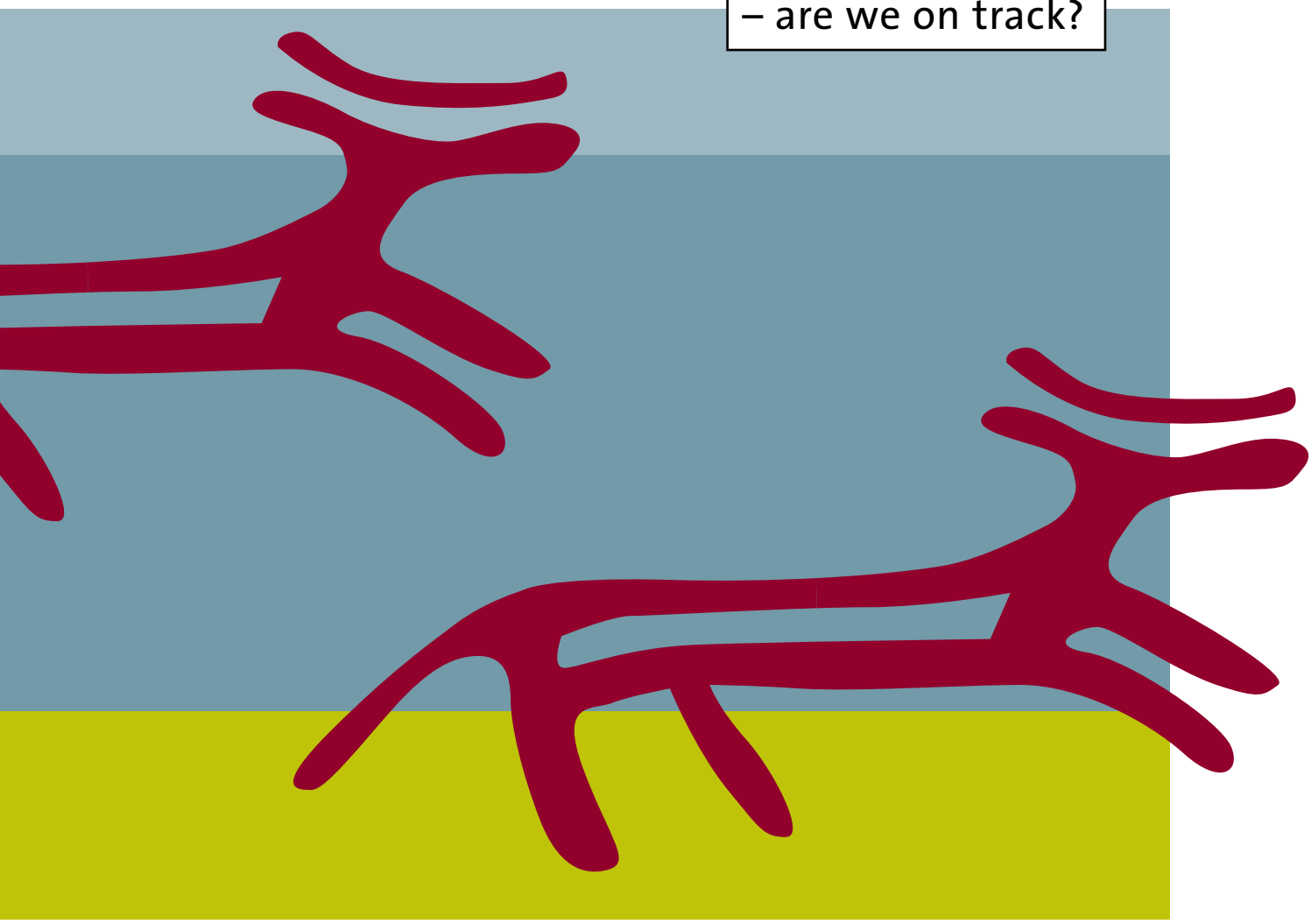
THE FIFTEEN ENVIRONMENTAL

objectives

– are we on track?



de Facto

2002

A progress report from the Swedish Environmental Objectives Council

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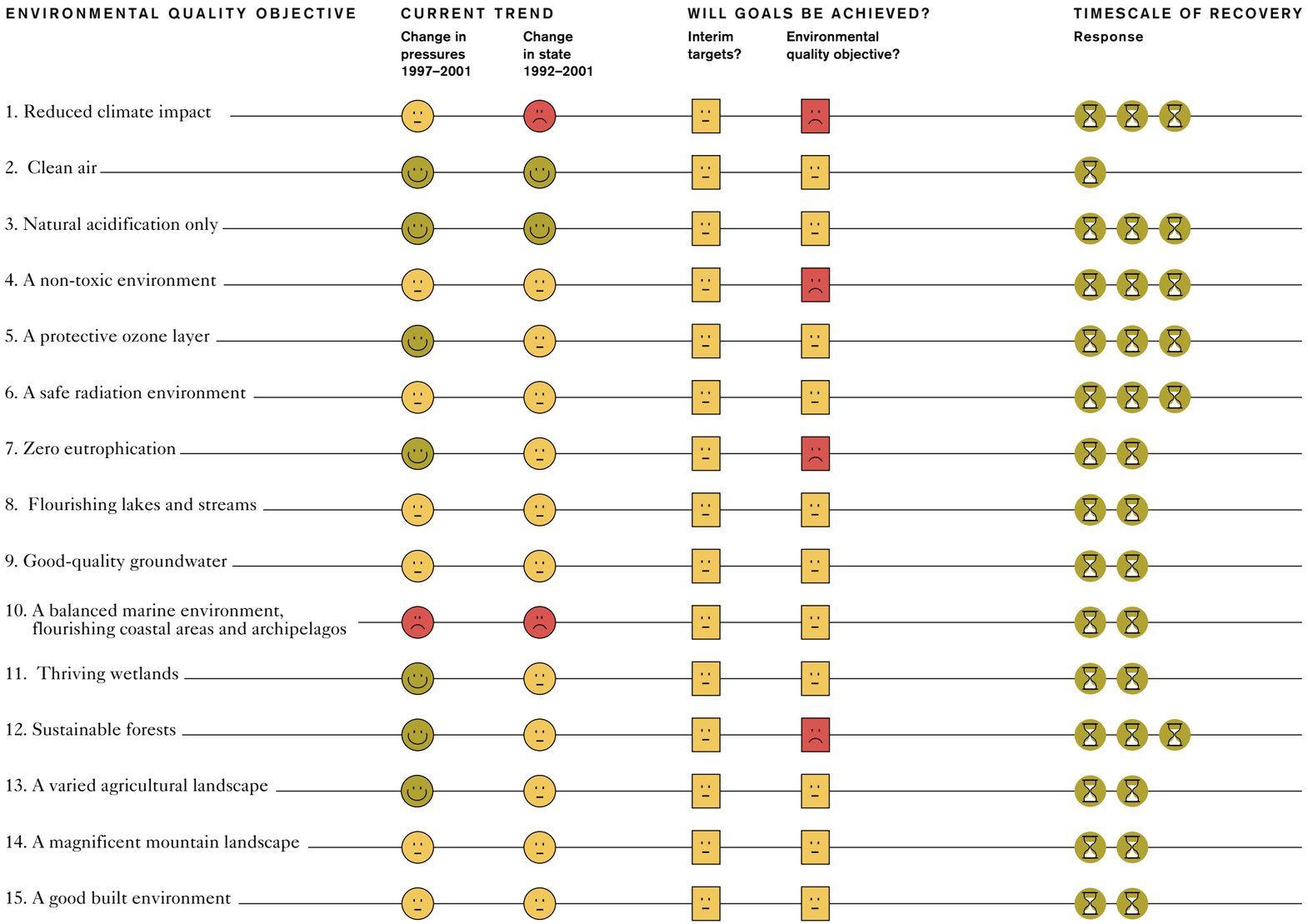


CURRENT TREND

- Favourable
- No clear-cut trend
- Unfavourable

WILL GOALS BE ACHIEVED?

- Yes
- Possibly, but further action required
- Very difficult within time-frame

TIMESCALE OF RECOVERY

- 0–5 years
- 6–30 years
- > 30 years

Progress towards the objectives

The diagram to the left gives an overall assessment of progress towards the environmental quality objectives, covering the natural environment, cultural heritage, human health and natural resources.

Changes in *pressures* on the environment are assessed with regard to how emissions, land use, pressures on cultural heritage etc. have developed over the last five years. Trends in the *state* of the environment are evaluated over a ten-year period. The neutral face symbol, meaning 'no clear-cut trend', is also used when a favourable trend (e.g. falling levels of PCBs and DDT in the sea) is judged to be offset by an unfavourable one (e.g. rising levels of certain toxic brominated pollutants). A smiley face under 'change in pressures' means that pressures on the environment have been significantly reduced and that things are moving in the right direction.

The feasibility of achieving the *interim targets* defined by Parliament (around 70 in all) is assessed overall for each environmental quality objective. Thus, in some cases a neutral face means that one target is considered easy to meet, while another is judged to be more difficult to attain. An appraisal is also given of the prospects of achieving the *environmental quality objectives* themselves in the time-frame set by Parliament.

Finally, the diagram shows how long it will take for the environment to recover once all the necessary measures have been implemented. We refer to this as the environment's *response* to the action taken. Two hour-glasses, for instance, means that recovery is expected to be largely complete within a period of 6–30 years.

Preface

In April 1999 the Swedish Parliament adopted environmental quality objectives relating to fifteen areas, describing what quality and state of the environment and natural and cultural resources of Sweden are ecologically sustainable in the long term. To guide efforts to achieve these objectives, in spring 2001 the Government proposed interim targets for each of them, indicating the direction and timescale of the action to be taken. The targets were set out in the bill *Swedish Environmental Objectives – Interim Targets and Action Strategies* (2000/01:130), which was approved by Parliament in November 2001. Further interim targets in support of the objectives were contained in the Chemicals Bill (2000/01:65, passed in June 2001) and the Climate Bill (2001/02:55, approved in March 2002). The Indoor Environment Bill (2001/02:128), put before Parliament in March and due to be passed in June 2002, also proposes interim targets.

In line with the Environmental Objectives Bill, the Government has set up an Environmental Objectives Council to monitor and report on overall progress towards the objectives. The Council consists of representatives of the Confederation of Swedish Enterprise, county administrative boards, the Geological Survey of Sweden, municipal authorities, the National Boards of Housing, Building and Planning, Fisheries, Forestry, and Health and Welfare, the National Chemicals Inspectorate, the National Heritage Board, the National Institute of Public Health, the National Road Administration, the Swedish Board of Agriculture, the Swedish Energy Agency, the Swedish Environmental Protection Agency and the Swedish Radiation Protection Authority. Members are appointed by the Government.

Each year, the Council is required to present to the Government an overall assessment of progress towards the environmental quality objectives. This is the first of its annual reports. The Council intends to further refine its monitoring and reporting procedures. In addition to the fifteen objectives, this report considers four broader issues related to them: the natural environment, land use planning and wise management of land, water and buildings, the cultural environment, and human health.

Progress reports on the environmental objectives have previously been published by the Environmental Protection Agency in the *de Facto* series (1998, 2000, 2001).

Jan Bergqvist
Chairman, Environmental Objectives Council

Glossary

Alkalinity = ability to resist acidification

Anthropogenic = resulting from human activities

Antifouling systems = agents and methods used to prevent growth of aquatic organisms on boats, jetties etc.

AOT40 = accumulated exposure (to ground-level ozone) over the threshold concentration of 40 ppb

Bycatch = unwanted fish and other marine animals trapped in nets during fishing for a different species

CAP = Common Agricultural Policy of the European Community

CET = Central European Time

CFCs = chlorofluorocarbons, used in refrigeration, heating and air-conditioning equipment, chemical products and foamed plastics

CLRTAP = Convention on Long-Range Transboundary Air Pollution

Demographic = relating to the size, structure and development of populations

Dystrophic = used to denote lakes whose water is coloured brown by peat or humic acids

EEA = European Environment Agency

Eutrophic = nutrient-rich

External dose = amount of radiation from the surrounding environment

Fennoscandia = geographical and geological region comprising Norway, Sweden, Finland, the Kola peninsula and Russian Karelia

FOI = Swedish Defence Research Agency

GDP = gross domestic product

Halons, used in fire-extinguishing equipment

HCFCs = hydrochlorofluorocarbons, used in refrigeration, heating and air-conditioning equipment, chemical products and foamed plastics

Internal dose = amount of radiation from radioactive substances in the body. Caesium-137 is ingested with food; potassium-40 occurs naturally in the body.

International bunker fuel emissions = emissions from fuel sold to ships or aircraft engaged in international transport

IPCC = the UN's Intergovernmental Panel on Climate Change

IVL = IVL Swedish Environmental Research Institute Ltd.

Landscape features = e.g. stone walls, wooden fences, ditches, solitary trees, avenues, meadow barns

Malignant melanoma = highly malignant form of skin cancer

MED = minimum erythemal dose, i.e. the amount of radiation from the sun or a solarium that causes slight reddening of the skin

Mesotrophic = moderately nutrient-rich

Methyl bromide, used as a pesticide, mainly in developing countries

mSv = millisievert, unit of absorbed dose of radiation

nGy/h = nanogray per hour, unit of absorbed dose of radiation

OECD = Organisation for Economic Co-operation and Development

Oligotrophic = poor in nutrients

PCBs = polychlorinated biphenyls

PM10 = particulate matter with a diameter of less than 10 micrometres

ppb = parts per billion (i.e. per one thousand million)

Ramsar Convention = Convention on Wetlands of International Importance especially as Waterfowl Habitat, adopted at Ramsar, Iran, in 1971

Recruitment = increase in natural population as young animals grow and reach a size qualifying them to be counted as a member of the population

Red List = list of threatened and near-threatened species

RIVM = Rijksinstituut voor Volksgezondheid en Milieu, the National Institute of Public Health and the Environment of the Netherlands

SGU = Geological Survey of Sweden

SMF = Stockholm Marine Research Centre

Stratosphere = layer of the atmosphere 20–50 km above the earth's surface

Sublittoral = zone of the seashore that is normally permanently covered by water

Terrestrial = relating to land

Troposphere = layer of the atmosphere 0–20 km from the earth's surface

UV = ultraviolet

VOCs = volatile (i.e. readily evaporating) organic compounds

WHO = World Health Organization, a UN agency

WWF = World Wide Fund for Nature

The environmental objectives – are we on track?

A progress report from the Environmental Objectives Council

Will the environmental quality objectives be achieved? Are we making sufficiently rapid progress? Will we be able to hand over to the next generation a society in which the major environmental problems have been solved? Are efforts to safeguard the natural and cultural environments, human health and natural resources adequately integrated with other societal goals, so as to secure the best solutions?

Objectives and fundamental principles

Increasingly, the focus of international cooperation is on the environment and sustainable development. Thirty years ago, the first global conference on environment and development under UN auspices was held in Stockholm. The Rio Conference, 20 years later, highlighted the need for both global and local efforts to safeguard the environment. One of the documents adopted in Rio was Agenda 21, a global programme for sustainable development, which has had a powerful impact at the local level in Sweden. 'Sustainable development' is a question of interaction between the natural and cultural environments and social and economic development. Sweden's fifteen environmental quality objectives describe the state of the country's environment that is necessary to achieving sustainable development.

During the 1990s, the Swedish Parliament introduced around 170 environmental goals. Three years ago, it adopted fifteen new environmental quality objectives, replacing the existing goals. These objectives are intended to

- promote human health,
- preserve biodiversity and the natural environment,
- preserve the cultural environment and cultural heritage,
- maintain long-term ecosystem productivity and
- ensure wise management of natural resources.

These five fundamental principles were described in *de Facto 2001*.

The generation goal

The overall goal is to hand over to the next generation a society in which the major environmental problems now facing us have been solved. This means that all the important measures needed in Sweden must be implemented by 2020 (2050 in the case of the climate objective). Nature takes time to recover, so in some cases the desired environmental state will not be attained by 2020, even if very substantial efforts are made.

To achieve the 'generation goal', major commitments by a wide range of actors are required. Technical advances can help to solve some of the problems. More far-reaching societal changes may also be necessary. For some objectives, Swedish measures will be sufficient, but most require action both in this country and abroad. To tackle the threat of climate change, global agreements are needed, even if the necessary measures must be taken by each country on a national basis – and indeed, by every citizen.

Pressures on environment are changing

Pollution from point sources is abating. Vehicle exhausts and factory flue gases are becoming cleaner, improving air quality and, in the long term, reducing damage to buildings and cultural artefacts. Lower nitrogen emissions from trans-

port, sewage systems and agriculture mean that a slight easing of the eutrophication problem can be discerned, although the improvement has not been fast enough. We have an inadequate knowledge of the environmental effects of diffuse emissions from the growing quantities of chemicals in use. Greenhouse gas emissions have not changed appreciably in the last few years.

In forestry, much greater care is now being taken to preserve valuable habitats. Farmers are better placed to manage their pasture land and preserve cultural features, thanks to payments under the Environmental and Rural Development Plan in Sweden. Wetlands are better protected against drainage and are being restored in farming areas. Adverse pressures on wetlands, farmland and forests have thus eased significantly in the last five years.

There is still too much pressure on the marine environment. Overfishing has led to the collapse of some stocks and significant shifts in the balance between species. The Baltic cod population is now seriously under threat.

Environment's response is slow

In the case of many environmental and health problems, recovery, or the environment's response to action taken, is a slow process. The state of the environment therefore does not improve as quickly as pressures ease, as the following examples illustrate:

- It will take about 10 years for there to be any discernible improvement in the ozone layer, and over 50 for it to recover completely, assuming phase-out of ozone-depleting substances continues as planned.
- Persistent toxic pollutants can remain in water and soil for a very long time after they are emitted. When taken up by plants and animals, they can continue to affect the environment and human health.
- Cancer has a long latency period, which means that reduced incidence rates are sometimes not observed until 20 years after the exposure responsible has been reduced. Skin cancer following excessive exposure to UV radiation is a case in point, although its incidence depends very much on people's lifestyles and outdoor habits.
- Despite successful action in agriculture and forestry, it will in many cases be a long time before any improvement is seen in the environment. In forests, the time lag is often at least one forest generation, or 70–150 years.
- Greenhouse gas emissions influence climate for hundreds of years to come, and a temperature rise that has occurred will persist for a very long time, even if emissions fall sharply.

Most interim targets can be met, but further action is required

Parliament has adopted numerous interim targets, to be met by specific dates (usually 2010). Many of them will probably be attained without additional measures – for example, the targets for sulphur levels in air, hard dead wood in forests, landfill disposal of waste, emissions from ships, conservation of small-scale habitats on farmland, and clean-up of contaminated sites.

In most cases, though, further action is necessary. Carbon dioxide emissions and nitrogen losses from soils are two examples. In a few cases it may prove very difficult to meet the targets, owing for instance to conflicting goals or a lack of knowledge, or because such far-reaching change is needed that it is difficult to persuade all the relevant actors to implement it in the defined time-frame.

Under each environmental quality objective there are interim targets that are easy to meet and others that are difficult to attain. The overall assessment is thus that the interim targets can be achieved, but that further action needs to be taken. The targets vary in character: some are an integral part of the final objective, while others represent one step towards it.

Consequently, an environmental objective may not necessarily be achieved, even if all the interim targets are met. New interim targets therefore also need to be developed.

Will we achieve the overall objectives?

Within one generation, i.e. by 2020, the environmental quality objectives are to have been achieved – or at any rate, all the measures necessary to attaining them are to have been implemented. In some cases, it may take longer than this for the environment to recover. Reducing our impact on climate will take more than one generation, and here Parliament has adopted a long-term goal for the year 2050. In several cases, international efforts are crucial to achieving the objectives.

Some of the environmental objectives are judged to be difficult to achieve, even if additional action is taken. This is especially true of the climate goal, but also of those relating to eutrophication, forests and a non-toxic environment. For many of the objectives, developments in the transport, energy and construction sectors are critical to success. In several cases, conflicts with other goals of society create difficulties. An adequate supply of energy, for example, is hard to achieve without any impact on climate, aquatic environments or the cultural landscape. Similarly, our need for efficient transport impedes progress towards several of the objectives. Expansion of infrastructure can disturb the natural and cultural environments, and yet appropriately designed infrastructure – making possible sewage treatment, greener transport etc. – can help ensure that environmental problems are not exacerbated.

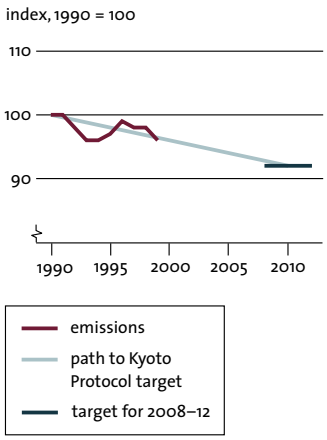
The far-reaching structural changes occurring in society are undermining much of the basis for using and conserving our cultural heritage. If parts of our history are not to be obliterated, we need to pursue regional development policies that promote the survival of existing cultural environments. Otherwise, the objectives that include conservation and development of built environments of cultural and historical value could prove difficult to achieve. This is particularly true as regards the farmed landscape, where a continuation of agriculture is essential to preserving both cultural heritage and biological assets in their proper context.

Noise, especially from traffic, is a widespread environmental problem and the form of disturbance that affects the largest number of people. An estimated two million Swedes are exposed to noise levels that affect their health. It is expected to be very difficult to achieve the targets for noise by 2020. Radon in homes and other buildings is another problem. Almost half a million homes have radon levels exceeding the interim target proposed in the Indoor Environment Bill. Radon causes some 400 cases of lung cancer every year. Smokers are particularly at risk, accounting for around 350 of these cases. Air pollution, e.g. from road traffic, still causes many deaths.

In several areas it has proved possible to sever the link between economic growth and pressure on the environment. This is true, for example, as regards industrial country emissions of acidifying pollutants, and emissions of nitrogen oxides. Energy consumption and hence carbon dioxide emissions are closely linked to economic development. Even if less and less energy is used in manufacturing and other processes, it will be difficult to eliminate this link.

The development of our society – and hence success in securing a better environment – is intimately bound up with developments at the international level. Progress can be noted, including the EU's chemicals strategy and the Gothenburg Protocol on air pollution. The Kyoto Protocol lays the foundations for a global regulatory framework to limit and reduce greenhouse gas emissions. In several fields, Sweden needs to take an even clearer lead, not least within the EU. This is obviously the case in relation to the climate goal, but it is also important for some of the other objectives.

FIG. A Index of greenhouse gas emissions in the 15 EU member states, 1990–1999



In the index year 1990, EU emissions of greenhouse gases, expressed as carbon dioxide equivalents, totalled 4199 million tonnes.

Between 1990 and 1999, emissions fell by 4% for the EU as a whole, with Germany and the UK making particularly significant contributions to the overall reduction. Further action needs to be taken, though, if the EU member states are to fulfil their first joint commitment under the Kyoto Protocol. Predictions indicate that greenhouse gas emissions in 2010 will not be below 1990 levels.

1| Reduced climate impact

OBJECTIVE

The UN Framework Convention on Climate Change provides for the stabilization of concentrations of greenhouse gases in the atmosphere at levels which ensure that human activities do not have a harmful impact on the climate system. This goal must be achieved in such a way and at such a pace that biological diversity is preserved, food production is assured and other goals of sustainable development are not jeopardized. Sweden, together with other countries, must assume responsibility for achieving this global objective.

Human activities have affected climate

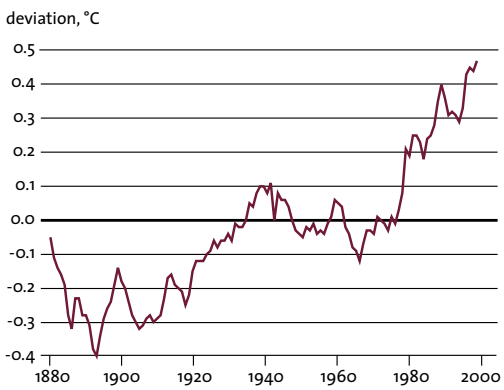
Levels of greenhouse gases in the atmosphere have increased since the Industrial Revolution, and are continuing to rise. The UN's Intergovernmental Panel on Climate Change (IPCC) has evaluated all the scientific data and concludes that there is clear evidence that climate has changed in the last 150 years. The IPCC considers this to be partly a result of human activities. If global emissions continue at their present level, the risk of the climate system being affected to a dangerous degree will increase, in terms of both the scale and the pace of the temperature rise.

Burning of fossil fuels a major cause

Combustion of fossil fuels accounts for the largest Swedish contribution to the greenhouse effect. However, the proportion of the country's energy supply derived from renewable sources has increased. At the same time, energy use is becoming more efficient, helping to reduce specific energy requirements. This does not always result in an absolute decrease: for example, carbon dioxide emissions from transport are continuing to rise. Furthermore, emissions vary widely from one year to another, depending on the state of the economy, the availability of hydroelectric power and the weather – the latter especially in winter, when most heating is required.

In 2000, emissions of greenhouse gases were just under 2% lower than in 1990. Emissions of methane and nitrous oxide fell by an estimated 14% and 9% over this period, and thus account for a large share of the decrease. Carbon dioxide emissions were 0.5% lower in 2000 than in 1990.

FIG. 1.1 Deviation of global annual mean temperature from average for 1951–1980 (five-year mean)

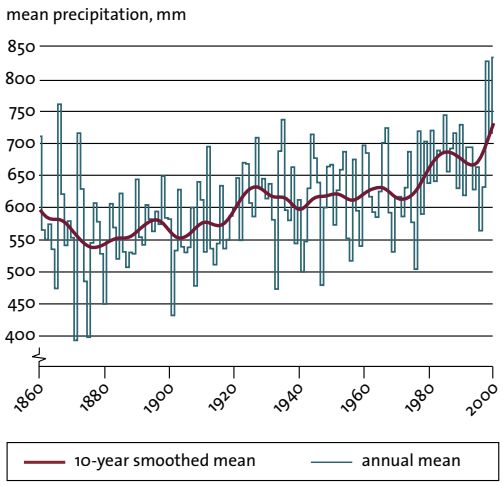


Since the end of the 19th century, the earth's temperature has risen by about 0.6°C. The IPCC's assessment is that most of this rise can be attributed to an increase in atmospheric concentrations of greenhouse gases, resulting from human activities.

Temperature expected to rise more in Nordic region than worldwide

Climate change is expected to be more pronounced in the Nordic countries than in the world as a whole. If the global temperature rise is about 2.5°C on a timescale of 50–100 years, the increase in the Nordic region could be around 4°C. Precipitation could also be markedly affected. The consequences for important Swedish sectors such as agriculture and forestry could be far-reaching. Regarding nature conservation and biodiversity, there is a risk of sensitive ecosystems in mountain areas and the Baltic Sea being eliminated. Furthermore, the basic conditions for sustainable development in other parts of the world could be radically altered, with repercussions for Sweden.

FIG. 1.2 Annual mean and ten-year mean precipitation, 1860–2000



Precipitation has increased in Sweden in the last 140 years, although some of the rise reflects improvements in recording instruments and stations over the years. Higher temperatures in decades to come will probably be accompanied by increased precipitation over much of the country.

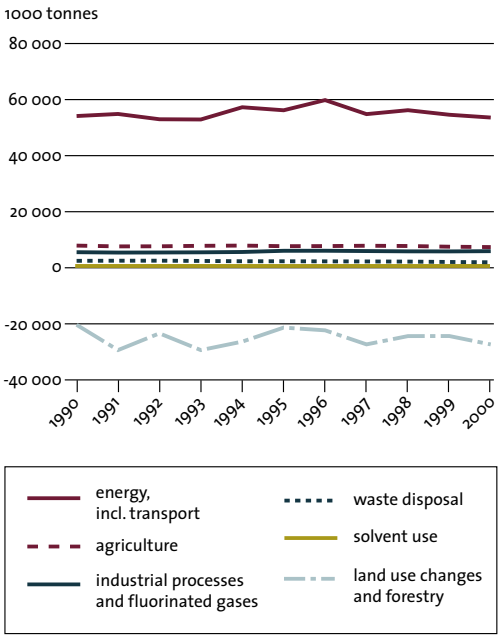
Progress towards the objective

Under the Kyoto Protocol, the industrial nations have pledged to limit their emissions of greenhouse gases. By 2008–12, emissions in the EU as a whole are to have fallen by 8% from 1990 levels. Over the same period Sweden is permitted to increase its emissions by 4%, but in March 2002 Parliament adopted an interim target for greenhouse gases, calling for average Swedish emissions to be at least 4% lower in 2008–12 than in 1990. This is to be achieved with no allowance made for uptake by carbon sinks (growing forests which bind carbon dioxide) or flexible mechanisms (various forms of emissions trading). Progress towards the target is to be monitored, and further measures may be proposed at checkpoints in 2004 and 2008.

The latest projections of greenhouse gas emissions, in Sweden's third national communication under the Climate Change Convention (2001), indicate that emissions will be stabilized by 2010 and subsequently rise. Additional action may therefore be needed to meet the interim target.

Parliament has also adopted a long-term goal for greenhouse gases. By 2050, Sweden's total emissions should be below 4.5 tonnes of carbon dioxide equivalents per capita per year, with a further reduction to follow. This means that emissions are to be cut by almost 50% from their present level. On current trends, and with the action strategies adopted so far, this goal will not be achieved.

FIG. 1.3 Emissions and uptake of greenhouse gases



Around 80% of Sweden's greenhouse gas emissions are due to the burning of fossil fuels in industry, the transport sector and at power and district heating plants, with other sectors accounting for the remaining 20%. Forests absorb carbon dioxide by incorporating it in biomass, and in Sweden this uptake corresponds to almost 30% of emissions.

2| Clean air

OBJECTIVE

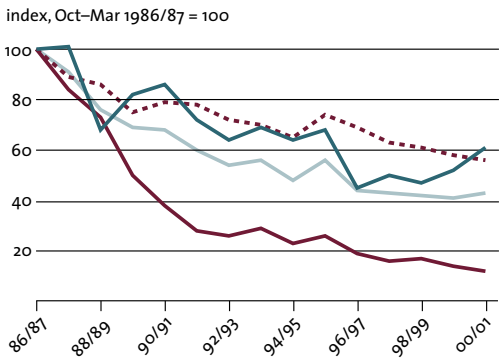
The air must be clean enough not to represent a risk to human health or to animals, plants or cultural assets.

The objective is intended to be achieved within one generation.

Damage to health, vegetation and materials

Air pollutants give rise to a wide variety of adverse effects on health, including respiratory symptoms, allergies, cancer – and even deaths. The pollutants responsible include nitrogen oxides, sulphur dioxide and ground-level ozone, as well as certain volatile organic compounds (VOCs) and airborne particles less than 10 micrometres in diameter (PM10).

FIG. 2.1 Air quality index



The index is based on concentrations of sulphur dioxide, nitrogen dioxide and soot during the winter months (October–March) in some 35 municipalities, weighted for the sizes of their populations.

Oct–Mar 1986/87: NO_2 31 µg/m^3, SO_2 17 µg/m^3, soot 11 µg/m^3

Emissions of sulphur dioxide in Swedish towns, chiefly from energy production and transport, have decreased by some 90% since the 1970s. Most of the other EU countries, too, have seen a sharp fall in emissions. In the case of nitrogen dioxide and soot, the improvements observed in Sweden have been appreciable. As a result of all these factors, corrosion and health problems have been significantly reduced.

In a statistical sample of Sweden's population, one-tenth reported medical symptoms that were primarily the result of vehicle exhausts and wood smoke. The incidence of cancer due to urban air pollution in Sweden is estimated at 200 cases a year.

Forest trees and agricultural crops are also affected by air pollutants. In the 1980s, production losses in Swedish agriculture due to ground-level ozone were estimated at around SEK 1 billion a year. In addition, air pollutants accelerate degradation of metals, limestone, rubber and plastics and damage culturally and historically significant buildings, statues and ancient remains.

Emissions both at home and abroad

In urban areas, elevated atmospheric levels of nitrogen oxides, particulates and VOCs are caused by emissions from transport, industry and domestic heating. Use of solvents is another source of VOCs, and burning of wood and other biofuels for heating gives rise to emissions of both VOCs and particulates.

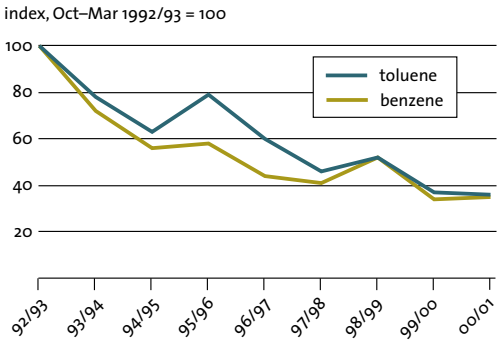
The majority of particulate matter measured as PM10 derives from abrasion of road surfaces and brake pads and, in spring, from grit applied to roads during the winter. The largest numbers of airborne particulates consist of very small particles (less than 0.1 micrometres), emitted by engines and other combustion sources.

The air pollution situation in Sweden is also strongly influenced by pollutants carried by winds from other countries.

International and national action

The main frameworks for international efforts to improve air quality are the UN Convention

FIG. 2.2 Indices of benzene and toluene concentrations



The indices are based on concentrations of benzene and toluene during the winter months (October–March) in some 35 municipalities, weighted for the sizes of their populations.

Oct–Mar 1992/93: benzene 6 µg/m^3, toluene 12 µg/m^3

Emissions of benzene entail a risk of cancer, primarily leukaemia: a rough estimate suggests that, in Sweden, current concentrations give rise to some 10 cases per year. One source of benzene is petrol, to which a limit of 1% benzene by volume now applies. Thanks to the use of catalytic converters on vehicles, benzene emissions are falling significantly. The target for this pollutant, to be achieved within one generation, is a concentration in air of 1 µg/m^3.

on Long-Range Transboundary Air Pollution (CLRTAP) and the EU's Clean Air For Europe (CAFE) programme. The focus here is on producing data to support revisions of earlier emission reduction agreements: the Gothenburg Protocol – the most recent one signed under CLRTAP – and the EC Directive on national emission ceilings. Under the latter, Sweden is committed to cutting emissions of VOCs (other than methane) to a maximum of 241 000 tonnes by 2010. To honour this commitment, further action will be needed relating to small-scale burning of wood, transport, mobile machinery, industry and evaporation of solvents.

A new directive on air pollution due to ozone is currently being finalized. Work is also in progress on an EC directive to reduce air pollutant emissions from major sources and to establish air quality objectives.

In Sweden, standards have been laid down under the Environmental Code for maximum acceptable levels of sulphur and nitrogen dioxide, lead and particulates in outdoor air. These standards provide a tool for action at the local level.

Progress towards the objective

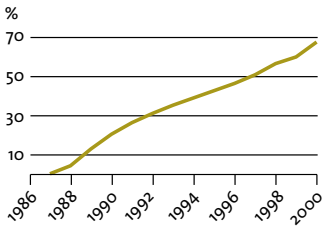
Levels of sulphur dioxide already meet existing environmental quality standards. In most places, they are also below the most stringent limits, designed to protect cultural artefacts and materials.

Nitrogen oxide emissions from road transport have been reduced by more efficient catalytic converters and the more stringent emission standards for heavy vehicles introduced in the mid-1990s. However, concentrations remain high in major urban areas and on streets with heavy traffic. Tougher emission standards are to be introduced for all vehicles. Measures are also needed in the energy and mobile machinery sectors.

Corrosion of materials and health effects due to ground-level ozone will abate, but concentrations with effects on crops could still be exceeded 20 years from now.

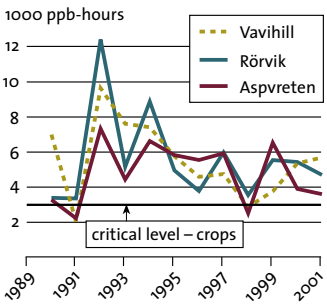
It is primarily in urban areas that people are exposed to particles and carcinogenic substances. These pollutants remain a problem, especially in areas where wood-based heating is common, although concentrations above rooftop level will fall. Measures to reduce larger particulates in air are the easiest to implement. The Environmental Protection Agency has been asked to propose interim targets for smaller particles (PM2.5), too, and will be reporting in the summer of 2003.

FIG. 2.3 Percentage of vehicle fleet fitted with catalytic converters, 1987–2000



When catalytic converters became compulsory on new petrol-engined vehicles, in 1989, air pollutant emissions from road traffic began to fall more significantly. From a pollution point of view, this measure can be regarded as the most important one affecting road transport in the 1990s. In 2000, the proportion of traffic (in vehicle-kilometres) accounted for by vehicles fitted with catalysts was 78%.

FIG. 2.4 Exposure of crops to ozone at three sites in southern Sweden



Exposure of crops to ozone is expressed in AOT40 (ppb-hours). According to a proposed EC directive, this measure is to be calculated for the period May–July, 8 am–8 pm CET. Since Sweden has longer hours of daylight than this in summer, the real level of exposure may be higher. In the 1990s, the critical level for crops was exceeded at all three sites shown. By 2010, this level is not to be exceeded.

3| Natural acidification only

OBJECTIVE

The acidifying effects of deposition and land use must not exceed the limits that can be tolerated by soil and water. In addition, deposition of acidifying substances must not increase the rate of corrosion of technical materials or cultural artefacts and buildings.

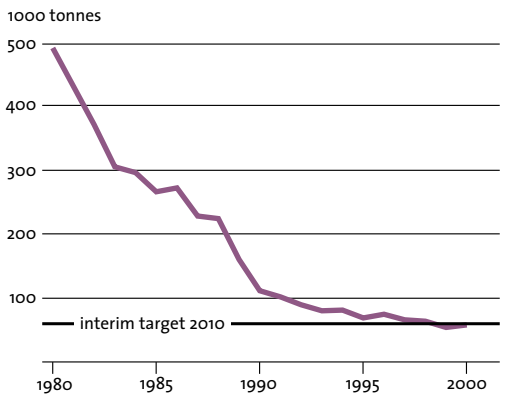
The objective is intended to be achieved within one generation.

50 years of severe acidification have left their mark

Acidification of air, soil and water has had a radical impact on Sweden's environment, affecting more than a fifth of the country's forest and lake areas. The situation is most serious in the south. Above all, the flora and fauna of lakes and streams have been affected, partly as a result of acidic, aluminium-contaminated water draining from forest land. In addition, vital nutrients have been leached from forest soils.

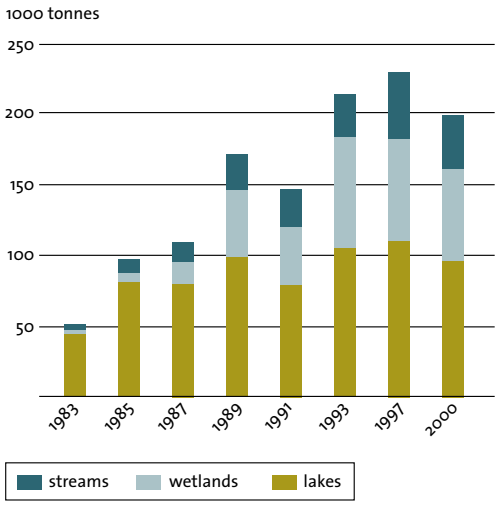
Other effects of acidifying pollutants include corrosion of water pipes and degradation of buildings, monuments and heritage objects such as rock carvings and buried archaeological remains. Human health can also be affected, e.g. by acidic well water; in some parts of Sweden, groundwater is acidified.

FIG. 3.1 Swedish emissions of sulphur dioxide to air (excl. international bunker fuel emissions)



Since the interim target for sulphur dioxide emissions was set, the emission figures have been revised. As a result, this target has already been achieved.

FIG. 3.2 Quantities of lime applied to lakes, streams and wetlands in Sweden



Although emissions of acidifying pollutants have decreased, liming remains a necessary remedial measure in many of Sweden's lakes and streams.

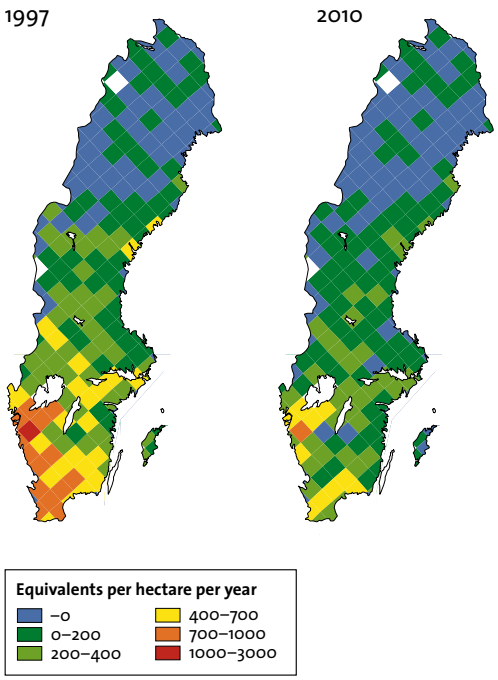
Foreign emissions the main cause

The primary cause of modern-day acidification is atmospheric deposition of sulphur and nitrogen. In 1996, around 90% of the sulphur, 80% of the nitrogen oxides and 60% of the ammonia deposited in Sweden derived from foreign sources.

The main Swedish sources of sulphur dioxide are burning of coal and fuel oil and industrial processes. Nitrogen oxide emissions come from the transport and energy sectors and mobile machinery, while the principal source of ammonia is agriculture.

In forest areas, forestry also contributes to acidification of soils, lakes and streams, as a result of growth and harvesting of trees.

FIG. 3.3 Exceedance of critical loads for forest soils and lakes in Sweden, 1997 and 2010 (in line with Gothenburg Protocol)



In 2010, acid deposition in south-west Sweden will still clearly exceed what the natural environment is able to withstand.

International cooperation bearing fruit

Acid deposition has abated in Sweden, thanks to the international agreements reached under CLRTAP and action taken at the EU and national levels in the energy, industrial and transport sectors. The most recent CLRTAP protocol was signed in Gothenburg in 1999.

A national measure that can best be described as a holding action is liming of lakes and streams. In Sweden, some 7500 lakes have been limed – just over 90% of the area acidified.

Progress towards the objective

Deposition of sulphate fell by around 60% in the 1990s. Concentrations of nitrogen in rain and snow have declined over much of Sweden in recent years, but as total precipitation has increased no clear trends in deposition can be seen. If the Swedish natural environment is to recover, even larger emission cuts must be achieved – beyond the Gothenburg Protocol's targets and the EU's Emission Ceilings Directive – in Sweden and the rest of Europe.

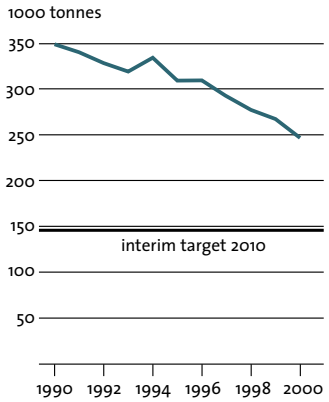
In 2000 Sweden emitted approx. 57 000 tonnes of sulphur dioxide (excluding international bunker fuel emissions) and the interim target for this pollutant has thus been met. Nitrogen oxide emissions, on the other hand, need to be reduced by almost another 100 000 tonnes.

European estimates, made as a basis for international negotiations, indicate that the area of natural ecosystems where the critical load for acidification is exceeded will decrease from 16% in 1990 to 4% in 2010. However, more detailed Swedish estimates suggest that in 2010 the critical load will still be exceeded in 13% of the area. And even if deposition falls below critical levels, recovery may take several decades.

The trends for forest soils are contradictory, but suggest that acidification is persisting across much of Sweden, with weak signs of a recovery in the south. Recovery will be facilitated by forestry methods adapted to the acid sensitivity of individual sites and by an increased area of forest with a significant deciduous element.

In lakes and streams, recovery began as early as the 1980s and accelerated in the 1990s. Despite this, it is uncertain whether the interim target will be met: studies in south-west Sweden suggest that many lakes will still be acidified in 2010.

FIG. 3.4 Emissions of nitrogen oxides in Sweden



With the present rate of decrease of emissions, it is uncertain whether the interim target of 148 000 tonnes – relevant to the two objectives Natural acidification only and Zero eutrophication – will be met.

4| A non-toxic environment

OBJECTIVE

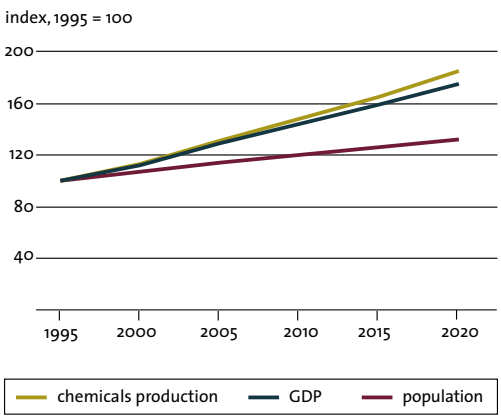
The environment must be free from man-made or extracted compounds and metals that represent a threat to human health or biological diversity.

The objective is intended to be achieved within one generation.

Thousands of chemicals in circulation

Currently, over 12 000 chemical substances are listed in the National Chemicals Inspectorate's register of chemical products manufactured in or imported to Sweden. These substances are found in some 64 000 chemical products, which in turn are used in an even larger number of products such as vehicles, plastic items, clothes and building materials. In addition, an unknown number of substances enter the Swedish market in imported goods, and substances are formed unintentionally in industrial processes. Every year, an estimated 160 million tonnes of goods enter circulation in Sweden. Chemicals can be released from products, buildings etc. when they are produced, used or scrapped. The presence of hazardous substances in goods makes recycling more difficult. The global output of chemicals is expected to continue to rise in pace with gross domestic product.

FIG. 4.1 Projected growth in world GDP, population and chemicals industry production



The output of chemical products is rising. According to the OECD, the value of world production of chemicals is expected to increase by 85% between 1995 and 2020.

Knowledge gaps and risks must be tackled

Major gaps exist in our knowledge of the health and environmental effects of chemicals and pollutants, making it difficult to identify all the substances that could damage health or the environment and to assess and reduce the risks. However, we do know that, overall, chemicals in workplaces and in the outdoor and indoor environments have effects on health and the natural environment. A few per cent of the population have too much cadmium in their kidneys, for example. PCBs and brominated flame retardants can be found in breast milk. A million Swedes have symptoms linked to the indoor environment, where chemicals are one of the background factors.

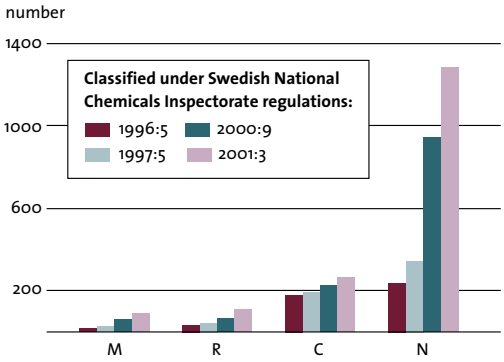
In the area of chemicals, adequate EU rules are crucial, since in many cases they define the most stringent requirements that can be imposed nationally. Sweden must therefore continue to seek to influence the design of EU regulations on knowledge requirements, phase-out and risk reduction of dangerous substances. It is also vital that Swedish companies compile data on and phase out such substances, and minimize process emissions of pollutants. A forward-looking approach in this area can bring long-term commercial benefits.

Contaminated sites also require action

Apart from the chemicals in products and structures, there are a large number of contaminated sites. In 2001, county administrative boards identified 38 000 sites that are suspected to be contaminated – far more than the earlier estimate of 22 000.

A framework for remediating such sites is currently being developed, *inter alia* by strengthen-

FIG. 4.2 Numbers of classified substances assigned to different categories



Within the EU, more and more substances are being classified in the categories mutagenic (M), toxic for reproduction (R), carcinogenic (C) and dangerous for the environment (N). As a result, our knowledge of certain substances with dangerous properties is improving. Classification and labelling help to disseminate information about such chemicals. For many substances, risk reduction measures are necessary. In addition to the substances included in the diagram, 671 complex carbon- and petroleum-based substances are classified as carcinogenic.

ing the resources and expertise of county administrative boards. Legal proceedings to establish precedents in cases of unclear responsibility should help to clarify where remediation is not the responsibility of society at large. Clean-up of sites will take a long time and require major investments by the parties concerned.

Progress towards the objective

The EU's chemicals strategy, presented in spring 2001, has improved the prospects of achieving this objective. So too have global efforts, e.g. under the Conventions on Persistent Organic Pollutants and on the Control of Harmful Antifouling Systems on Ships.

One interim target is for data to be available on the properties of all chemicals on the market by 2010. A new EU system, with timetables for testing and registration, is being developed, and this will provide better information about chemicals and their properties. However, whether this system will be sufficiently ambitious remains to be seen.

Also by 2010, products are to be labelled with health and environmental information on any hazardous substances they contain. A great deal of work has still to be done to create a corresponding system at the global level.

Phase-out of substances that are carcinogenic, toxic for reproduction or mutagenic is to be achieved at the EU level, through an authorization system. The EC Council wants this system to cover persistent and bioaccumulating substances, too. These issues have yet to be addressed in related directives, e.g. the Plant Protection Products Directive.

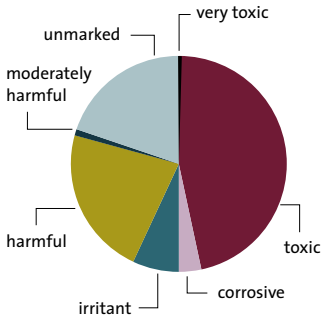
In addition, an overall reduction of risks is called for. The EU's chemicals strategy gives industry a clear responsibility for this. According to risk indicators calculated for agricultural and horticultural pesticides, the risks entailed by pesticides entering the market remain undiminished. Steps have, though, been taken to reduce the risks arising from their use.

TABLE 4.1 Number of substances and timetable for registration

Tonnes per company and year	Number of substances on market	Deadline for registration
> 1 000	2 700	2005
101–1 000	5 000	2008
1–100	30 000	2012

The EU's new chemicals strategy is based on registration, evaluation and authorization. All chemicals produced or imported in quantities exceeding 1 tonne are to be registered. Data corresponding to the basic requirements for new substances are only available for 14% of the chemical products currently used in the EU in volumes of more than 1000 tonnes per year. The new system is intended, step by step, to provide us with better knowledge in this area.

FIG. 4.3 Percentage distribution of chemical products by category of danger



In 2000, the turnover of chemical products on the Swedish market was around 70 million tonnes, of which some 19 million tonnes were exported. Fuels such as petrol and diesel are classed as toxic, and since they are used in large volumes almost half the total quantity of chemical products falls into this category.

5| A protective ozone layer

OBJECTIVE

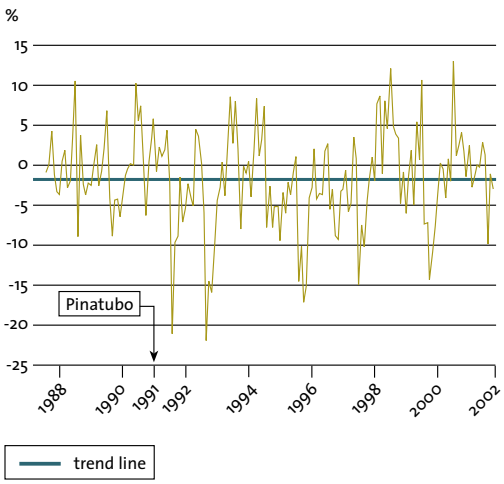
The ozone layer must be replenished so as to provide long-term protection against harmful UV radiation.

Effects of 50 years' emissions now visible

In the last 15 years, the ozone layer has been depleted by about 5% worldwide. Over Antarctica, thinning of roughly 50% occurs during the spring months of September–October. At north European latitudes, depletion of 5–10% has occurred in the last 20 years. Measurements of the thickness of the ozone layer above Norrköping reveal wide seasonal and between-year variations, and no clear trend has been identified.

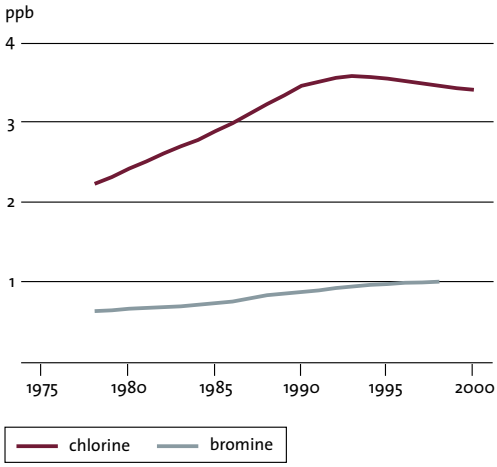
Ozone depletion is due largely to the last 50 years of emissions of ozone-depleting substances such as CFCs, HCFCs, halons, methyl bromide and certain chlorinated solvents. These compounds often remain in the atmosphere for a very long time before they are broken down, and the impact of emissions persists for several decades. Other factors also influence the thickness of the ozone layer, e.g. particulates and water vapour from high-altitude aircraft and concentrations of greenhouse gases in the atmosphere.

FIG. 5.1 Ozone layer above Norrköping, 1988–2002, relative to ozone layer above Uppsala, 1951–1966 (monthly deviation, %)



The blue line indicates the deviation of the linear trend for Norrköping over the period. It shows that, on average, the ozone layer has been thinner above Norrköping since 1988 than it was above Uppsala over the period 1951–66. The eruption of Mount Pinatubo in 1991 had a clearly discernible effect on ozone levels in the stratosphere.

FIG. 5.2 Tropospheric concentrations of chlorine and bromine



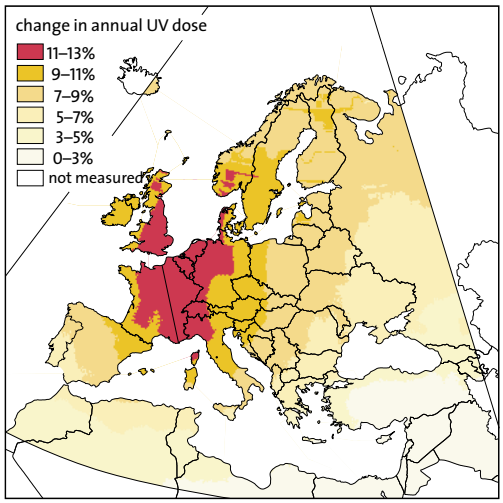
Chlorine levels in the troposphere peaked around 1993, while the concentration of bromine is still rising. The total concentration of chlorine and bromine in the stratosphere was expected to begin to fall around 2000.

Damage to health and environment

A depleted ozone layer allows more ultraviolet (UV) radiation to reach the earth's surface, causing harm to health and the environment. The main adverse effects include increased risks of:

- sunburn and different types of skin cancer,
- damage to the immune system,

FIG. 5.3 Estimated increase in ultraviolet radiation in Europe, 1980–1997



As a result of thinning of the ozone layer, levels of ultraviolet (UV) radiation in Sweden rose by 7–11% over the period 1980–97.

Changes in UV radiation have been calculated on the basis of measured total ozone values (assuming cloud-free conditions).

- damage to the eyes, e.g. cataracts,
- damage to aquatic and terrestrial ecosystems,
- damage to agricultural crops and forest trees,
- damage to materials.

Progress towards the objective

Up to now, phase-out of ozone-depleting substances has often involved their being replaced in refrigeration equipment and other applications with chemicals which instead have some impact on climate. The Swedish Parliament has decided that the great majority of the country's ozone-depleting emissions are to be eliminated by 2010. To achieve that aim, alternative, environment-friendly technologies or other methods need to be made available. At present, ozone-depleting substances are used chiefly in the defence forces, in civil aviation and at certain laboratories. Ozone depleters can also leak from products when they are used or scrapped, although these emissions can be reduced by better monitoring and environmentally sound waste management. In addition, growth in high-altitude flying is increasing emissions in the stratosphere, with possible adverse effects on the ozone layer.

Thanks to measures introduced by Sweden and other countries, atmospheric levels of ozone-depleting substances are now beginning to fall. However, other factors affecting the ozone layer have also changed, partly offsetting this improvement. Assuming that the Montreal Protocol is implemented by all the signatories, levels of ozone depleters in the stratosphere are expected to fall to about 2 ppb chlorine by 2050. It will take at least 100 years for concentrations to return to their natural level of 0.7 ppb chlorine. The latest assessments by European scientists indicate that there will be no discernible recovery of the ozone layer above Europe until 2010 at the earliest, and that full recovery will take at least until 2050.

6| A safe radiation environment

OBJECTIVE

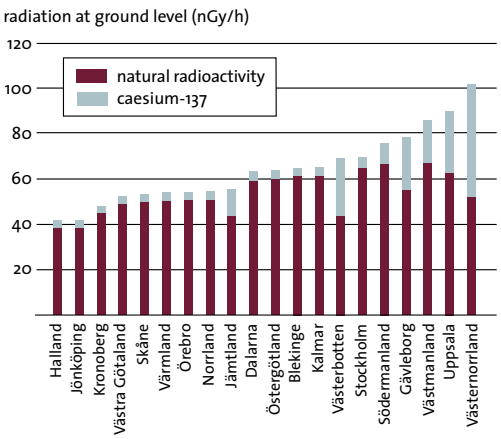
Human health and biological diversity must be protected against the harmful effects of radiation in the external environment.

Sources both natural and man-made

We are constantly exposed to different sources of radiation in our environment. In the case of certain natural sources, such as radon and ultraviolet (UV) radiation, we ourselves can do something about our levels of exposure. As far as radon is concerned, the synergetic effect of radon and smoking means that most cases of lung cancer occur among smokers. The radiation source with the biggest impact of all on health is UV radiation from the sun and solaria, exposure to which depends largely on individual lifestyles and outdoor habits. Information to persuade people to reduce their annual UV dose is therefore important. To assist in this information effort, a system to provide data on the level of solar UV radiation at any chosen location in Sweden is being developed.

There are also radiation sources that are the result of human activities, such as nuclear power. A major challenge today is to resolve the issue of final disposal of spent nuclear fuel. Other sources of radiation include fallout from nuclear weapons tests and reactor accidents, electromagnetic fields produced for example by mobile phones, radioactive wastes from health care and industry, and enrichment processes in industry.

FIG. 6.1 External dose at ground level from naturally occurring radioactive substances and fallout of caesium-137, by county, estimated for 2001
(Data for Gotland county not available)

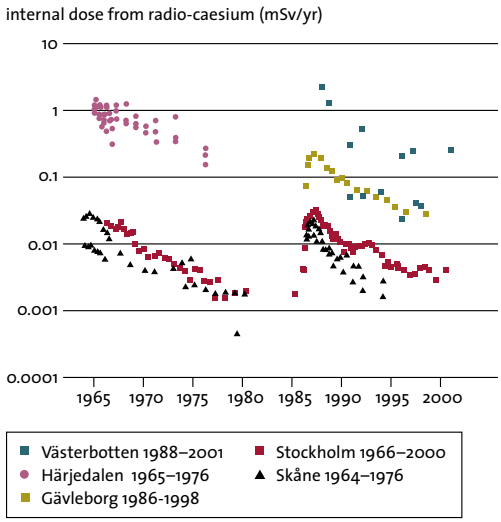


Caesium-137 began to occur in the environment in the 1950s, as a result of human activities. The largest radioactive releases came in the wake of the nuclear weapons tests of the 1950s and 1960s and the Chernobyl accident in 1986. After the weapons tests, radioactive substances dispersed widely through the atmosphere and fell to the ground with precipitation over several years. The fallout from Chernobyl, on the other hand, was highest in the regions that happened to have rain in the few days following the accident.

No protection criteria for environment

At present, there are no indicators or radiation protection criteria relating to plants and animals, and no national monitoring programme to provide an overall picture of the radiation environment and any effects of radiation. Among other things, we need to know more about the processes which redistribute radioactive substances in the environment. For example, caesium-137 may be released as an unintentional by-product of a practice, with local effects on the radiation environment – for example, when ash from biofuel-fired plants is recycled to forest soils or landfilled. Natural redistribution processes, too, can result in local enrichment of radioactive substances:

FIG. 6.2 Internal dose from the body's content of caesium-137, in population groups from different regions (Note that the scale of the *y*-axis is logarithmic)



The variation in caesium-137 levels in the body within and between regions is mainly due to the differing concentrations of this substance in people's diets. The higher values noted in the 1960s and 1970s are a result of fallout from the nuclear test explosions, while those observed after 1986 reflect the accident at the Chernobyl nuclear power plant.

when dissolved in water they may for instance be taken up by wetland plants or accumulate in peat soil. To allow action to be taken, more needs to be known about these processes and their consequences for radiological protection.

Progress towards the objective

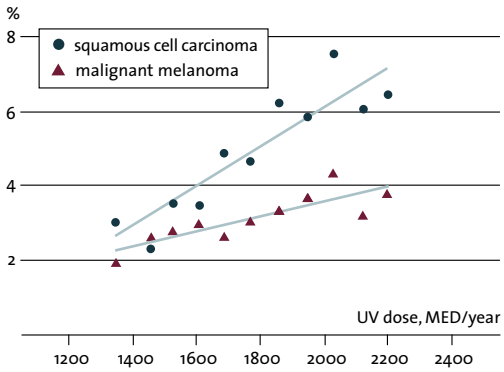
To achieve the interim target for UV radiation, long-term measures need to be introduced as soon as possible. Thanks to increased funding for 2002, public agencies are now better placed to play a part in reducing the future incidence of skin cancer.

One area relevant to the target for radioactive emissions is the management of spent nuclear fuel and other radioactive wastes. The nuclear power industry must develop a final disposal system that meets radiological protection standards and enjoys wide support among decision-makers and the general public. If the target date is to be met, priority must be given to scrutiny of proposals, consultation, and definition of standards.

Environmental monitoring and research form an important basis for radiological protection. If such work shows them to be necessary, enforcement measures can be introduced, e.g. based on regulations and recommendations. The scale of research in radioecology and radiobiology is once again as limited as it was just before the Chernobyl accident in 1986: in 2001, funding for these areas was virtually non-existent.

Work has begun to develop a national environmental monitoring programme for radioactive substances, and it is important that it continues. A programme of this kind will provide a better basis for estimating total radiation doses to human beings and the environment, and also for remedying the current lack of indicators and radiation protection criteria for animals and plants.

FIG. 6.3 Skin cancer cases as a percentage of all cases of cancer in 1999, related to estimated total annual dose of UV radiation at different latitudes in Sweden



Malignant melanoma has become more common, increasing from a couple of hundred cases a year in the late 1950s to 1600 cases in 1998. Some 350–400 people die of the disease every year. Since the time between exposure and the development of skin cancer is almost 20 years, it is important that children and young people in particular learn to sunbathe in moderation.

7| Zero eutrophication

OBJECTIVE

Nutrient levels in soil and water must not be such that they adversely affect human health, the conditions for biological diversity or the possibility of varied use of land and water.

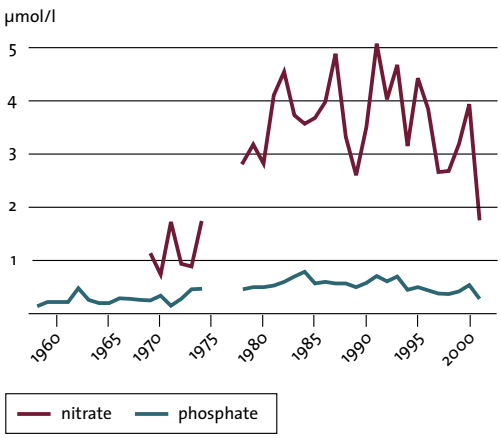
The objective is intended to be achieved within one generation.

Biodiversity affected and altered

Eutrophication is caused by high levels of nitrogen and phosphorus. In many bodies of water, excessive inputs of these nutrients give rise to algal blooms, reduced transparency, oxygen depletion, contracting algal belts and anoxic bottom areas. Eutrophication is one of the most serious threats to the sea, and a major problem in many lakes and rivers. Toxic algal blooms can pose a serious health risk to people and animals.

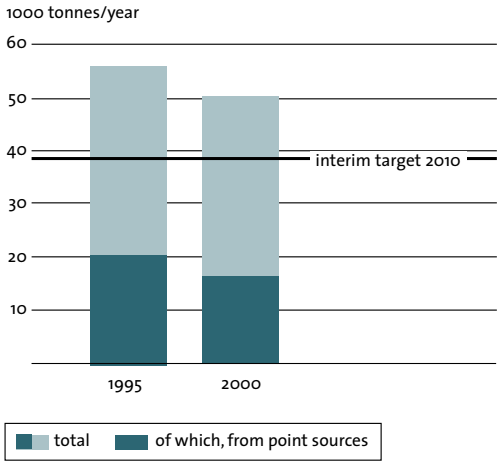
Nitrogen from atmospheric deposition has accumulated in the soils of forests, meadows and pastures. As a result, their vegetation is gradually changing, as species adapted to nutrient-poor conditions are displaced. Also, the risk of nitrogen losses to streams and groundwater is increasing. High nitrate levels in groundwater cause health problems, especially in children. Eutrophication is primarily a problem in southern Sweden, but there are also signs of it in the mountain areas of the north.

FIG. 7.1 Nitrate and phosphate levels in surface water at the Gotland Deep



To attain the goal of Zero eutrophication, the nutrient status of coastal and offshore waters needs to be essentially the same as it was in the 1940s. In the surface water of the Baltic proper, nutrient levels have tended to fall somewhat in recent years, but they are still significantly higher than in the 1940s. What is more, in bottom water, levels of phosphorus have risen by about 20% since 1995, owing to oxygen depletion.

FIG. 7.2 Total anthropogenic nitrogen inputs to sea areas south of the Åland Sea, 1995 and 2000

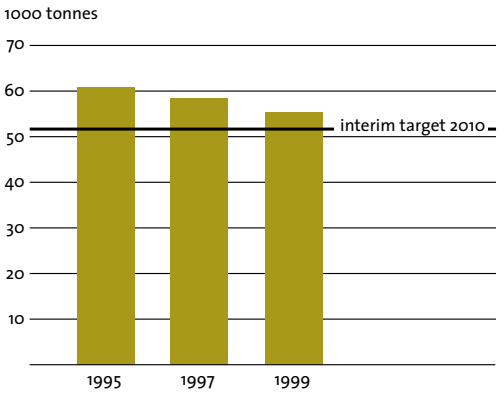


Inputs from point sources (municipal sewage works serving more than 2000 people, factories, and single-household sewage systems) have fallen by about 4000 tonnes, i.e. 20%, whereas agricultural inputs are estimated to be basically unchanged. Action in the farming and forestry sectors takes a long time to feed through into reduced inputs to the sea.

Farming, sewage and transport are the biggest sources

Nutrient enrichment of forests, heathlands and mires is largely due to deposition of nitrogen, while that of lakes and rivers can mainly be

FIG. 7.3 Emissions of ammonia to air in Sweden



Ammonia emissions to air decreased by 9% between 1995 and 1999. It is perfectly possible to reduce them further and achieve the interim target.

traced to emissions of phosphorus from agriculture, sewage systems and industry. A significant share of this phosphorus derives from sewage in sparsely populated areas, where there are roughly a million households not served by municipal treatment plants. Coastal and open sea areas are chiefly affected by river-borne nitrogen and phosphorus, but roughly a third of the nitrogen input is atmospheric. Locally, nutrients from fish farms can be a major factor.

Some 75–80% of nitrogen deposition in Sweden is of foreign origin. The main sources of nitrogen oxides are transport and energy production, while around 90% of ammonia deposition derives from agriculture.

International and national action

Under the EU's Water Framework Directive, Sweden has to draw up a programme of measures to achieve 'good ecological status' in its lakes, rivers and coastal waters by 2009. To attain this goal, both national and international action to tackle eutrophication is necessary. The proposed new environmental quality standards for nitrate in groundwater and phosphorus in lakes could prove very significant at a local level. It is important, for example, to reduce phosphorus discharges from single-household sewage systems.

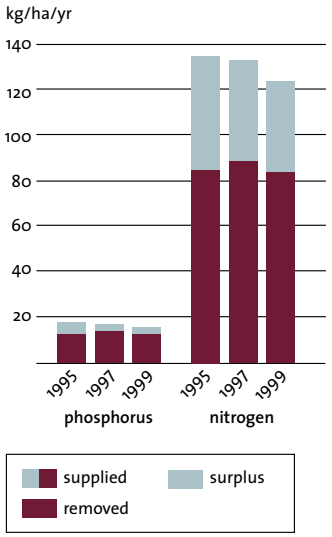
One means of reducing nutrient inputs to water from farmland is to establish wetlands. Partly for this reason, 6000 ha of wetlands are to be recreated and restored in 2000–06 under the Environmental and Rural Development Plan. A large-scale advisory programme on nutrients has been established by the Swedish Board of Agriculture and the Federation of Swedish Farmers. In principle, eutrophication could be further alleviated by reducing livestock production; however, this could conflict with biological and cultural heritage goals relating to pastures, an open agricultural landscape, small-scale habitats and culturally significant landscape features.

Progress towards the objective

Over many decades, large amounts of nitrogen and phosphorus have accumulated in soils and sediments. Given the inertia of natural systems, it will take a long time for acceptable conditions to be restored. International agreements and EC directives to reduce nitrogen emissions to air are now in place, but they are not sufficient to bring nitrogen deposition to forests down to acceptable levels by 2010: even by that date, the critical load will be exceeded on about 19% of forest land.

The action programme on nutrient losses in agriculture and measures in industry and the sewage sector could reduce the loading to the sea by 25–30% by 2010, compared with 1995. Total inputs to Swedish sea areas from all sectors need to be cut by 40% from 1995 levels to achieve this environmental quality objective.

FIG. 7.4 Nutrient balances for Swedish arable land



Plant nutrients are supplied to arable land in fertilizers and seed and by atmospheric deposition and nitrogen fixation, and are removed with harvested crops and crop residues. The amounts removed are smaller than the amounts supplied. The surplus may be leached from the soil into streams and end up in lakes and seas – where problems of eutrophication can arise. The greater the surplus, the greater the risk of leaching.

8| Flourishing lakes and streams

OBJECTIVE

Lakes and watercourses must be ecologically sustainable and their variety of habitats must be preserved. Natural productive capacity, biological diversity, cultural heritage assets and the ecological and water-conserving function of the landscape must be preserved, at the same time as recreational assets are safeguarded.

The objective is intended to be achieved within one generation.

Greater attention to natural and cultural environment needed

To protect valuable natural and cultural environments in and near lakes and running waters, traditional site protection is not enough. It is also necessary to develop conservation-friendlier practices in farming, forestry and other sectors. In the last decade, forestry operations on stream and river banks have become more sensitive to nature conservation needs, but an evaluation has shown that protection zones are left in only about half of such operations. Smaller streams fare least well in this regard, and where protection zones are retained they are rarely of sufficient conservation value to serve their intended purpose.

TABLE 8.1 Number of Natura 2000 sites in Sweden in 2002 containing freshwater habitat types

Habitat type	Number of sites
Oligotrophic, mineral-poor lakes of sandy plains	18
Oligotrophic to mesotrophic lakes with *Littorella*, *Isoetes* or annual vegetation on exposed banks	206
Hard oligo-mesotrophic lakes with benthic vegetation of *Chara* spp.	32
Natural eutrophic lakes with *Magnopotamion*- or *Hydrocharition*-type vegetation	86
Natural dystrophic lakes and ponds	277
Fennoscandian natural rivers	125
Alpine rivers and the herbaceous vegetation along their banks	87
Watercourses with submerged or floating vegetation or aquatic mosses	98

These eight freshwater habitat types are listed in the EU's Habitats Directive. Note that several types may be represented at any one site. Together with terrestrial and marine habitats, they make up the European Natura 2000 network.

Restoration projects still limited in scale

Most river restoration schemes are local projects to promote fisheries or biologically restore limed waters, e.g. by removing barriers to migration or re-establishing habitats. The Klingavälsån valley nature reserve in Skåne, however, provides an example of a fairly comprehensive restoration of a river in a farming area: 2.5 km of the channel has been redug to reinstate the meandering course of the 19th century and the bed level prior to deepening in the 1940s.

When watercourses are restored for nature conservation purposes, care must also be taken to preserve their cultural heritage interest.

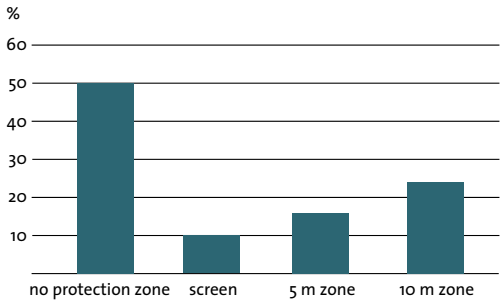
Non-native species affect ecosystems

Alien species released into Swedish lakes and streams have affected both native wildlife and ecosystems. Many have been introduced to offset a decline in native species (fish), caused for example by river regulation, overfishing or disease. To avoid further adverse effects of non-native species, the National Board of Fisheries has published a strategy on introductions and transfers of fish.

Rivers serve wide range of functions

Conflicts of interest may arise between the functions of rivers in terms of biodiversity, fisheries and recreation and as a resource for energy production. Since 1997, state grants for small-

FIG. 8.1 Percentage of length of stream and river banks left with no protection zone, a screen of trees, or a 5 m or 10 m protection zone after felling



Despite increasing attention to nature conservation in forestry, retention of strips of woodland to form streamside protection zones is practised in only around half of all felling operations along streams and rivers. Such zones are important in conserving the natural assets and water quality of running waters. (The diagram is based on a study of 270 km of watercourses in Värmland, Örebro and Västra Götaland counties.)

scale hydro have been available in Sweden. Up to 2001, the Swedish Energy Agency had approved 12 out of 35 applications, and paid out grants in six cases. Eligible projects include schemes to upgrade or increase the output of earlier operations, but not new hydroelectric plants. However, the earlier operation need not have involved electricity generation, nor does it have to be currently active. In most cases this has meant that conflicts with nature and heritage conservation interests have arisen when funded projects have been implemented.

Another conflict is that between the need to prevent flooding and the great ecological value of natural river flows and water level variations. Today, many homes and businesses are sited within rivers' natural flood plains, often owing to inadequate knowledge, care and planning.

More freshwater sites protected

The county administrative boards have compiled data relating to, and proposed sites hosting, the different habitat types and species which the EU countries have agreed to protect through the Natura 2000 network. There are now 750 Natura 2000 sites in Sweden containing one or more of the eight freshwater habitat types in the EU's Habitats Directive. The natural features of the sites listed are to be preserved, which in the case of lakes and streams may require measures relating to water quality, flows and physical environments. Of the country's more than 2400 nature reserves and nature conservation areas, some 70 have been designated (four of them in 2001) partly to protect the natural features of a freshwater environment. In addition, several new lakes and watercourses were listed under the Ramsar Convention during the year. There is some overlap between Natura 2000 sites, Ramsar sites and nature reserves.

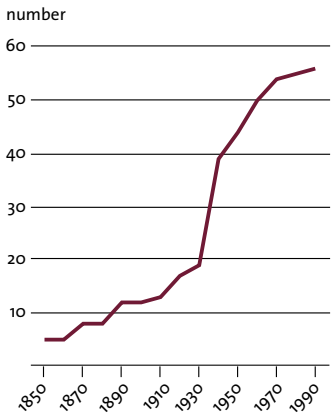
Progress towards the objective

The process of compiling the data required to identify particularly valuable natural environments is now under way. As for cultural heritage sites, more information is needed: for example, only a partial inventory has been made of ancient monuments associated with water bodies.

The Natura 2000 process represents a major step forward in the conservation of lakes and streams. However, to achieve the environmental quality objective, priority must be given to safeguarding valuable sites in and near fresh waters, combined with restoration work and more conservation-sensitive practices in different areas of land use. Restoration projects have complex legal and practical implications, and may cost more and take longer than expected.

Current knowledge is not sufficient to quantify the measures needed to protect valuable natural and cultural environments (interim target 1) and to restore running waters (target 2) To achieve this objective, the goals relating to eutrophication, acidification and a non-toxic environment must also be attained.

FIG. 8.2 Introductions of non-native species to Swedish lakes and streams, cumulative total 1850–1990



Of the total of 56 non-native species, 14 are fish. Fish have often been introduced to offset a decline in native species, caused for example by river regulation, overfishing or disease. Introduced species are a threat to biodiversity, in that they modify the habitats of native species, disturb natural food chains and compete for food supplies or breeding grounds.

9| Good-quality groundwater

OBJECTIVE

Groundwater must provide a safe and sustainable supply of drinking water and contribute to viable habitats for flora and fauna in lakes and watercourses.

The objective is intended to be achieved within one generation.

Water shortages could arise in some areas

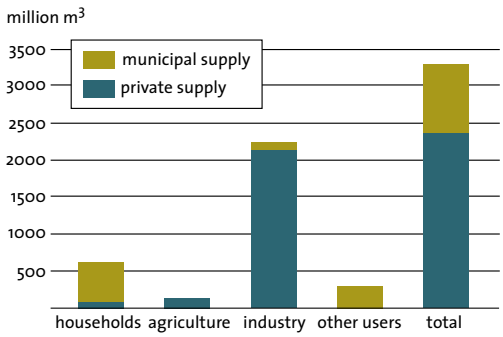
Sweden is relatively well endowed with water. However, groundwater sources capable of supplying sufficient quantities are not always where they are needed. Continuing urbanization and concentrations of second homes in certain coastal areas are accentuating this problem.

Inadequate protection rules lead to groundwater pollution

Water, food and energy supply systems, construction and transport all affect groundwater. The farming methods used in food production result in nitrogen and pesticides leaching into groundwater.

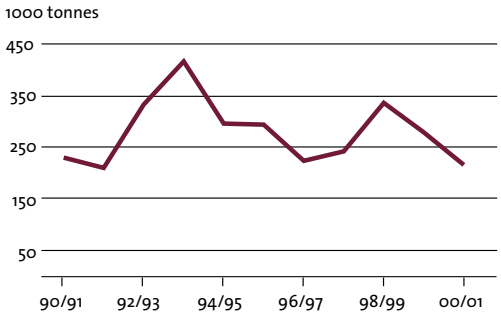
Roughly 5% of wells in superficial deposits in Sweden supply water with such high nitrate levels that it should not be given to infants under a year old. Pesticides have been detected in 40% of a total of over 2000 groundwater samples analysed over a 15-year period. They were found most frequently in samples from Skåne and Gotland, which also contained a larger number of identified substances than those from other counties. One pointer to the inadequacy of existing zones and regulations designed to protect water supplies is that pesticides have been found in 80 municipal drinking water sources. In almost half of these, concentrations have at some time been so high as to render the water unfit to drink according to National Food Administration regulations. Data to shed light on the situation

FIG. 9.1 Water consumption in 1995, by user category and type of supply



56% of household water derives from groundwater sources, of which some 20% are recharged artificially with surface water. Industry, on the other hand, obtains 97% of its water from surface water bodies. As for the proportions of surface and ground water used in agriculture, for irrigation and livestock, precise figures are not yet available.

FIG. 9.2 Use of road salt by National Road Administration



Road salt is used at temperatures around 0°C, and the amounts required thus vary according to the weather. Even allowing for the total length of roads treated and differences in weather, less salt was used on Sweden's state road network in 2000/01 than the previous season. However, the quantities employed by local authorities have gradually increased, and the rise looks set to continue. If de-icing salt were not used, there would be around 60 more deaths or serious injuries on the roads every winter. A conflict exists between ensuring passable roads and high standards of safety and protecting the environment.

nationwide are not yet available, however. An environmental quality standard for pesticides in groundwater and a programme to monitor compliance should be considered.

Transport in conflict with water supply

The biggest change in groundwater quality in recent decades has been due to the use of road salt (sodium chloride) to ensure the safety of road transport in winter. The effect has been most noticeable for households that rely on private wells fed by small aquifers, but large groundwater sources are also increasingly affected. In some 80 municipal water sources, chloride levels have risen in the last 20 years. Salt corrodes pipes and water heaters. Here there is a conflict between transport policy goals and the environmental objective. The road transport sector should present an action plan for winter maintenance of roads that will permit unrestricted use of groundwater supplies.

When new roads are built, optimum routes in engineering and road safety terms are often less suitable with regard to protecting groundwater.

Acidification persists, despite less sulphur

In acidified areas, aluminium and heavy metals are leached from the soil and find their way into groundwater. Acidification of shallow groundwater affects the surface-water environment. Some 22% of shallow wells in Sweden have a pH of less than 6.0. The most severe acidification effects can be seen in the south. Although sulphur deposition has fallen sharply since the early 1970s, groundwater acidification has hardly abated; pH values are still tending to fall. Acidic groundwater corrodes water pipes and raises levels of heavy metals in tap water.

Progress towards the objective

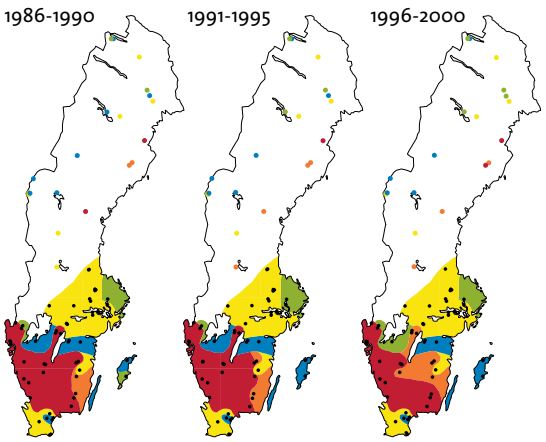
The EU's Water, Nitrates and Landfill Directives, and the proposed national environmental quality standard for nitrate in groundwater, are powerful tools for achieving this objective.

The goal of a safe and sustainable supply of drinking water for most of the population is considered achievable within one generation, on the basis of existing policy instruments. However, instruments to safeguard private wells supplying less than 10 cubic metres a day have yet to be established, particularly as far as quality is concerned. The possibility of introducing a legal requirement to submit data on groundwater quality to a central database should be studied.

Changes in the soil and groundwater system are slow, and efforts to reduce pollutant levels or effects of acidification will therefore take a long time to produce results. Consequently, the aim that groundwater should contribute to viable habitats for freshwater flora and fauna will not be achieved by 2020. A system to monitor the effects of different measures should be established.

For this objective to be met, the eutrophication, acidification and non-toxic environment goals must also be achieved.

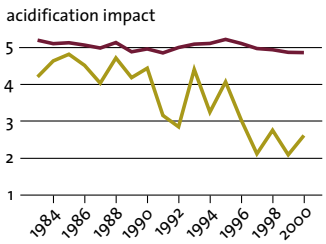
FIG. 9.3 Acidification of shallow groundwater



Groundwater acidification has abated somewhat in south-eastern Götaland (southern Sweden) – hopefully because the marked decrease in sulphur deposition is beginning to make itself felt in groundwater. One benefit if this trend continues will be that groundwater will be less corrosive, reducing levels of harmful metals in tap water.

Acidification impact
Dots represent sampling sites.
- very strong impact (5)
- strong impact (4)
- pronounced impact (3)
- moderate impact (2)
- insignificant or no impact (1)

FIG. 9.4 Impact of acidification on groundwater



measured in groundwater
calculated according to environmental quality criteria

The upper curve shows the impact of acidification as measured in groundwater. The lower curve shows the same variable calculated according to Sweden's *Environmental Quality Criteria – Groundwater*, in relation to sulphate deposition.

Calculations based on sulphate deposition, which has decreased very markedly, suggest that the impact of acidification on groundwater should have fallen to about 2, 'moderate impact'. But owing to the inertia of the soil/groundwater system, the decline in deposition has yet to be reflected in groundwater, which is still more or less as acidified as it was twenty years ago.

10| A balanced marine environment, flourishing coastal areas and archipelagos

OBJECTIVE

The North Sea and the Baltic Sea must have a sustainable productive capacity, and biological diversity must be preserved. Coasts and archipelagos must be characterized by a high degree of biological diversity and a wealth of recreational, natural and cultural assets. Industry, recreation and other utilization of the seas, coasts and archipelagos must be compatible with the promotion of sustainable development. Particularly valuable areas must be protected against encroachment and other disturbance.

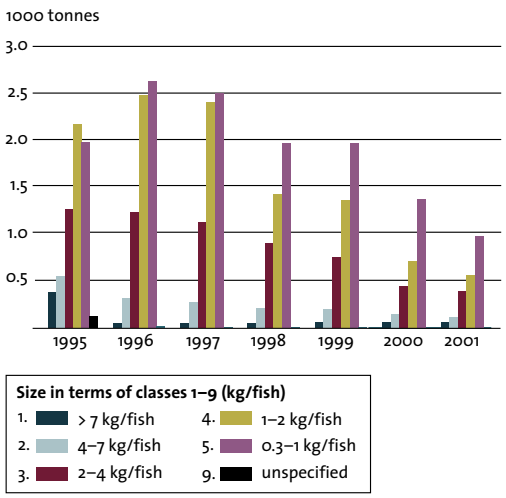
The objective is intended to be achieved within one generation.

Many problems in marine environments

In Sweden's coastal and open sea areas, eutrophication, toxic pollutants and overfishing have increasingly been found to disturb biodiversity and marine productivity.

In addition, coastal ecosystems are threatened by the physical impacts of infrastructure, settlements, ships and pleasure craft, certain fishing methods, dredging etc. All these activities can disturb benthic flora and fauna. Shallow bottom areas are particularly important as spawning and nursery grounds for fish. Disturbed recruitment of fish species was reported in the late 1990s, e.g. in Kalmarsund.

FIG. 10.1 Landings of cod by size of fish, 1995–2001



Excessive catches of immature cod have been partly responsible for a decline in cod stocks. To deal with the problem, selective fishing gear has been developed. Note the sharp fall in the quantities of larger fish landed over the period.

Quotas a threat to fish recruitment

According to fisheries biologists, the EU fishing fleet is too large and catch quotas too high in relation to fish stocks. Fishing is not being carried on within safe biological limits. Overfishing has resulted in a collapse of the stocks harvested and significantly shifted the balance between species. Such effects can in turn spread to other parts of the ecosystem. Owing to overfishing and impaired conditions for reproduction, Baltic Sea cod stocks fell well below the 'lowest biologically acceptable level' in the early 1990s, and have not recovered since, as catches have remained too high. To ensure sustainable use of Baltic fish stocks, a management plan has been adopted and quotas for cod and other food fish have been lowered. Quotas for the waters off Sweden's west coast have also been reduced, and a management plan for these areas is being prepared.

Unwanted species and undersized fish trapped in nets

In several fisheries, excessive bycatches of fish, birds and mammals (seals and porpoises) occur. This represents a waste of marine resources and a threat to the survival of viable populations of the species concerned. To reduce the bycatch of small cod, for example, the mesh size of cod trawls used

TABLE 10.1 Number of Natura 2000 sites in Sweden containing certain marine habitat types

Habitat type	Number of sites
Sublittoral sandbanks	45
Mudflats and sandflats	71
Shallow inlets and bays	100
Estuaries	24
Lagoons*	80
Reefs	91
Baltic coastal meadows*	144

* EU priority habitat type

The EU's Habitats Directive identifies a range of marine habitat types as being of Community interest and hence meriting attention in national conservation efforts. A total of 23 habitat types on the EU's list are marine or marine-related. Note that several types may be represented at any one site. Several of the marine habitat types listed in the directive occur in shallow sea areas, which are important, for example, for fish reproduction.

in the Baltic has been increased. A management plan for the grey seal, adopted in 2001, includes further work to develop seal-proof nets.

International efforts protect marine sites

As part of the process of implementing the EU's Habitats and Birds Directives, habitat types and species of particular conservation interest are being selected. Twenty-three of the habitat types defined are marine or marine-related. Together with freshwater and terrestrial habitats, they will make up the European Natura 2000 network. Sweden's list now includes 368 sites containing marine habitats, the most recent ones added in January 2002. One of these is Hoburg Bank, located partly within Sweden's economic zone south of Gotland. This area is of considerable biological interest, having large wintering populations of birds, including long-tailed duck.

Under the Ramsar Convention, several new coastal areas of international importance were listed in 2001. The same year, Knähaken, a shallow just off Helsingborg, became a local authority nature reserve.

In recent decades, international and national action has been taken to reduce oil discharges from ships, but such discharges still occur on a large scale. In December 2001, Parliament passed a bill on measures to prevent pollution from ships.

Cultural environments affected

Coastal sites of cultural heritage interest have been adversely affected, both by the disappearance of traditional industries in areas with declining populations and by increased population pressure in attractive areas. Spiralling land prices and a shortage of housing make it more difficult for the younger generation to take over and for new businesses to become established. Wind power projects along Sweden's coasts may give rise to conflicts between the climate objective and protection of the natural and cultural environment. The growing popularity of diving poses a threat to the marine archaeological heritage.

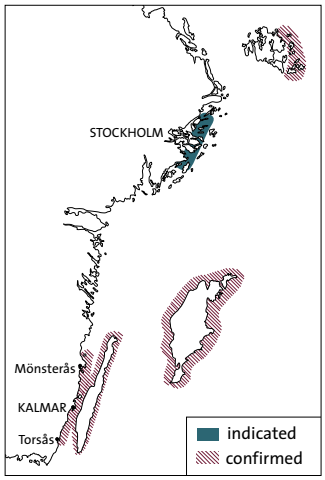
A current project to develop regional cultural environment profiles could inspire different actors to make use of the cultural heritage in their activities.

Progress towards the objective

The development of Natura 2000 represents an advance in terms of conserving valuable marine environments. Some action has been taken to reduce bycatch of small cod, but much more must be done in the fisheries sector if this environmental quality objective is to be achieved.

Attainment of the marine environment objective is dependent on the eutrophication and non-toxic environment goals being achieved. The goals relating to the agricultural landscape, the built environment, forests, wetlands, and lakes and streams also have a bearing on this objective.

FIG. 10.2 Areas with disturbed recruitment of perch and pike



Coastal populations of perch and pike declined dramatically in some parts of the Baltic during the 1990s, apparently owing to poor recruitment of new year classes over several years in the areas concerned. The underlying reasons have not been established, but eutrophication could be a contributory factor.

11| Thriving wetlands

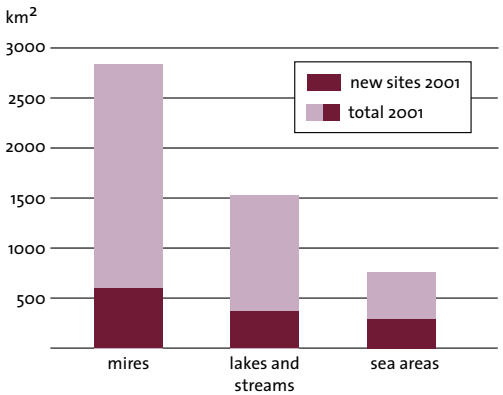
OBJECTIVE

The ecological and water-conserving function of wetlands in the landscape must be maintained and valuable wetlands preserved for the future.

Drained wetlands are being restored

In Sweden, as elsewhere, wetlands have been encroached on to a very significant degree: between 1880 and 1980, for example, the state provided funding of some SEK 7 billion to promote drainage of lakes and wet forest- and farmland. As awareness of the consequences grows, many actors are now involved in restoring wetlands. However, there is still no strategy for the protection and management of such areas, including their cultural heritage assets.

FIG. 11.1 Area of Ramsar sites in Sweden



Sweden's Ramsar sites comprise a wide range of habitat types, including lakes, running waters, bogs, fens, wet woodlands, deltas and shallow sea areas. In 2001 new designations added 1300 km² to the area listed, making a total of just over 5100 km² since the Ramsar Convention came into force in 1974.

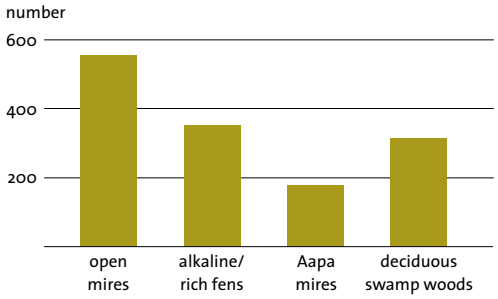
Sites were originally selected entirely on the basis of their bird populations, but the criteria have been broadened significantly in recent years, extending the range of biological variation among the areas designated. Internationally, Sweden has a major responsibility for the conservation of mires, and this habitat type is well represented among the country's Ramsar sites.

Wetlands often contain archaeological remains, and it is important that such sites are not damaged in restoration projects. Since new wetlands are rarely created in locations that reflect earlier land use, they do not enhance the historical dimension of the landscape.

One interim target concerns the establishment or restoration of wetlands and ponds in farming areas. In recent years, agri-environmental support of around SEK 100 million has been provided for conversion of farmland to wetlands. Under the Environmental and Rural Development Plan, 6000 ha of wetlands are to be re-created and restored between 2000 and 2006. Through the Local Investment Programme, state funding of some SEK 120 million (on top of the sums invested by local authorities) was provided in 1998–2000 for wetland creation schemes, including projects to enhance the self-purifying capacity of natural systems. Other key players in this context are the National Road Administration, WWF-Sweden and the Swedish Association for Hunting and Wildlife Management.

In recent years, several important bird lakes have been restored and some 100 frog habitats and numerous waters for game birds have been created. As well as enhancing biodiversity, such measures increase the 'environmental space', i.e. nature's ability to absorb waste products, using the self-purifying capacity of freshwater systems. Despite the change of direction in recent years, it is uncertain whether the target of 12 000 ha of restored wetlands and ponds in farming areas can be met by 2010. It is important that wetlands end up where they are most needed, and not where they are most easily established. Cultural heritage must also be taken into account. To achieve the target, increased agri-environmental support is

FIG. 11.2 Number of Natura 2000 sites in Sweden in 2001 containing certain wetland habitat types



Through a series of government decisions, a range of wetland sites have been identified and reported to the EU as Swedish contributions to the Natura 2000 network. Evaluations are to be carried out to determine whether these contributions are sufficient. As far as wetlands are concerned, some 15 habitat types included in the EU classification are now represented in the network, in addition to types incorporating lakes, running waters and sea areas.

needed. The involvement of a wide range of actors is a good thing, but makes greater demands in terms of coordination and communication.

Protection plan needs to be implemented

By 2010, all the sites listed in Sweden's mire protection plan are to enjoy long-term protection. The main reason why progress towards this target has been slower than intended is a shortage of personnel; protection of forests has been given priority. The total area of mires in Sweden is estimated at 6.3 million ha. Sites covering some 2500 ha have been designated as cultural reserves. The mire protection plan should be supplemented to include cultural historical information. Extraction of peat is incompatible with cultural heritage conservation.

More species action programmes needed

The latest Swedish Red List (May 2000) includes many species that are associated with wetlands for at least part of their life cycle. Support for such species has been stepped up in recent years and, for several, action programmes have been adopted. These include programmes for six amphibian species, with another planned for a seventh. Several threatened amphibians have now begun to recover, probably for a variety of reasons: many ponds have been created or restored, there have been several years of favourable weather, several species have been bred and released, and there is now much more information about and interest in amphibians.

For certain other species, though, the trend remains negative. To achieve the target regarding action programmes, more programmes for species and their habitats are needed and they must probably be implemented by a wider range of partners.

International undertakings promote objective

In 2001, the number of Swedish wetlands listed under the Ramsar Convention rose from 30 to 51. Given the Convention's definition of wetlands, its implementation is also relevant to the goals for the marine environment and lakes and streams.

As the EU's Habitats Directive is implemented, different habitat types are gradually being protected. The directive identifies several wetland types of Community interest, and hence of importance in national conservation efforts. Apart from rivers, lakes, sea areas and deltas, the EU's list includes several types of mire. Together with other habitats, these will form part of the Natura 2000 network.

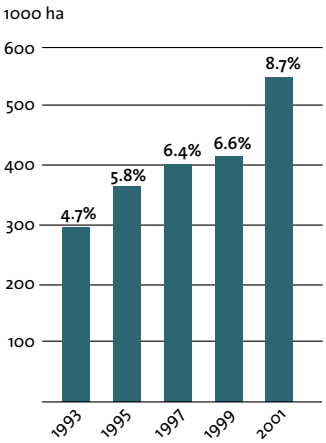
Progress towards the objective

Progress is being made towards the environmental quality objective, but it is still uncertain whether it can be achieved within one generation.

TABLE 11.1 Mires make up a large proportion of Sweden's aquatic environments

	Million ha
Mires (peatland), incl. mixed mires	6.3
Lakes, rivers and streams	4.0
Wet woodlands	2.5
Shallow sea areas (< 6 m deep)	0.6
Others (mountain wetlands, coastal meadows)	0.3

FIG. 11.3 Total area of protected mires



Sweden's mire protection plan covers an area of 392 000 ha. Of this total, some 245 000 ha have been protected so far, with an area of 4800 ha added in 2001. The present rate of protection of new sites is not sufficient to achieve the environmental objective. This is partly a result of protection of forests being given priority, and partly because of problems at many sites demarcating mire areas from forest land.

12| Sustainable forests

OBJECTIVE

The value of forests and forest land for biological production must be protected, at the same time as biological diversity and cultural heritage and recreational assets are safeguarded.

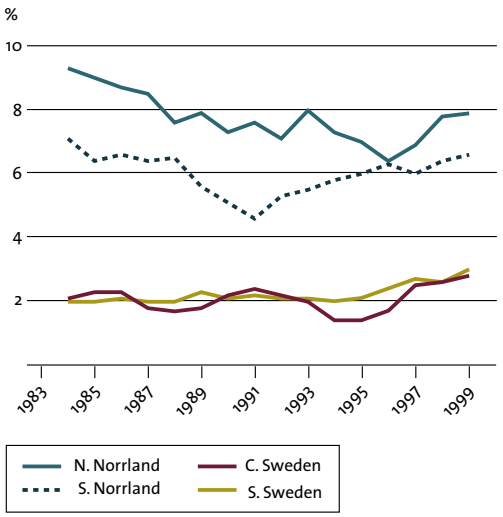
The objective is intended to be achieved within one generation.

Pollutants and browsing affect forests

Both the productivity and the biodiversity of forests are affected by air pollutants and climate. For decades, forest areas have been subject to heavy deposition of acidifying compounds and nitrogen. We know how much deposition is occurring, but cannot predict with any certainty what the consequences will be if it continues at its present high level. Predicting the effects of any changes in climate is even more difficult.

Browsing by wildlife is another problem with regard to both productivity and biodiversity. Several deciduous tree species are threatened. Browsing is one of the reasons why harvested forests are now replanted with spruce rather than pine in southern Sweden.

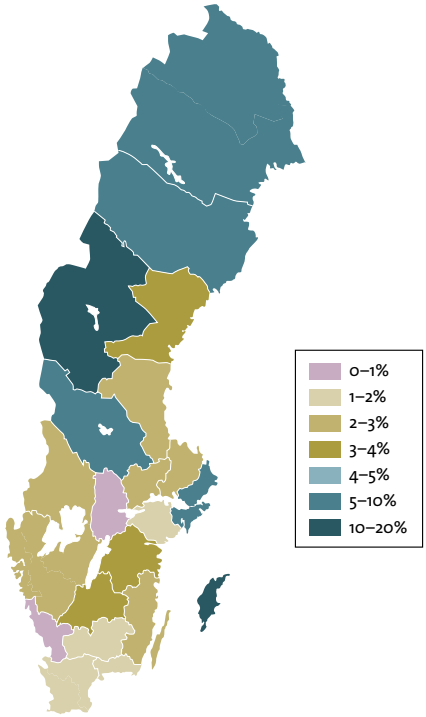
FIG. 12.1 Old forest as a proportion of all forest outside protected areas



If biodiversity is to be conserved, a higher proportion of old forest ecosystems is needed. 'Old forest' is defined here as forest older than 140 years in the north of Sweden (Norrland and the counties of Dalarna, Värmland and Örebro) and older than 120 years in the rest of the country. In biological terms, though, trees of these ages are still young.

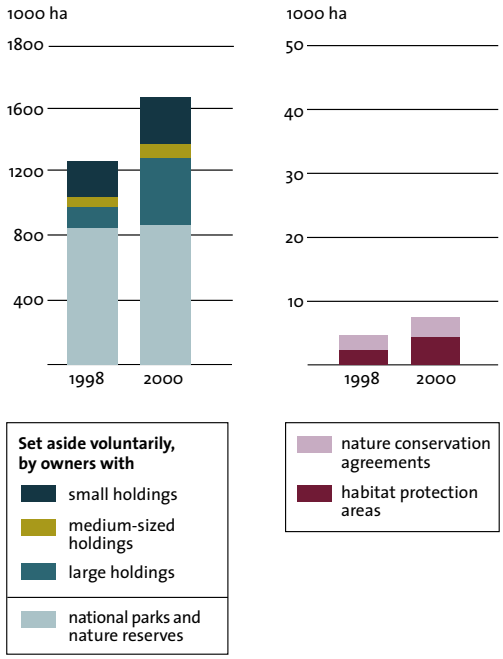
Since the mid-1990s, the proportion of old forest has increased throughout Sweden, largely because the oldest forest stands are not being harvested to any significant degree.

FIG. 12.2 Proportion of old forest in 1998, by county



The proportion of old forest varies, both across the country and within individual counties. There is a particular lack of it in southern and central regions and along the coast of northern Sweden.

FIG. 12.3 Areas of forest land with legal protection or set aside voluntarily



The area of forest land set aside voluntarily for nature or cultural heritage conservation has increased substantially in recent years, and now totals some 800 000 ha. That is almost as large an area as enjoys legal protection in national parks, nature reserves and habitat protection areas.

Large areas protected

At the end of 1998, some 865 000 ha of productive forest land had some form of legal protection. A further 400 000 ha are to be protected within ten years: 320 000 ha in nature reserves, 30 000 ha in habitat protection areas and 50 000 ha under nature conservation agreements.

Forest land is also set aside voluntarily by owners. In 1998, the total area thus safeguarded was 230 000 ha. The target for 2010 is for another 500 000 ha of forest of conservation interest to be set aside on a voluntary basis. By 2001 the area protected in this way already totalled around 800 000 ha, and another roughly 120 000 ha is likely to be set aside by major forest owners by 2005. The prospects of achieving the target by 2010 are judged to be good. Two areas of uncertainty are the quality and durability of voluntary set-aside of forest land.

Forestry can harm cultural heritage

In conjunction with felling and other forestry operations, irreparable damage still occurs to ancient monuments and other valuable cultural sites, a problem that calls for urgent action. To avoid this type of damage, nationwide inventories should be undertaken and the results made readily accessible to the forestry sector. In addition, more careful ground preparation methods need to be developed.

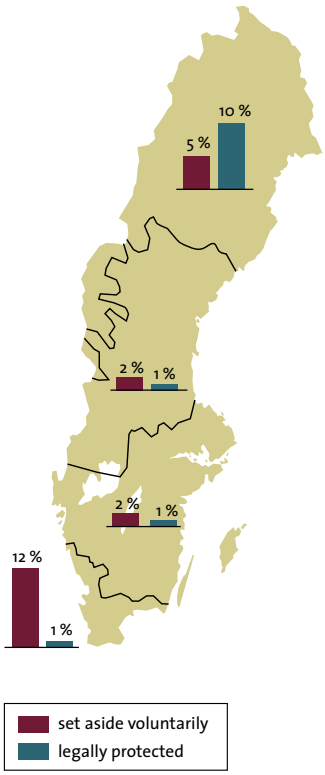
Progress towards the objective

Nature conservation measures and voluntary set-aside by owners, inventories, training, and state funding for site protection have been the most important factors in establishing a better basis for conserving forest biodiversity. However, owing to the lingering effects of forestry methods practised between the 1930s and 1980s, many of the goals will not be achieved until after 2020.

Old forest (i.e. older than 120 or 140 years) is very unevenly distributed, and it is especially scarce in southern and central Sweden. In the south, this is the case as regards both coniferous and deciduous forest. In such areas, particular effort should be devoted to advice to owners, and the proportion of old forest needs to increase more rapidly than the national average.

To achieve this environmental quality objective, the acidification goal also needs to be attained.

FIG. 12.4 Proportions of productive forest land with legal site protection and set aside voluntarily for nature conservation, 2000



Both the area of forest set aside voluntarily and the area with legal protection are very unevenly distributed across Sweden. Site protection needs to be greatly extended outside the montane forest zone of the north. Especially in the far south of the country, though, areas safeguarded voluntarily make up to some extent for the lack of legal protection.

13| A varied agricultural landscape

OBJECTIVE

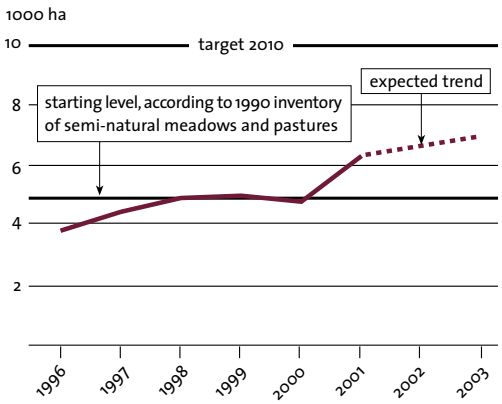
The value of the farmed landscape and agricultural land for biological production and food production must be protected, at the same time as biological diversity and cultural heritage assets are preserved and strengthened.

The objective is intended to be achieved within one generation.

Profitability not the only factor

To maintain a varied agricultural landscape, farming needs to be carried on throughout the country, and meadows, pastures and cultural environments must be managed in ways that preserve their values. This may be difficult to reconcile with efficient and competitive agriculture. In Sweden as a whole, the arable area and the number of farms are gradually decreasing; in inland areas of the north and in Värmland and Dalarna, the decline is much more rapid and a cause for concern. Farm closures and withdrawal of land from arable production are not only due to poor profitability, however, and a study of other factors behind this process in sparsely populated areas is currently in progress.

FIG. 13.1 Area covered by agri-environmental support for mown meadows



Without the mown meadows scheme, scrub invasion of meadows would continue and species favoured by annual mowing would be displaced. The target for the area of managed mown meadows in 2010 is 10 000 ha. Take-up of this scheme is expected to continue to increase. The estimated increase for 2001–03 (dotted line) is based on the areas within the scheme for restoring meadows.

Meadows and pastures need grazing livestock

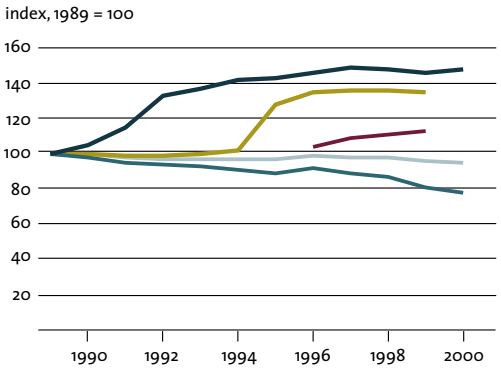
The biological and cultural heritage interest of pasture land is dependent on the area of pasture grazed, which in turn depends on numbers of grazing livestock and where they are kept. In certain districts, there are not enough animals, and the pasture area is decreasing. Overall, though, both livestock numbers and utilized areas of pasture are increasing, creating better conditions for plants and animals dependent on grazing.

The number of mown meadows managed with agri-environmental support under the Environmental and Rural Development Plan is rising, and there is a good chance of the target area being achieved. Take-up of agri-environment payments for the most threatened types of pasture is also increasing, but it is unclear whether the increase is sufficiently rapid. In northern Sweden, however, less than half of the relatively few meadows and pastures are covered by agri-environment schemes, and there is thus a great risk of such land being left unmanaged. Current knowledge of the long-term biological effects of management on meadows and pastures is inadequate, and work on indicators is now under way.

Achievement of other interim targets

Small-scale habitats are important for biodiversity. An indicator to measure their value in this

FIG. 13.2 Relative changes in areas of arable land and pasture, grazing livestock units and number of farms, 1989–2000



'Grazing livestock units' is a measure of the number of suckler cows, steers, heifers and sheep, weighted according to the area of pasture these animals require during one grazing season.

Over the period shown, the arable area and the number of farm enterprises have decreased. If this trend continues, the long-term prospects of achieving the environmental quality objective will be undermined. At the same time, the potential for conserving the values of pastures has improved, since both total grazing livestock units and the area of pasture utilized have increased. The marked change in the total pasture area from 1994 to 1995 is due to modified data collection methods and the greater importance of pasture in applications for farm support. The growth in numbers of grazing livestock in the early 1990s is an effect of the agricultural conversion programme introduced in Sweden at that time.

respect is being developed, and work has begun on a strategy to increase the number of such habitats in farming regions. Action programmes are being drawn up for the most endangered species, and some are now being implemented.

So far, a third of the target increase in the number of culturally significant landscape features maintained has been achieved, although this quantitative increase says nothing about whether the measures taken are sufficient. A review study of historically valuable farm buildings is beginning in autumn 2002, and a programme on redundant agricultural buildings in northern Sweden has been launched.

A national programme for plant genetic resources has been established and is expected to be fully developed by 2010. Work is in progress on a long-term conservation strategy for indigenous breeds of livestock.

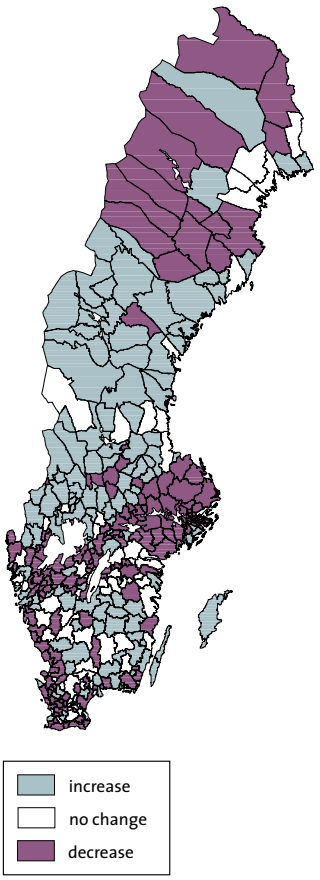
Environmental and Rural Development Plan is important

Measures and policy instruments are to be regularly reviewed to ensure a more coordinated approach, taking greater account of the biological and cultural heritage values of the farmed landscape. Information efforts and payments for management measures under the Environmental and Rural Development Plan are the most important tools for achieving the interim targets. A review, recommending various changes, was submitted to the Government in December 2001.

Progress towards the objective

The prospects of achieving this environmental objective within a generation are judged to be good. However, to do so, it is not sufficient to attain the interim targets in purely quantitative terms; it is also vital to preserve and strengthen qualitative features, such as species associated with mowing or grazing and traces of agrarian cultural heritage. The fact that farms are being abandoned in certain regions is a cause for concern. A regional breakdown of the interim targets is needed, along with action to conserve biodiversity on a regional as well as a national scale. In addition, farmers and the public need to be aware of why it is important to conserve biodiversity and cultural environments in farming areas, and to understand what measures are required.

FIG. 13.3 Change in numbers of grazing livestock, 1995–1999



Since the introduction of the CAP, numbers of grazing livestock have continued to increase in forest districts, but have decreased on the agricultural plains.

14| A magnificent mountain landscape

OBJECTIVE

The pristine character of the mountain environment must be largely preserved, in terms of biological diversity, recreational value, and natural and cultural assets. Activities in mountain areas must respect these values and assets, with a view to promoting sustainable development. Particularly valuable areas must be protected from encroachment and other disturbance.

The objective is intended to be achieved within one generation.

Off-road vehicles cause noise and pollution

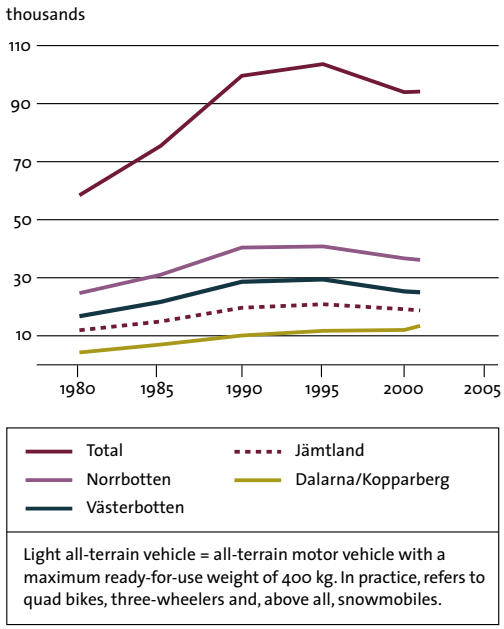
The use of snowmobiles and other light all-terrain vehicles has increased appreciably in the mountain counties of Sweden in the last 20 years. Snowmobile-based tourism is a growth industry, and more and more snowmobile routes are being created. A report from the Environmental Protection Agency on the regulation of off-road vehicle use in the Swedish mountains, commissioned by the Government, contains proposals relating to vehicle standards, off-road driving plans, driver training, scrapping premiums for old vehicles, and support for environmentally sustainable reindeer herding.

Impacts of reindeer herding to be studied

Reindeer husbandry is crucial to achieving this environmental quality objective, which is concerned with a majestic landscape influenced to a high degree by grazing. At the same time, a great responsibility rests on reindeer herders themselves to ensure that their activities are sustainable. To enable the impacts of reindeer herding on the landscape to be monitored, a survey method for reindeer pasture areas is currently being developed on the initiative of the Swedish Board of Agriculture. In the area of environmental monitoring, too, new methods are being developed, e.g. landscape monitoring based on random sampling, to allow trends in mountain areas to be studied.

A conflict exists between the reindeer sector's need for large areas for grazing and migration routes and the need for facilities for outdoor recreation and mineral extraction. Another conflict concerns reindeer herding and the size of predatory mammal populations.

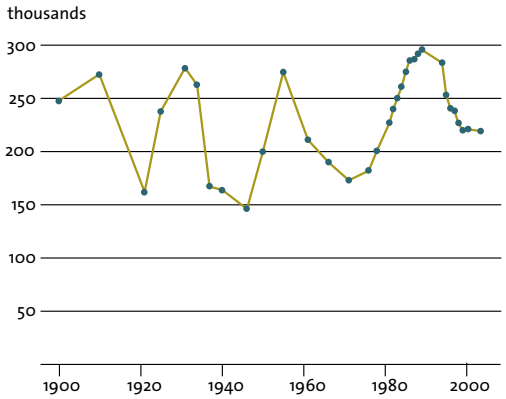
FIG. 14.1 Light all-terrain vehicles in use in mountain counties of Sweden, 1980–2001



Light all-terrain vehicle = all-terrain motor vehicle with a maximum ready-for-use weight of 400 kg. In practice, refers to quad bikes, three-wheelers and, above all, snowmobiles.

The main legal users of off-road vehicles on snow-free ground in mountain areas are reindeer herders, along with the defence forces and telephone and energy companies. Driving on ground unprotected by snow damages soil and vegetation, and may also harm ancient monuments. Other adverse effects, on snow-covered as well as bare ground, are noise and exhaust emissions, which make the mountain environment less attractive for outdoor recreation. Snowmobiles may, however, be important for certain aspects of tourism.

FIG. 14.2 Reindeer numbers during the 20th century



Reindeer are counted in winter, after the autumn slaughter and before calving. At this time of year, they graze mainly on lichens. Fluctuations in reindeer numbers reflect the varying abundance and accessibility of lichens, chiefly in the forest provinces outside the mountain region.

Support for valuable natural and cultural environments insufficient

Schemes under the Environmental and Rural Development Plan to promote conservation of valuable natural and cultural environments in the reindeer-herding region are unsatisfactory. As a result, old reindeer milking areas, enclosed reindeer pastures and other landscape features, e.g. buildings, are maintained and managed on a very limited scale. To increase take-up of the schemes, payment levels need to be increased. In addition, knowledge about the cultural environments, ancient monuments and settlements of mountain areas needs to be enhanced.

Undisturbed areas threatened

The prospects of increasing the area of undisturbed mountain terrain are affected not only by the use of off-road vehicles, but also by pressure to exploit wind power in mountain areas. An expansion of wind power would also affect the natural and cultural heritage assets of these areas.

Regional, national and international measures support objective

Parliament has entrusted a number of tasks to the Government in this area. The Government intends to introduce a legal requirement to draw up off-road driving plans. Environment-friendlier all-terrain vehicles are to be developed in consultation with the industry, and efforts will be made to develop alternative forms of reindeer husbandry. The Environmental Protection Agency is to evaluate the regulations issued under the National Parks Ordinance.

Within the EU, Sweden will promote the introduction of noise limits for light all-terrain vehicles and seek to ensure that it is able to introduce exhaust emission standards. The Government will also take action relating to aviation in sensitive mountain areas.

In addition, it has emerged that protection of lakes and watercourses needs to be enhanced, and that additional action programmes for threatened species need to be established. The Government will be requesting the relevant county administrative boards to draw up a regional environment and sustainable use programme for the mountain region.

Progress towards the objective

Exploitation of wind power and increased off-road traffic will reduce the extent of areas of high amenity, nature conservation and cultural heritage interest. In addition, increased traffic, and to some extent also wind energy projects, will result in greater noise disturbance. As part of its follow-up of this environmental objective, the Environmental Protection Agency plans to analyse ways of measuring and evaluating 'undisturbed' conditions.

One interim target is that, within ten years, the extent of damage to soil and vegetation due to human activities should be negligible. As yet, there is no evidence that such damage is becoming less common.

15| A good built environment

OBJECTIVE

Cities, towns and other built-up areas must provide a good, healthy living environment and contribute to a good regional and global environment. Natural and cultural assets must be protected and developed. Buildings and amenities must be located and designed in accordance with sound environmental principles and in such a way as to promote sustainable management of land, water and other resources.

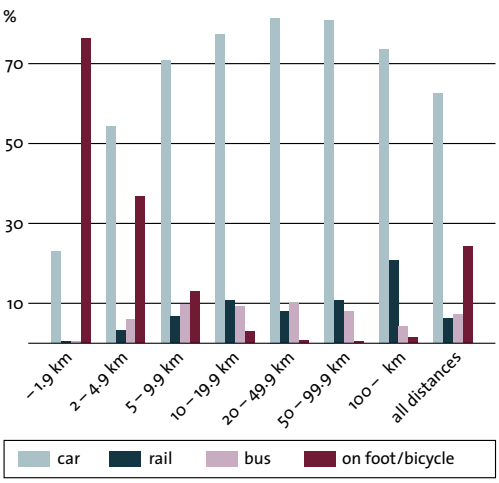
The objective is intended to be achieved within one generation.

Attitudes and distance affect how we travel

In the last 40 years, Sweden's urban population and area have risen sharply, while residential density has fallen. Distances and transport needs have therefore increased. Most Swedes of working age have to travel to and from a place of work every weekday. How they travel is a structural issue with wide regional variations: public transport is highly developed in the major urban regions, but in sparsely populated areas the car may be almost the only feasible means of transport. But it is also a lifestyle issue: in 1999, 44% of women travelled to work by some other means than a car, compared with only 31% of men.

To reduce car use, investments in environmentally sound, safe, convenient and speedy forms of transport are needed. The location of housing in relation to workplaces, shops and other services is another key issue. We also need to change our behaviour.

FIG. 15.1 Travel to and from work, by mode of transport and distance travelled, 1994–2000



This diagram shows – not surprisingly – that choices of mode of transport depend to some extent on the distances involved. But it also shows that many people travel to work by car, even though they have a journey of less than 5 km.

TABLE 15.1 Urban green space as a percentage of total built-up area, 1970–1995, %

Category of urban area	1970	1980	1990	1995
Towns < 10 000 inhab.		37.0	33.9	33.1
Towns > 10 000 inhab., excl. 3 largest cities		27.2	26.2	25.2
Stockholm, Göteborg and Malmö		27.3	26.1	24.8
All urban areas	33.0	31.0	30.3	29.4

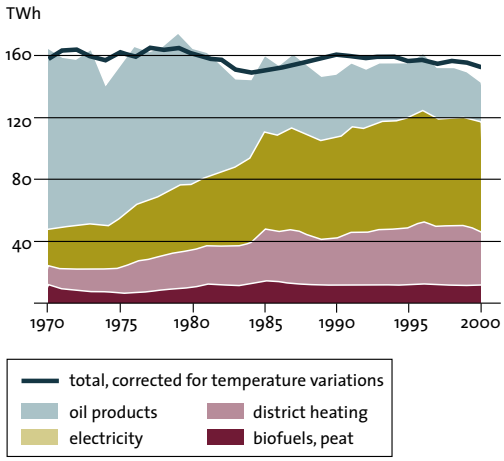
One aim for the built environment is to preserve and enhance green space and areas of water in urban and suburban areas, and to ensure that the percentage of hard surfaces does not increase. However, the statistics show that green space has steadily been eroded in towns of all sizes, as the proportion of land built on – and hence of hard surfaces – has increased.

Noise control offset by traffic growth

Traffic noise is often perceived as the biggest local environmental problem in built-up areas. Noise can interfere with speech intelligibility and cause irritation, disrupted sleep and cardiovascular effects. In 1998, over 2 million people were exposed to noise exceeding guide values in the open air near their homes. The same year, an estimated 840 000 experienced excessive noise in the home; by 2010, this number is to have been reduced by 5%.

Government transport agencies, municipalities and property owners do a great deal to reduce noise, e.g. by installing noise barriers or better-

FIG. 15.2 Energy consumption in the residential and services sector



Energy consumption in the residential and services sector fell slightly between 1995 and 2000. Since 1970 there has been a major change in the forms of energy used. Some district heating is based on fossil fuels: in 1995, the proportion was 29%, but by 2000 it had dropped to 16%. Increasingly, fossil fuels are making way for biofuels.

insulated windows. Such measures are costly. One problem is that not all homes exposed to noise have been identified; in addition, growth in traffic means that their number is increasing.

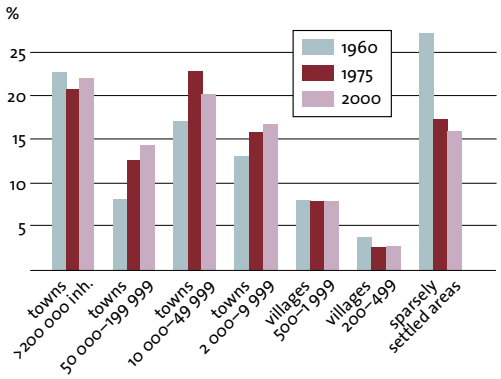
Greater energy efficiency in homes

Partly through improved efficiency, the environmental impact of energy use in homes and commercial premises is to be reduced by 2010, compared with 1995. Between 1990 and 1998, sulphur dioxide emissions from combustion in the residential and services sector fell by 62%, nitrogen oxides by 38%, carbon dioxide by 14% and VOCs by 17%. The decreases were due to reduced use of fossil fuels, cleaner oil and improved technology.

More attention to urban heritage needed

By European standards, Sweden has a small proportion of residential buildings from before 1900.

FIG. 15.3 Proportions of the population living in urban and rural areas



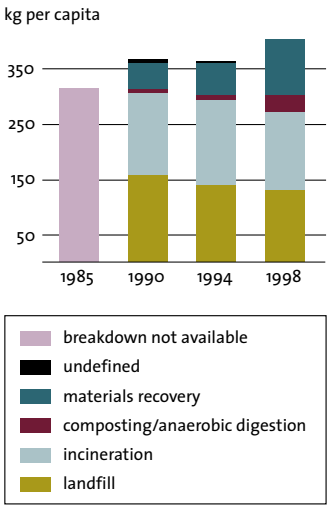
One of the interim targets calls for management programmes and strategies and/or long-term protection for culturally significant built environments. Building permits and planning are vital instruments. However, a study of comprehensive plans recently adopted by local authorities shows that such plans rarely contain tangible guidance on managing the cultural assets of built-up areas. Furthermore, there are considerable statistical gaps in this area. We know that there are around 2000 listed buildings, but the number of alteration restrictions under the Planning and Building Act is unknown. To achieve this target, resources and new methods are needed.

Progress towards the objective

This environmental quality objective is highly complex, making it difficult to assess overall whether – and at what rate – we are moving closer to it. Moreover, in several cases statistics are deficient, a problem that must be remedied if progress is to be monitored. One challenge with this objective is the long lifespan of buildings and infrastructure: one generation from now, some 90% of existing buildings will still be there. To achieve the objective, therefore, the sustainability of both existing and new built environments needs to be enhanced.

Small to medium-sized towns have grown most in the last 40 years, while the population of sparsely settled rural areas has declined by more than 600 000. The largest increase has occurred in towns with 50 000–200 000 inhabitants, which have more than doubled their combined population. The proportion of Sweden's population living in the three largest cities has remained basically constant (at just over 20%), but the total number of inhabitants in these cities has grown by over 250 000.

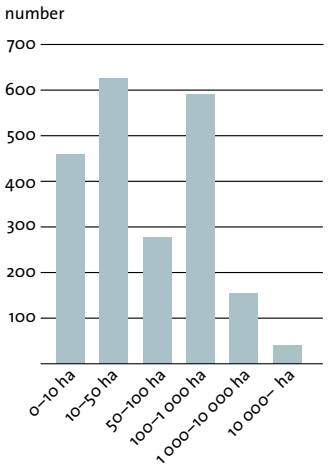
FIG. 15.4 Quantities of household waste, by treatment/disposal route



The quantity of waste disposed of to landfill is to be reduced by at least 50% by 2005, compared with 1994, while the total amount of waste generated is not to increase. The diagram shows that the quantity of household waste received by waste treatment facilities has increased, but also that the proportion landfilled decreased between the base year 1994 and 1998.

I| The natural environment

FIG. I.1 Number of nature reserves of different sizes, 2001



Sweden's nature reserves encompass a wide range of environments, from small-scale habitats to entire landscapes. The largest is Vindelfjällen, covering 550 000 ha. Roughly half the country's nature reserves have an area of less than 50 ha.

Site protection part of management strategy

All the environmental objectives are related, at least indirectly, to the natural environment, in that they express a desirable state that is of significance for the biosphere – for biodiversity and natural habitats. Some of the goals are particularly relevant to the natural environment: those relating to lakes and streams, the marine environment, wetlands, forests, farmland, mountain regions and the built environment. The strategy that has been adopted for the management of land, water and the built environment, which is very important in achieving these goals, builds on three main components:

- prudent use of land and water areas,
- environmentally sound land use planning and construction,
- protection of particularly valuable environments and resources and the creation of a varied cultural and natural environment.

One area of activity with a bearing on many of the objectives is site protection, i.e. designation of national parks, nature reserves, cultural heritage reserves etc. This is one part of the management strategy, and is designed to conserve biodiversity and natural and cultural environments.

Funding for site protection has increased in last decade

Since the early 1990s, site protection has been greatly extended, with particularly marked growth in the last few years following parliamentary decisions to increase funding, especially for protection of valuable forest areas.

One measure of the increased level of activity is the change over time in the number of decisions on site acquisition and compensation relating to nature reserves and national parks. From 1990 to 2000, the Environmental Protection Agency made an average of 270 such decisions a year. Towards the end of the decade, the number rose, and in 2001 it was 535. The average cost per decision/agreement was broadly the same throughout the period: around SEK 800 000. The 535 decisions in 2001 involved some 20 500 ha, of which around 12 000 ha were productive forest land.

Most protected areas are small

The Environmental Protection Agency and county administrative boards are now drawing up site protection strategies that are relevant above all to the objectives relating to forests, wetlands, and lakes and streams. The primary need here is to conserve valuable forest areas. An important aspect of this task is assessing the action taken by other parties, especially protective measures by the forestry authorities (habitat protection, nature conservation agreements) and voluntary set-aside by landowners. The areas involved in such cases are generally relatively small. A significant proportion of reserves, too, are limited in size, and 20% are smaller than 10 ha.

The near-natural forests of today are fragments of once landscape-wide forests. Fragmentation remains a basic ecological problem, and is reducing the country's near-natural forests to even smaller remnants. In 1999 the Environmental Protection Agency submitted a report to the Government on criteria for the protection of forest land, describing the state's responsibility for reserve designation in relation to other actors' measures to protect forest biodiversity. Briefly, reserve designation is chiefly intended for significant areas of near-natural forest and mixed ecosystems, and for efforts targeted on larger areas with ecological features of particular conservation value.

II| Land use planning and wise management of land, water and buildings

Wise management responsibility of all

Appropriate management means using land, water and other physical resources for the purpose to which they are best suited and, if possible, for more than one purpose. Elements and minerals, water, energy and other resources need to be used efficiently and carefully. It is also essential to maintain good conditions for production, conserve natural and cultural assets, and limit pressures on natural systems to levels which they can withstand.

Carefully planned development can help to restore the capacity of natural systems (e.g. wetlands) to absorb waste products (e.g. nutrients). It can also enrich the environment from an aesthetic and amenity point of view, through the interaction of built-up areas and their surroundings. Our use of resources is driven by the development of society and the business sector, and by our lifestyles. We are all responsible for keeping resource use at a reasonable level.

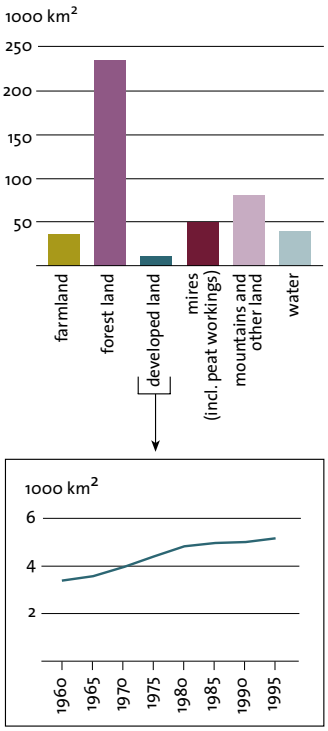
Local authorities' comprehensive plans important for wise management

An important tool in this context is environmentally sensitive land use planning. Planners have traditionally worked with a variety of societal goals in a long-term perspective. Different sectoral interests need to be coordinated and the various demands of both conservation and development balanced – primarily through close consultation with local people and by linking municipal planning to other strategic and sectoral planning processes. Sound land use planning takes into account different uses of land, water and the built environment, along with ecological and societal factors: it may for example be a matter of choosing sites for housing which minimize impacts on water and air quality. At present, some 190 local authorities have up-to-date comprehensive plans or are revising such plans. Existing policy instruments need to be scrutinized to establish whether, and if so how, they promote appropriate use of resources and to identify any new instruments that are required.

Changes in society call for planning

Swedish society and the Swedish landscape are constantly changing. Small-scale agriculture and forestry have been rationalized, renewable energy projects such as energy forests and wind farms are being established, people are moving from rural to urban areas, and travel and transport patterns are changing. Drinking water supply and waste management are growing problems. Migration and urban sprawl are making new demands in terms of buildings, areas required and infrastructure. Far-sighted planning improves the chances of reducing the adverse effects of such changes, and of achieving the environmental quality objectives.

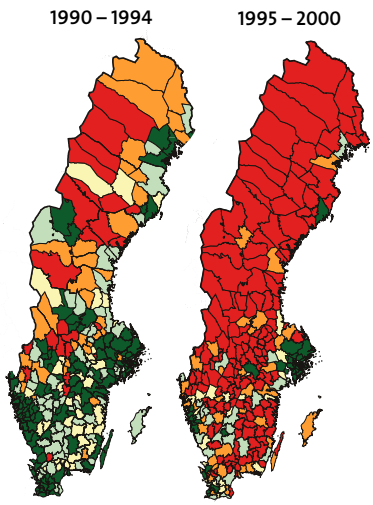
FIG. II.1 Land use in 1995 and area of developed land



Between 1960 and 1995 the proportion of developed land increased by almost 35%, or 180 000 ha, with just over a third of the increase occurring on farmland. Over the same period, the average population density of towns fell from over 30 to 22 people per hectare (2200 per km²).

III| The cultural environment

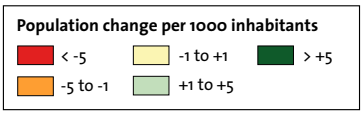
FIG. III.1 Population change, annual means



Our cultural heritage can only survive if people use it. Demographic changes therefore provide an important indication of where it may be under threat. The maps above show that the regional imbalance in Sweden was reinforced in the course of the 1990s, with population decreases across much of the country and increases in the major urban regions. The populations of the five largest cities grew appreciably, while those of most small towns decreased. From the standpoint of cultural heritage, these trends have had a particularly severe impact on agricultural areas of northern Sweden, and on Bergslagen and other regions of an industrial character. Conservation of the industrial heritage is primarily dependent on new uses being found for the buildings concerned.

Cultural heritage affected by social change

Sustainable development grows out of the interaction of old and new. The prospects of conserving the cultural heritage depend largely on how society develops. As people gravitate towards the cities, large areas of Sweden are becoming impoverished, while pressures on urban cultural environments are growing. Large-scale expansion of roads, railways, energy installations, telecommunication masts etc. is leaving clear imprints on the cultural landscape.



Greatest threat when sites are abandoned or redeveloped

The cultural environments of lake shores, river banks and coasts testify to the historical importance of water for human settlement and livelihoods. There is a danger of them either decaying or falling victim to insensitive redevelopment. Strategies for abandoned industrial and lighthouse sites are being developed, but further action is needed. In water bodies themselves there are remains such as mill dams and wrecks, which are still at risk of being removed by restoration projects or plunder.

In wetland and farming areas, agri-environment schemes are to some extent helping to preserve historical land uses and cultural features. The Environmental and Rural Development Plan is important in guiding countryside development, but it is not sufficient to ensure maintenance of barns and other farm buildings or, on its own, to prevent depopulation and farm closure in forest regions. On forest land, ancient remains are being damaged by highly efficient forestry; efforts are being made to promote greater awareness and more sensitive management, but there is still much to be done. A better knowledge base relating to mountain regions also needs to be established, and efforts to safeguard the Sami cultural heritage must continue.

Built environments serve a variety of functions. When old functions cease to be relevant, the technical and economic pressures for change can be considerable, often to the detriment of cultural heritage. Ultimately, the conservation and use of most buildings are the responsibility of owners and local authorities. Here, there is a need for more knowledge and better policy instruments, including economic instruments.

Pollution of air and soil needs to be reduced to levels that will not damage the cultural heritage. Progress has been made, but it will be a long time before the situation regarding such damage improves.

Different types of action needed

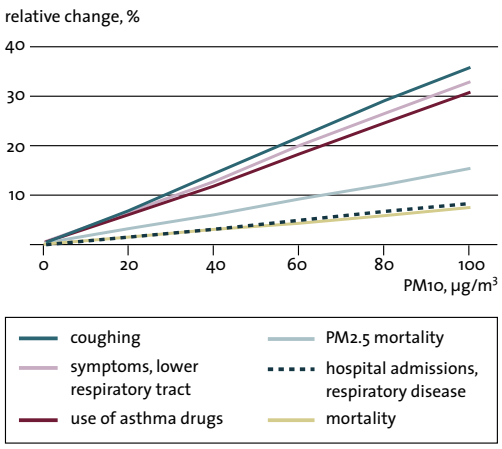
To achieve the cultural heritage elements of the environmental objectives, a combination of measures is required. Traditional active, legal protection of valuable sites is not the only way. It is also important to ensure that cultural assets are managed well and seen as a resource in the development of society. Their value must be recognized by the public at large. Active measures geared to safeguarding the basis for the survival of cultural environments are needed. Both local authorities and others must assume a broader responsibility and develop their expertise in the area of cultural heritage, particularly as regards the basic conditions for its use and management.

IV| Human health

The environmental quality objectives incorporate three main concerns with regard to health: preventing environment-related ill health arising, preventing disease symptoms being made worse by pollutants in the environment, and creating better basic conditions for health through land use planning.

It is important to gain a clearer picture of and reduce people's exposure to environmental factors harmful to health. One means of reducing exposure is by maintaining or increasing the number of green spaces and cultural sites available for exercise and recreation. Relatively unpolluted oases can enhance quality of life and alleviate pollution pressure in built-up areas.

FIG. IV.1 Relationship between exposure to particulates in ambient air and short-term effects on health



It is important to reduce atmospheric levels of particulates, which originate chiefly from vehicle exhausts and domestic heating. When particulate concentrations rise, a higher frequency of respiratory conditions can be observed. Existing symptoms are exacerbated, and more deaths occur.

Environmental health effects cause personal suffering and costs to society

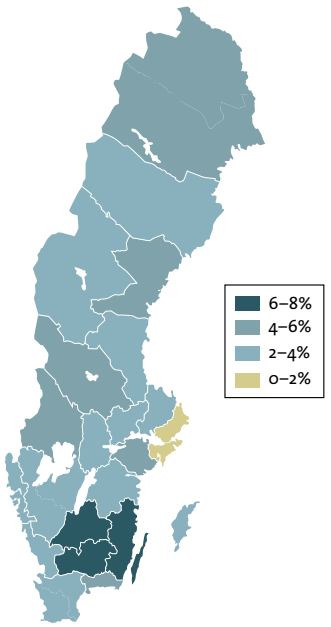
The 1999 National Environmental Health Survey showed that almost half of Sweden's population (women in particular) experience, at least once a week, one or more medical effects due to environmental factors. In most cases, the problems were attributed to the indoor environment. Almost a quarter of respondents said they were disturbed by noise. Hypersensitivity, e.g. allergy, has become much more common. Asthma sufferers are more sensitive to pollutants in indoor and outdoor air. Air pollution, e.g. from road traffic, still significantly affects overall mortality.

Low birth weight and cancer

Persistent organic pollutants and some metals can affect health. One study showed that fishermen's children on the Baltic coast had lower than average birth weight, an effect attributed to greater exposure to PCBs in Baltic Sea fish. Another study indicated that a few per cent of the population could be suffering from kidney conditions caused by cadmium. Smokers are particularly at risk, as their cadmium intake is already increased by smoking.

Many pollutants in air, soil and water are judged to be carcinogenic. One example is radon in indoor air, which according to the Swedish Institute of Environmental Medicine causes some 400 cases of lung cancer a year, 350 of them among smokers. Survival rates for lung cancer are very poor.

FIG. IV.2 Percentages of adults in different regions who, in last three months (at time of survey), had been disturbed by wood smoke in or near their homes



An important factor in improving air quality is reduced emissions of smoke from wood burning. Measures to achieve such reductions include more suitable wood fuels, adjustment or replacement of boilers and stoves, and switching to other, lower-emitting fuels or heating systems.

Data sources for figures and tables

FIG. A	*Environmental Signals 2002, EEA*
FIG. 1.1	*http://www.giss.nasa.gov/*
FIG. 1.2	*Sweden's Third National Communication on Climate Change, Ministry of the Environment, 2001*
FIG. 1.3	*Swedish Environmental Protection Agency*
FIG. 2.1	*MI 24 SM 0101, Statistics Sweden and Swedish Environmental Protection Agency*
FIG. 2.2	*MI 24 SM 0101, Statistics Sweden and Swedish Environmental Protection Agency*
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FIG. 2.4	*Swedish Environmental Monitoring Programme, IVL*
FIG. 3.1	*MI 18 SM 9901, Statistics Sweden and Swedish Environmental Protection Agency*
FIG. 3.2	*Swedish Environmental Protection Agency*
FIG. 3.3	*Swedish Environmental Protection Agency Report 5174*
FIG. 3.4	*Swedish Environmental Protection Agency*
FIG. 4.1	*Environmental Outlook for the Chemicals Industry, OECD 2001*
FIG. 4.2	*National Chemicals Inspectorate Regulations 1996:5, 1997:5, 2000:9, 2001:3*
TABLE 4.1	*Strategy for a future Chemicals Policy, European Commission White Paper, 2001*
FIG. 4.3	*Products Register, National Chemicals Inspectorate*
FIG. 5.1	*Swedish Environmental Monitoring Programme, SMHI*
FIG. 5.2	*EEA, ALE/GAGE/AGAGE network, NOAA/CMDL network*
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TABLE 8.1	*Swedish Environmental Protection Agency's Natura 2000 database*
FIG. 8.1	*National Board of Forestry, Meddelande 2/2002*
FIG. 8.2	*Swedish Environmental Protection Agency Report 4941*
FIG. 9.1	*MI 27 SM 9901, Statistics Sweden*
FIG. 9.2	*National Road Administration*
FIG. 9.3	*Swedish Environmental Monitoring Programme, SGU*
FIG. 9.4	*Swedish Environmental Monitoring Programme, IVL and SGU*
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FIG. 10.2	*National Board of Fisheries*
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FIG. 12.2	*National Board of Forestry*
FIG. 12.3	*National Board of Forestry*
FIG. 12.4	*National Board of Forestry*
FIG. 13.1	*Agri-Environmental Support Statistics, Swedish Board of Agriculture*
FIG. 13.2	*Agriculture Register, Statistics Sweden*
FIG. 13.3	*Agriculture Register, Statistics Sweden*
FIG. 14.1	*Statistics Sweden*
FIG. 14.2	*Svensk rennäring, Statistics Sweden 1999, Swedish Board of Agriculture*
FIG. 15.1	*Statistics Sweden*
TABLE 15.1	*Statistics Sweden*
FIG. 15.2	*Swedish Energy Agency*
FIG. 15.3	*Statistics Sweden*
FIG. 15.4	*Swedish Environmental Protection Agency and Statistics Sweden*
FIG. I.1	*Swedish Environmental Protection Agency*
FIG. II.1	*Statistics Sweden*
FIG. III.1	*Nordregio (Nordic Centre for Spatial Development)*
FIG. IV.1	*WHO. Air Quality Guidelines for Europe, 2000*
FIG. IV.2	*National Environmental Health Survey, National Board of Health and Welfare, 1999*

de Facto 2002

The 15 environmental objectives – are we on track?

This report is published by the Swedish Environmental Objectives Council through the Swedish Environmental Protection Agency. Draft texts and data for the report have been supplied by the following agencies with responsibility for the environmental quality objectives or for broader issues related to them:

Environmental quality objectives

1. REDUCED CLIMATE IMPACT
   Swedish Environmental Protection Agency
2. CLEAN AIR
   Swedish Environmental Protection Agency
3. NATURAL ACIDIFICATION ONLY
   Swedish Environmental Protection Agency
4. A NON-TOXIC ENVIRONMENT
   National Chemicals Inspectorate
5. A PROTECTIVE OZONE LAYER
   Swedish Environmental Protection Agency
6. A SAFE RADIATION ENVIRONMENT
   Swedish Radiation Protection Authority
7. ZERO EUTROPHICATION
   Swedish Environmental Protection Agency
8. FLOURISHING LAKES AND STREAMS
   Swedish Environmental Protection Agency
9. GOOD-QUALITY GROUNDWATER
   Geological Survey of Sweden
10. A BALANCED MARINE ENVIROMENT, FLOURISHING COASTAL AREAS AND ARCHIPELAGOS
    Swedish Environmental Protection Agency
11. THRIVING WETLANDS
    Swedish Environmental Protection Agency
12. SUSTAINABLE FORESTS
    National Board of Forestry
13. A VARIED AGRICULTURAL LANDSCAPE
    Swedish Board of Agriculture
14. A MAGNIFICENT MOUNTAIN LANDSCAPE
    Swedish Environmental Protection Agency
15. A GOOD BUILT ENVIRONMENT
    National Board of Housing, Building and Planning

Broader issues related to the objectives

I. THE NATURAL ENVIRONMENT
   Swedish Environmental Protection Agency

II. LAND USE PLANNING AND WISE MANAGEMENT OF LAND, WATER AND BUILDINGS
   National Board of Housing, Building and Planning

III. THE CULTURAL ENVIRONMENT
   National Heritage Board

IV. HUMAN HEALTH
   National Board of Health and Welfare

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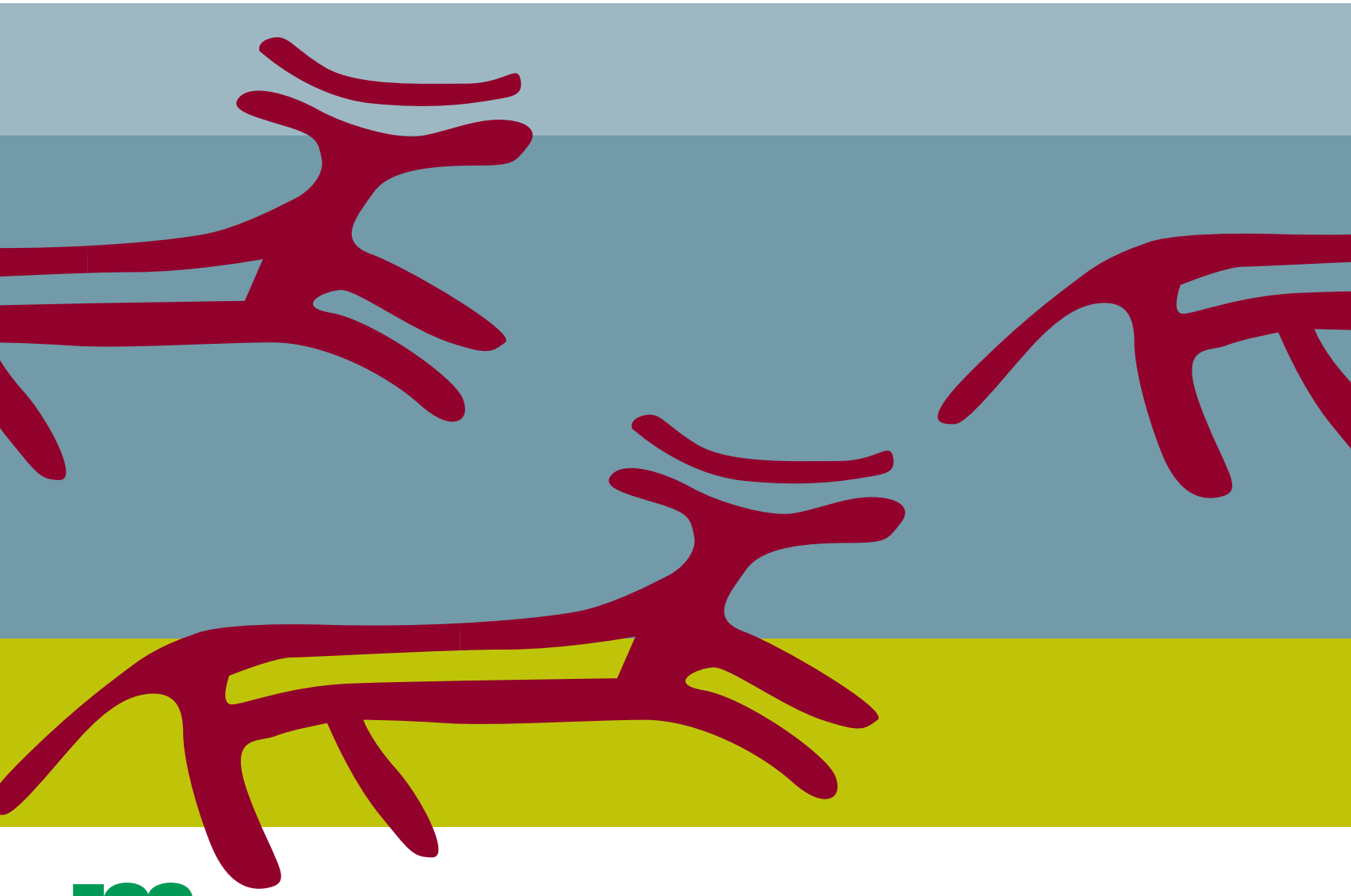
Annual report of the Swedish Environmental Objectives Council: **The 15 environmental objectives – are we on track? de Facto 2002.** Although far-reaching action has been taken, in many respects there has been little appreciable improvement in the state of the environment in the last ten years. This may be because of the slow rate at which ecosystems change: nature has simply not had time to respond to the easing of pressures on it.

This is the first report of the Environmental Objectives Council on progress towards Sweden's 15 environmental objectives, and the fourth publication in the *de Facto* series. It provides an overall picture of the environmental situation in Sweden and of the prospects of achieving the objectives.



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