Nature Directives adopted in 1979 and 1992 (Figure 11.13)
and the pan-European Biological and Landscape Diversity Strategy adopted at the Third Ministerial Environment for Europe Conference in 1995. Although the EU directives are legally-binding and Pan-European strategy is not, the two are mutually supportive and lead to an improved state of biodiversity in Europe. In 2001, the EU and its Member States committed to halt the loss of biodiversity by 2010 (CBD 2010a), but this target was not met, and the status of biodiversity is still a cause for serious concern (EC 2010d). As a result, a new EU 2020 biodiversity strategy was endorsed in May 2011 (Chapter 5) (EC 2011c; CBD 2010b).

For the purpose of this analysis, three policy clusters were identified as being beneficial in achieving biodiversity conservation goals:

- the establishment of ecological networks as a key means of reducing biodiversity loss (Chapter 5);
- payment for ecosystem services as an instrument for conserving European agro-biodiversity; and
- the sustainable management of forest resources.

Three cases were selected for further appraisal: the EU Natura 2000; agro-environment measures; and the voluntary pan-European Forest Europe process.

**The Natura 2000 network**

Natura 2000, a tool used by the EU 2020 Biodiversity Strategy, represents the largest supra-national network of protected areas in the world (EEA 2010f). It incorporates sites established under the EU Habitats and Birds Directives and aims to assure the long-term survival of Europe’s threatened and most valuable species and habitats (Fock 2011; Watzold et al. 2010). It has developed steadily over the last 15 years, and is now made up of more than 26 000 sites covering 18 per cent of the EU’s land and sea areas (Figure 11.13) (EC 2010d). Similar network approaches also apply beyond EU borders (Box 11.9).

The Natura 2000 network helps protect vulnerable habitats and species as well as a wide range of ecosystem services, including the regulation of climate (such as mitigation of climate change), purification of water and maintenance of water flows, preservation of landscape and amenity values, and support of tourism and recreation (Gantioler et al. 2010; Cliquet et al. 2009). Furthermore, it facilitates cooperation beyond national boundaries, contributes to the decentralization of national-level conservation policies, and encourages local and regional cooperation.
economic development by offering job opportunities and helping to attract finance (Joja et al. 2010; Kluvankova-Oravska et al. 2009; EC 2008). Even though implementation of the network requires around US$8 billion (€6 billion) annually, there are several examples demonstrating that the benefits exceed the associated costs (Gantioter et al. 2010).

While the development of the network has made little headway with marine environments, it is a real success for terrestrial ecosystems (EEA 2010f). The conservation status is, however, still only favourable for less than 20 per cent of terrestrial habitats and species, both within and outside the Natura 2000 network (Figure 11.14) (EEA 2010f). Initially, the designation of sites faced a number of problems, but these are being overcome through the democratization of multi-level biodiversity governance (Beijen 2009; Rauschmayer et al. 2009). To avoid many sensitive problems in negotiations, for example, in 1997 the EC initiated an apolitical process for selecting sites in a bio-geographical context through scientific seminars where boundaries were agreed (CEEweb 2011; Papp and Toth 2004).

Box 11.9 Ukraine’s national ecological network

Natura 2000 has been shown to have a significant influence on the development of protected area networks beyond the EU. Similar policies have been adopted both by potential candidate countries and other Central and Eastern European countries (UNEP 2007a). Ukraine, for example, as one of its priority strategic directions for biodiversity conservation, is trying to follow EU policies and has been developing its national ecological network since 2000. Although the creation of this network faces a number of challenges, including a high degree of agricultural expansion and large-scale fragmentation of natural landscapes, it has already resulted in the establishment of transboundary ecological corridors in the Carpathian region. The first corridors were established between 2008 and 2010 as part of a project to realize transboundary ecological connectivity in the Ukrainian Carpathians, linking national parks in Poland, Romania and Ukraine. The establishment of these corridors received full support not only from forest managers and local governments, but also from local communities (Deodatus et al. 2010; UNEP 2007a).

Figure 11.14 Conservation status of EU habitats and species, 2008

<table>
<thead>
<tr>
<th>Habitats</th>
<th>Favourable 17%</th>
<th>Unfavourable - inadequate 28%</th>
<th>Unfavourable - bad 37%</th>
<th>Unknown 18%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>Favourable 17%</td>
<td>Unfavourable - inadequate 30%</td>
<td>Unfavourable - bad 22%</td>
<td>Unknown 31%</td>
</tr>
</tbody>
</table>

Note: Bulgaria and Romania are not included.
Source: EEA 2010f; ETC/BD et al. 2008

Agri-environment measures

The need to preserve high nature-value farmland (Doxa et al. 2010; EEA 2009a) in the EU was agreed in 2003 and included in the Kyiv Resolution on Biodiversity (UNECE 2003); it is also highlighted by the EU as a key action to prevent the abandonment or intensification of these lands (EEA 2009a).

Agri-environment measures, an optional policy tool for farmers (Ziolkowska 2009), provide compensation payments covering implementation costs and associated income losses to farmers who commit to preserving the environment and maintaining their farmlands through environmentally friendly practices for at least five years (Box 11.10) (Ziolkowska 2009). Under the EU Common Agricultural Policy (CAP), Member States are obliged to co-finance these measures: between 2007 and 2013, nearly 22 per cent of the expenditure on rural development, some US$27.3 billion (€20 billion), was devoted to them (EC 2010a). Securing financial support and avoiding delay in payments is necessary to ensure farmer commitment (Whittingham 2007; Pinto et al. 2005).

In terms of biodiversity conservation, agri-environment measures are at their most successful over large areas (Whittingham 2007), where they also contribute to the maintenance and enhancement of landscapes, protection of the historic environment and of natural resources, and the promotion of public access to the countryside (EEA 2009a). Their high costs, however, may limit their replicability in non-EU European and developing countries. Other limitations to their spread include potential loss of income for farmers and the difficulty predicting their effects on biodiversity (Ziolkowska 2009; Whittingham 2007).
Box 11.10 Conserving high nature-value farmland in Portugal

On the steppe plains of Castro Verde in southern Portugal, the traditional farming system is based on non-irrigated extensive cereal production, with a two- or three-year crop rotation system. These semi-natural mosaic steppe habitats are of value for the conservation of nature, particularly the great bustard (Otis tarda). In 1993, a project under EU LIFE – a financial instrument supporting environmental and nature conservation – was implemented to support the preservation of these birds and their habitats by acquiring several farms, leaving the fields fallow, and raising awareness among farmers and landowners. Then, in 1995, an EU agri-environment plan was defined so that the farmers could continue their traditional management practices, rotating crops and maintaining low livestock densities. By 1999 the bird population had improved to such an extent that Castro Verde was included in the Natura 2000 network as a special protected area for birds. Assuring the maintenance and effectiveness of such projects is an essential element in meeting long-term conservation priorities. In this case, however, the agri-environment scheme has not proved popular as delays in subsidy payments led to some farmers withdrawing from the plan (Pinto et al. 2005).

Forest Europe

Although forests currently (2010) cover 45 and 38 per cent of Europe’s and the EU-27’s territory respectively, only 26 and 4 per cent of these forests are considered to be undisturbed by humans (Figure 11.15) (Forest Europe et al. 2011). Most European forests are heavily exploited and the share of old-growth stands, crucial for forest species, is critically low. Nonetheless, Europe’s total forest area is increasing thanks to national policy initiatives coordinated in the Forest Europe framework – a voluntary pan-European policy process for establishing sustainable management of the region’s forests.

The Forest Europe process develops common strategies to meet challenges such as climate change and the protection of biodiversity and freshwater, both in Europe and globally (EEA 2010h, 2010a). Since 1990, it has established a collaborative research network on forest ecosystems, a set of pan-European criteria and indicators for sustainable forest management, and a series of action programmes tackling cross-sectoral cooperation and national forest programmes (EEA 2008). Sustainable forest management, as defined by the Ministerial Conference on the Protection of Forests in Europe, has been recognized as a commendable example of the ecosystem approach advocated by the Convention on Biological Diversity (CBD) (EEA 2008).

The benefits of Forest Europe include harmonization of forest policies in European countries that aim to achieve goals for
protecting biodiversity, combating illegal logging and certifying carbon sequestration. Europe has gained 5.1 million hectares of forest since 2005 (Forest Europe et al. 2011), and between 2005 and 2010 about 870 million tonnes of CO₂ were removed annually from the atmosphere by photosynthesis and tree biomass growth, about half of it in the EU-27 (Forest Europe et al. 2011).

Efforts to enhance the sustainability of forests through management face a lack of national capacity and awareness, and intensifying competition in international forest product markets. There is therefore an urgent need for transnational coordination to address common and cross-border issues (Hogl 2002). National differences also reflect the different roles of forests in various countries and the resulting political need to establish official forest programmes.

The absence of a legally binding agreement on forests at a pan-European level cannot be considered a limitation to successful policy implementation, but at some point it could slow the process down, as common benchmarks and well-defined targets for evaluating effectiveness and efficiency are lacking. In order to improve and accelerate the process, in June 2011 the Ministerial Conference on the Protection of Forests in Europe adopted the Oslo Ministerial Mandate for Negotiating a Legally Binding Agreement on Forests in Europe.

CONCLUSIONS

One of the main conclusions of this chapter is that the coherent application of effective policies across themes and sectors can bring major benefits in terms of an improved physical environment and a healthier population. In European environmental governance, the integration of effective policies under multiple environmental themes and economic sectors is increasingly being taken into account. Even if such policies still have one environmental theme as an entry point, they increasingly cover wide ranges of related aspects. The recent 2009 EU Climate and Energy Package exemplifies such an integrated approach, including binding legislation to achieve three linked targets (the 20-20-20 targets).

It is through such integrated policies that multiple co-benefits can be obtained most cost effectively. Industrial CO₂ emission reduction through emissions trading, for example, will at the same time improve ambient air quality; and promoting renewable energy systems will not only reduce CO₂ emissions, but will also decentralize energy production, potentially improve energy security and provide employment opportunities and economic growth in small and medium-sized companies. Likewise, climate adaptation programmes will increase resilience to climate change effects such as flooding, drought, loss of biodiversity and increased vulnerability to disease, while at the same time improving ambient air quality and reducing greenhouse gas emissions, for example through adjusted agricultural practices, which will also contribute to more sustainable agriculture.

Experience shows that limitations can be overcome if the right enabling regimes are put in place. Common barriers to implementing the policy tools discussed in this chapter are:

- a lack of good data and information to assess impacts and risks and thus support decision making;
- insufficient financial resources from the private and public sectors for dealing with environmental issues both in the EU countries affected by the financial crisis and in non-EU European countries;
- a lack of systematic law enforcement;
• traditional consumption-oriented economic policies that contradict the imperative of more sustainable consumption and hinder the decoupling of human well-being from economic growth;
• intensifying competition in international product markets; and
• increasing egoism, diminished community solidarity and an increasing, though often unjustifiable, sense of community disconnection and insecurity.

Enabling conditions that would increase policy success and replication are:
• more policy coherence, streamlining and simplified procedures that enhance cost efficiency and effectiveness;
• more efficient monitoring systems;
• stronger long-term commitment on the part of politicians and governments;
• stronger enforcement;
• transnational coordination to address common and cross-border issues;
• stronger private-sector involvement by creating and making better use of markets; and
• a more active civil society engaged through awareness raising and strong multi-stakeholder agreements.

Promising emerging innovative policies relevant to the themes covered in this chapter that would help to improve European environmental governance further and would foster scale-up and replication include:

Climate change
• the EU Effort Sharing Decision, which establishes binding emission targets for 2013 – 2020 for transport, agriculture, buildings and waste, all sectors that are currently not covered by the EU Emissions Trading System;
• the encouragement of transnational voluntary networks for local action on climate change and air quality, which are actively spreading in Europe and are focusing on more sustainable urban lifestyles, such as Local Governments for Sustainability (ICLEI), Cities for Climate Protection, the Climate Alliance, Energy Cities, CIVITAS and the Aalborg Charter.

Air quality
• devolving responsibility in local air quality management to local administrations, facilitating identification and implementation of policies.

Freshwater
• the EC’s expected 2012 Blueprint to safeguard Europe’s water resources, which will focus on prevention and preparedness in relation to river basin management, water scarcity and drought, and vulnerability to climate change.

Chemicals and waste
• the proposed mandatory target under the Waste Electrical and Electronic Equipment Directive to recycle 65 per cent of such waste – currently only some 34 per cent is recycled;
• the forthcoming EU regulations on toys to increase protection of the most vulnerable (children);
• the forthcoming EU Cosmetics Directive, to ensure adequate protection from endocrine disruptors and nanomaterials; and
• new measure to address the integrated assessment of cumulative risks from multiple substances and other stressors, filling a main gap in current regulations covering chemicals.

Biodiversity
• the expected adoption of a new Pan-European Biological and Landscape Diversity Strategy 2020, aligned with CBD targets, will reinforce the EU 2020 Biodiversity Strategy;
• the common integrated framework in support of the EU 2020 Biodiversity Strategy, involving a wide range of services and ministries, will create ownership across all relevant policy areas and stakeholders beyond the traditional biodiversity community.

In summary, European examples of regional cooperation on the environment have served as a model for other countries and regions and can potentially serve in the future. Features include current formal institutional structures and the tradition of legislating to improve state and trends in various realms in an integrated way, though as contexts vary adjustments may need to be made in other parts of the world.

Ongoing European attempts strive for continually improving environmental governance, underpinned by strong civil society participation and the recognized right of access to environmental information and justice in environmental matters as laid down in the Aarhus Convention, to date only applied in Europe. These efforts are essential for a proper and robust treatment of the shared environmental space and a healthy future for all.
Part 2: Policy Options


Quality and Quantity of primary documents can be found in the UN System, and this can be an important source for policy analysis.