de Facto

ENVIRONMENTAL OBJECTIVES –
OUR GENERATION'S RESPONSIBILITY

2000

our generation's responsibility

In the Environment Bill it presented in spring 1998, the Swedish Government formulated a challenge to today's society: to leave to the next generation a society in which all the major environmental problems have been solved. This *generation goal*, as it has come to be known, means that by 2020 (in the case of climate change, 2050) the pressures placed on the environment must be reduced to levels that can be sustained in the long term. It is our generation's responsibility to take the decisions that will shape the environment in which our children and grandchildren will live.

To attain the generation goal, national environmental quality objectives have been drawn up in fifteen areas. These objectives, adopted by Parliament in April 1999, desscribe what Sweden's natural and cultural environment will look like once ecologically sustainable development has been achieved.

Radical change needed

Thanks to the action already taken, the pressures exerted on the environment in many sectors have abated in recent decades. But the steps taken or pledged so far are not enough to attain the environmental objectives adopted; a fundamental restructuring of the whole of society is called for.

In some cases, the rate of progress towards the goals depends on Sweden alone. This is true, for example, of the aims concerning groundwater and wetlands. Other objectives, such as those in the areas of air quality and eutrophication, require changes at both a national and an international level. And in the case of global problems – such as depletion of the ozone layer or climate change – we are entirely dependent on international collaboration to achieve our goals.

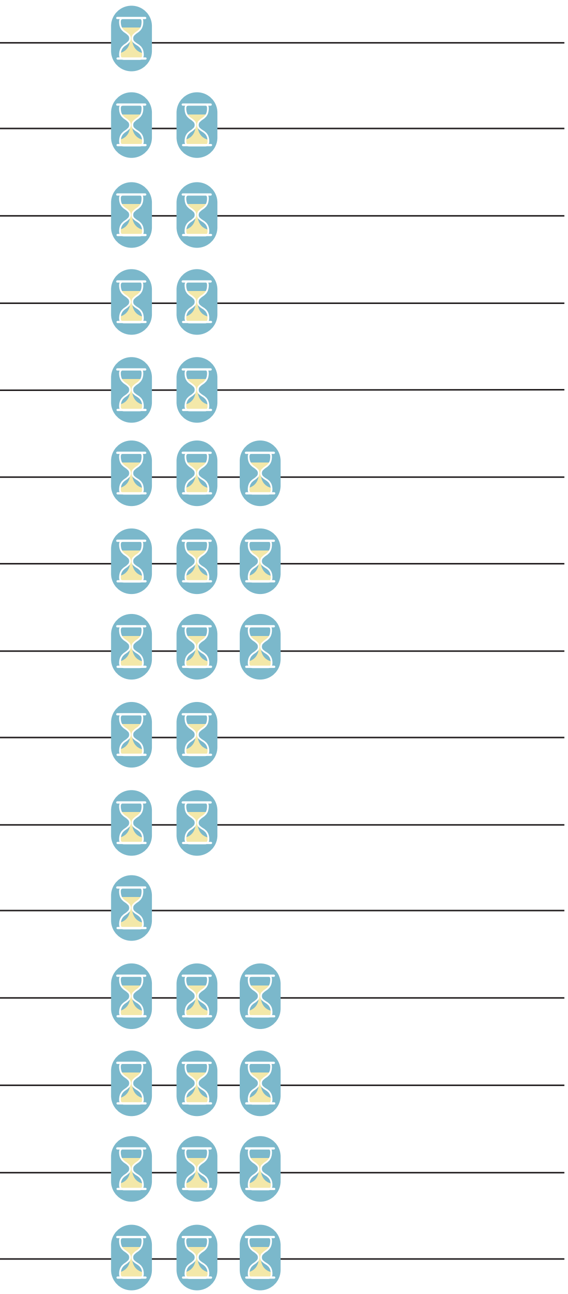
Effects linger despite action

In many cases, appreciable improvements in the state of the environment have still to occur, even though far-reaching action has been taken. This may be because ecosystems have a high degree of inertia; nature has simply not had time to respond to the easing of the pressures on it. Another reason, as far as toxic pollutants are concerned, could be that such substances are continuing to spread, even though direct emissions of them have ceased: they are now stored in sediments, landfills and products, from where they are escaping into the wider environment. The time lag is particularly marked as regards the ozone layer and climate. In these cases, it will take tens – or even hundreds – of years for emission reductions to feed through into visible effects.


ENVIRONMENTAL QUALITY OBJECTIVE
CURRENT TREND
Pressures on environment 1995–2000
State of environment 1990–2000
FURTHER ACTION
Can conditions for achieving the objective be created
by 2010?
by 2020?
1. clean air
2. high-quality groundwater
3. sustainable lakes and watercourses
4. flourishing wetlands
5. a balanced marine environment, sustainable coastal areas and archipelagos
6. no eutrophication
7. natural acidification only
8. sustainable forests
9. a varied agricultural landscape
10. a magnificent mountain landscape
11. a good urban environment
12. a non-toxic environment
13. a safe radiation environment
14. a protective ozone layer
15. limited influence on climate
(target year 2050)

RESPONSE OF ENVIRONMENT

Time needed to achieve the objective, once necessary conditions have been created



CURRENT TREND

- Things are moving in the right direction
- No clear-cut change has occurred
- Things are not moving in the right direction

FURTHER ACTION

- Realistic, but further action required
- Difficult, even if further action taken
- Not realistic within time-frame

RESPONSE OF ENVIRONMENT

- 0–5 years
- 5–30 years
- >30 years

Tracking progress

de Facto 2000 offers an overall assessment of whether the fifteen environmental quality objectives can be achieved within one generation. The diagrams and tables give examples of the *driving forces* in society that are behind environmental problems, the *pressures* on and *state* of the environment, the *impacts* of different pressures and our *responses* in terms of action. Each diagram stands alone.

Current trend

Pressures on the environment are assessed in terms of what has happened over the last five years, while our appraisal of the *state* of the environment is based on changes over the last ten years.

Further action

The action decided on so far by Parliament, the Government and other key players will not be sufficient to achieve the objectives adopted. The Environmental Protection Agency has therefore tried to assess whether, by 2010 or 2020, Sweden is likely to have implemented all the measures needed to create the basic conditions for attaining the various goals. Our assessment takes into account whether the necessary action can in fact be taken, bearing in mind the economic and social consequences it will entail. In some cases, action within the period stated is technically feasible, but not in our view a realistic possibility, given the heavy costs or far-reaching disruption of people's lifestyles that it would involve.

Response of the environment

We have also assessed how long it will take for the environmental quality objectives to be achieved – i.e. for the environment to respond to the action taken – once the basic conditions have been created. In the case of forests, for example, we judge current developments in terms of pressures and society's responses to be favourable. Even so, since one forest rotation spans 80–100 years, the resultant changes in the environment will not be fully visible for decades.

Different types of objective

For some of the environmental objectives, our assessment has focused on chemical pressures, while for others we have concentrated on physical and biological factors. The first group consists of the goals relating to air, eutrophication, acidification, toxic pollutants, radiation, the ozone layer and climate. The second comprises the objectives for lakes and watercourses, wetlands, the marine environment, coastal waters and archipelagos, forests, the agricultural landscape, mountains and the urban environment. In the case of the groundwater objective, we have considered both physical and chemical factors: as far as quantity and protection are concerned, the action taken will have noticeable effects in the environment within five years, but eliminating contaminants will take longer.

For many types of ecosystem, such as lakes, seas, forests and farmland, it will only be possible to claim that every environmental problem has been solved when the goals relating to eutrophication, acidification and toxic pollutants have been attained. The objectives concerning clean air and a safe radiation environment are similarly crucial with regard, for example, to the urban environment.

When a favourable trend is offset by an unfavourable one, the same symbol is used in the diagram opposite as for 'no clear-cut change'.

contents

1. air

Ill health and corrosion

Nitrogen oxides, ozone, particulates, volatile organic compounds (VOCs) and sulphur dioxide are the air pollutants of greatest concern. Urban air pollution is responsible for an estimated 200 cases of cancer in Sweden every year. Another 300 are due to people eating agricultural produce exposed to air pollutants. 90–360 people are admitted to hospital every year with respiratory problems resulting from high concentrations of ground-level ozone.

In the 1980s, ground-level ozone was responsible for production losses in Swedish agriculture totalling some SEK 1 billion a year. Ozone also affects forest trees.

Compulsory catalytic converters on 1989 and later models of cars and emission standards for new lorries and buses since 1993 have cut emissions of nitrogen oxides, organic compounds, particulates and carcinogens by 70–80%, compared with older vehicles.

FIG. 1.1 Mean benzene concentrations, October–March

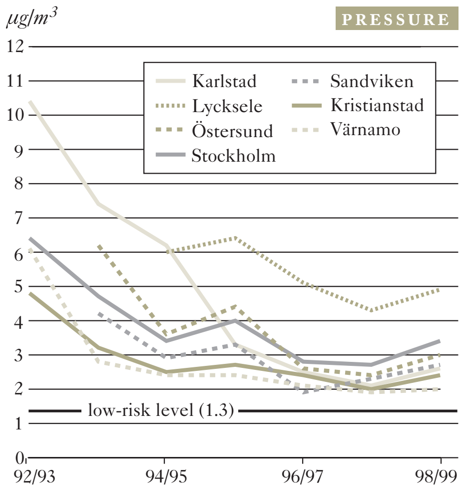
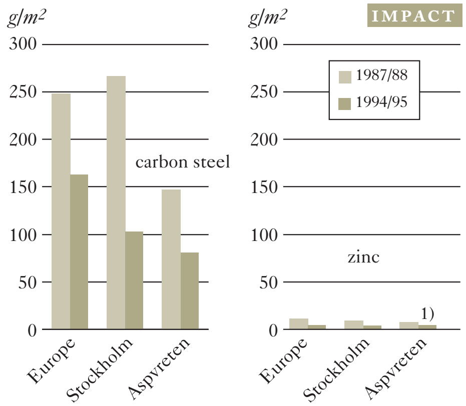


FIG. 1.2 Corrosion losses from steel and zinc



1) 1992/93

In addition, air pollutants accelerate the degradation of metals, limestone, rubber and plastics, and damage buildings, monuments and remains of cultural heritage value.

Emissions need to fall in Sweden and abroad

High levels of nitrogen oxides, particulates and VOCs in urban air are the result of emissions from traffic, industry and domestic heating. On the busiest streets, nitrogen oxide emissions need to be cut by 40–60% to achieve this environmental objective.

A large proportion of particulates are attributable to road traffic, with diesel exhausts and abrasion of road surfaces, brake pads and tyres the main sources. Burning of wood and other biofuels can cause large emissions of particles, but it is unclear how large; this source is believed to account for between 16% and 60% of the total.

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

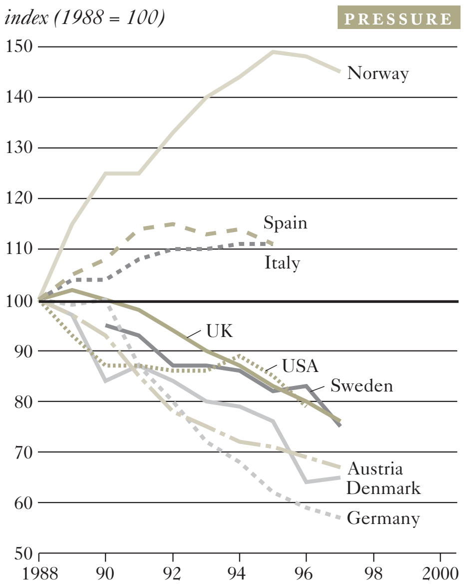
Air pollutants are also carried to Sweden by winds from other countries. Emissions in other parts of Europe are responsible for 90% of the ground-level ozone recorded in Sweden.

Progress towards objective

Sweden has ratified the UN ECE Convention on Long-Range Transboundary Air Pollution and, in addition, complies with EC directives. Sweden has also drawn up minimum environmental quality standards for air.

The countries shown in fig. 1.3 are nine of the 23 that signed the 1991 Protocol to the Convention on Long-Range Transboundary Air Pollution, which had the aim of reducing emissions of VOCs other than methane by 30% by 1999.

FIG. 1.3 Emissions of non-methane volatile organic compounds, % of 1988 levels



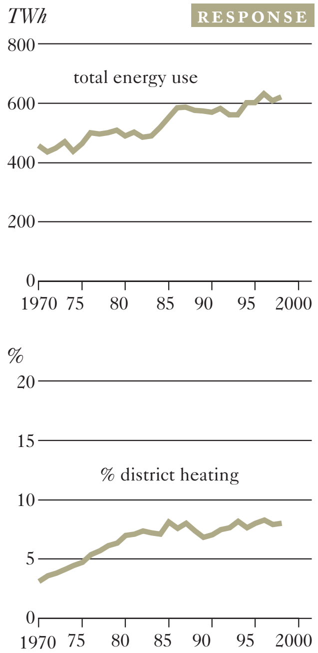
The prospects of reducing nitrogen oxide emissions depend crucially on measures in the transport, energy and mobile machinery sectors. The environmental quality standard for nitrogen dioxide will probably be met by 2010, thanks to cuts in vehicle emissions achieved by the use of catalytic converters.

The targets for 2010 for particulate matter with a diameter of less than 10 µm (PM 10) and for carcinogens will probably be achieved as far as roof-top concentrations are concerned, but not in terms of street-level concentrations, which have the biggest impact on human exposure to these pollutants. Nor will the targets be met by 2010 in areas where small-scale wood burning is widespread.

It is expected that, by 2020, Sweden will have met its target for ground-level ozone with respect to corrosion of materials, but concentrations with effects on crops will probably still be exceeded. Effects on human health will have been substantially reduced.

Sulphur dioxide concentrations already meet the environmental quality standard with regard to health effects. In most places, they are also below the even more stringent long-term target level proposed for the protection of cultural assets and materials.

FIG. 1.4 Use of district heating as a percentage of total energy use in Sweden



2. groundwater

Water threatened by pollution

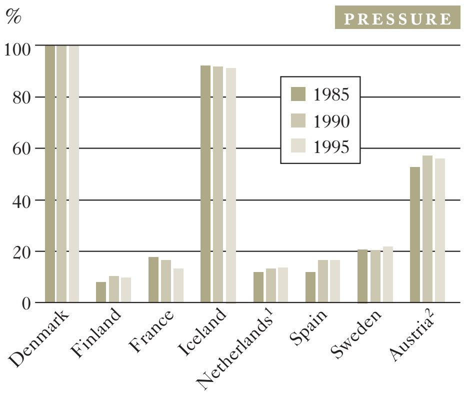
Sources of groundwater pollution include the use of pesticides, atmospheric deposition, and leachates from contaminated land and waste sites.

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. This problem primarily occurs in farming areas in the south. It can also be caused by sewage disposal systems in the vicinity of wells.

In areas affected by acidification, larger amounts of aluminium and heavy metals dissolve from the soil and enter groundwater. Acid groundwater corrodes pipes and raises heavy metal concentrations in tap water.

More than 80% of surface water comes from groundwater.

FIG. 2.1 Annual groundwater abstraction as a percentage of total freshwater abstraction



TOTAL FRESHWATER ABSTRACTION IN 1995, MILLION M³							
915	2 404	40 670	164	7 798	33 300	2 961	2 207

1) Latest data 1991 2) Latest data 1994

Radon in groundwater

In some 66% of wells drilled in bedrock, natural radon levels exceed 100 becquerels/litre (Bq/l) (making the water 'potable with a warning of potential health risks'), and in some 4% they exceed 1000 Bq/l ('unfit for human consumption'). Radon in water can cause cancer, primarily as a result of our inhaling the gas released when the water is run or flushed. Ingestion of water containing radon causes an estimated ten cases of gastrointestinal cancer in Sweden annually.

Natural and recharged groundwater

The most valuable groundwater resources in Sweden are to be found in the sand and gravel deposits left by the receding ice sheet at the end of the last ice age. These resources can be supplemented by pumping surface water into basins, from which it seeps down into the aquifer. Roughly 50% of Sweden's drinking water consists of natural or artificially recharged groundwater.

Exploitation of eskers

Exploitation of eskers and other deposits of sand and gravel affects groundwater availabil-

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.

TABLE 2.2 Use of water in Sweden, 1995

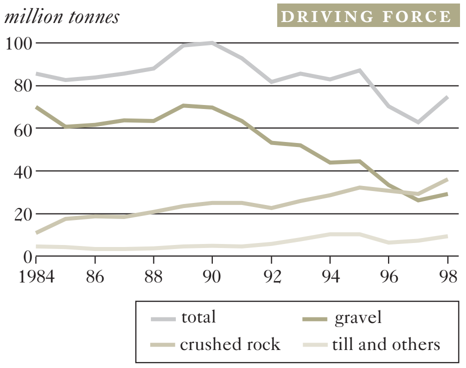
DRIVING FORCE

AREA OF USE	VOLUME, 1000 M³
Total abstraction of water	3 301 408
% groundwater	*17.3*
Used in:	
Households	616 424
Industry	2 242 306
Agriculture	137 291
irrigation	94 371
livestock production	42 920
Others	305 387

Protection zones or regulations currently apply to just over 65% of all municipal surface water and groundwater sources (the majority of them groundwater). Protection of water sources should be extended to all sources supplying more than 10 m³/day or serving more than 50 people.

ity. Eskers have long been the main source of aggregates for roads and buildings. They have also, since time immemorial, provided routes for roads, and more recently for railways. In addition, factories, airports and other developments have traditionally been located in areas with sand and gravel deposits.

FIG. 2.3 Production of aggregates



Salt water intrusion

Near coasts and in areas once covered by the sea, falling groundwater levels can result in the intrusion of salt water into aquifers. This may be due to excessive abstraction of groundwater, or to wells being drilled too deep. When chloride levels in water exceed 100 mg/l there is a risk of pipes being corroded, and at 300 mg/l the taste of the water is affected.

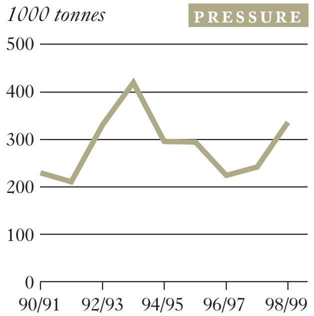
Salt applied to roads in winter also affects groundwater quality by increasing chloride concentrations.

Progress towards objective

The forthcoming EC Water Framework Directive will give groundwater greater prominence in physical planning. This directive and those on nitrates, drinking water and landfill will be key instruments in achieving this environmental objective. At the national level, there are plans to introduce an environmental quality standard for nitrate in groundwater.

Changes in the soil-water and groundwater system are slow. Efforts to reduce pollutant concentrations will therefore take a long time to produce results. Groundwater levels, on the other hand, could be restored more quickly. The goal of a safe and sustainable supply of drinking water is considered achievable within one generation, but the target regarding groundwater quality will not be attained by 2020. To meet this objective, the goals relating to eutrophication, acidification and a non-toxic environment must also be achieved.

FIG. 2.4 Use of road salt by National Road Administration



If road salt were not used on busy roads, another approx. 60 people would be killed or seriously injured in Sweden every winter, assuming that the same speed limits applied.

3. surface waters

Hydro, farming and forestry

The main environmental problems affecting lakes, rivers and streams are physical disturbance, eutrophication and acidification. The last two are dealt with in more detail under the relevant objectives.

In most of Sweden's major rivers, migration of fish is prevented by hydroelectric dams. This has eliminated several genetically unique stocks of salmon and brown trout, and naturally spawning salmon are now threatened. Another adversely affected species is the freshwater pearl mussel, whose reproductive cycle is dependent on the brown trout; it now survives mainly in northern Sweden. Attached algae, too, are entirely absent or less abundant in rivers harnessed for power.

Agriculture and forestry have also put heavy pressure on freshwater habitats, e.g. through drainage, filling in of ponds, and use of shores and edge zones. Some 260 red-listed (i.e. threatened or near-threatened) species are associated with fresh water.

Non-native species

To offset losses of fishing in rivers developed for hydroelectric power, North American species have been stocked on a large scale since the early 1940s. Few waters are unaffected by non-native species.

Fishing alters fish stocks

Over two million Swedes fish for recreation at least once a year, and commercial fisheries exist in the country's five largest lakes and elsewhere. One problem is that commercial fishing using nets is carried on in waters with mixed stocks. This involves a risk of bycatch, e.g. of undersized fish belonging to other species, which have to be thrown back. Survival rates for such fish are low.

Surface water sources often unprotected

Many large waterworks that make use of surface water obtain their raw water from lakes lacking protection zones or regulations. Where regulations are in force, they often provide inadequate protection. A large proportion of Sweden's population therefore drink water from poorly protected surface waters.

The biggest threat to water sources is the use of fertilizers and pesticides on nearby land. A conflict thus arises between drinking

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.

FIG. 3.1 Energy supply 1998, 555 TWh

DRIVING FORCE

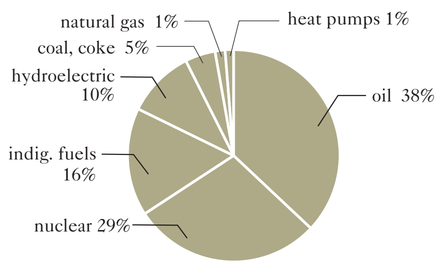


TABLE 3.2 Average catches of 13 fish species sampled in 13 environmental monitoring lakes, 1999

IMPACT

	NO. OF LAKES	MEAN WEIGHT, G/NET
Arctic char	1	451.3
Bleak	3	12.0
Bream	2	395.6
Burbot	2	17.0
Perch	12	419.1
Pike	11	111.6
Roach	12	243.3
Rudd	5	10.1
Ruffe (pope)	7	12.2
Smelt	3	1.1
Tench	2	724.4
Vendace	1	58.0
Whitefish	4	95.7

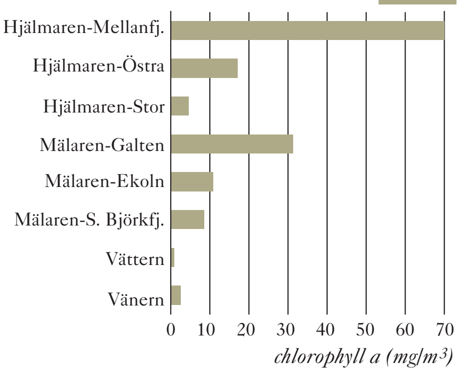
water supplies and efficient agriculture. Transport of hazardous goods is another threat.

Cultural heritage sites on shores and banks

Valuable cultural heritage sites associated with lakes and rivers range from ancient settlements, graves and rock carvings to more recent features such as watermills, sawmills, dams, bathing resorts and harbours. Such sites are threatened not only by development, but also by discontinuation of the associated activities. Timber floating installations, for example, may be dismantled.

FIG. 3.3 Chlorophyll concentrations in major lakes, 1997

STATE



Progress towards objective

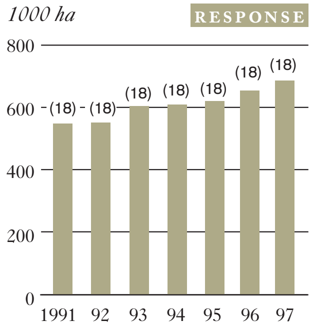
Sweden itself is able to regulate and modify commercial lake fishing to ensure that it is sustainable. However, the demands of efficiency are reducing the number of commercial fishermen, and as a result traditional cultural environments are being lost. Decisions to protect other natural and cultural assets threatened by building projects and other development can also be taken at the national level. To reduce atmospheric transport of acidifying pollutants, nutrients and toxic substances from other countries, however, international cooperation is required.

One important factor affecting the prospects of achieving this objective within a generation is energy policy. An electricity shortage could result in previously undammed rivers being harnessed for power. Other decisive factors are what efforts different sectors (e.g. agriculture, forestry, tourism) make to maintain the conservation interest of lakes and watercourses, and what central and local government do to safeguard important freshwater habitats. Greatly improved knowledge is needed as a basis for planning site protection. Applications for exemptions from shore protection rules must be closely scrutinized.

Success in implementing this goal is dependent on the objectives concerning eutrophication, acidification and toxic pollutants being achieved.

FIG. 3.4 Area of water in protected areas
(as % of total protected area in parentheses)

RESPONSE



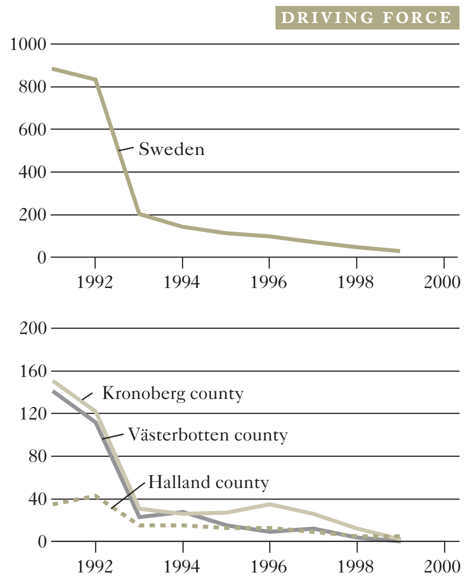
4. wetlands

Landscape changed by forestry and farming

Of the wetland area existing in Sweden around 1800, roughly a quarter, or 3 million ha, has been lost altogether as a result of drainage or other interference, mainly for the purpose of producing crops or trees. Large areas of wetland have been exploited for peat extraction or eliminated by flooding of shores and banks in connection with hydroelectric schemes.

In Skåne and the Lake Mälaren basin, only some 10% of the original wetland area now remains. The Öster- and Västergötland plains and Gotland have also suffered extensive losses of wetlands. Even if no new drainage projects are undertaken, the wetland area will continue to contract for another ten years or so, since soil water levels will still be affected by existing drains. These losses will not be offset by current projects to create new and restore old wetlands.

FIG. 4.1 Number of applications for permission to drain forest land



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

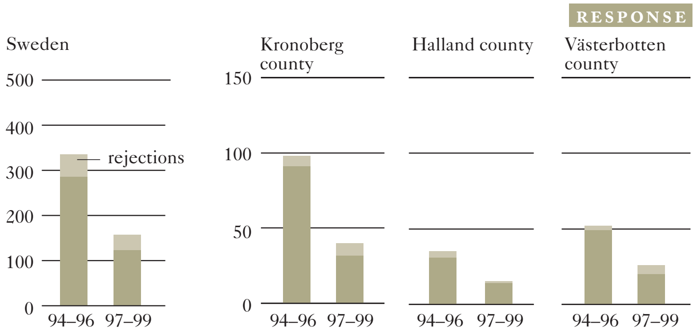
Important for biodiversity

Many plants and animals are dependent on wetlands at some stages of or throughout their life cycles. Even more use wetlands as a complementary or alternative habitat. Of the 4120 threatened or near-threatened species in Sweden, 620 (15%) occur in wetlands. Exploitation of wetlands has resulted in poorer conditions for plants and animals, especially amphibians, and their powers of dispersal have been further reduced by the fragmentation and drainage resulting from forest roads. Another threat to wetland habitats is scrub encroachment, due to drainage, atmospheric deposition, and abandonment of traditional haymaking and grazing. Many plant species depend for their survival on traditional management regimes.

Wetland cultural heritage

Wetlands have been a major factor in people's livelihoods. They have been mined for bog iron ore and peat, provided peasant communities with hay, and in winter offered excellent communication routes. Hay-drying racks, barns and ditches are visible evidence

FIG. 4.2 Number of decisions concerning drainage of forest land



of earlier times, while today's bogs may hold hidden treasures.

Progress towards objective

Several international conventions and EC directives relate to the protection of wetlands.

By international standards, a large proportion of Sweden's wetland area has – despite the losses – been preserved. Particularly in upland forest areas in the north, many wetlands remain undisturbed.

New drainage schemes are now prohibited throughout southern Sweden, in most of the central region and in some northern coastal areas. Peat extraction is regulated by law, and agri-environmental payments are available to support the re-creation of historically documented haymaking mires. As part of the agri-environment programme, 13 000 ha of wetlands and small water bodies are to be created, chiefly with the aim of preventing nitrogen inputs to the sea. Such projects will also promote biodiversity. The national mire protection plan will safeguard 6% of the mire area. In addition, a certain area of mire habitat is already protected, and further sites are to be safeguarded in Norrbotten county, which is not yet fully covered by the protection plan.

Although conflicts do exist with energy production and greater efficiency in agriculture and forestry, the assessment is that this environmental quality objective can be achieved by 2020.

FIG 4.3 Newly built or improved forest roads

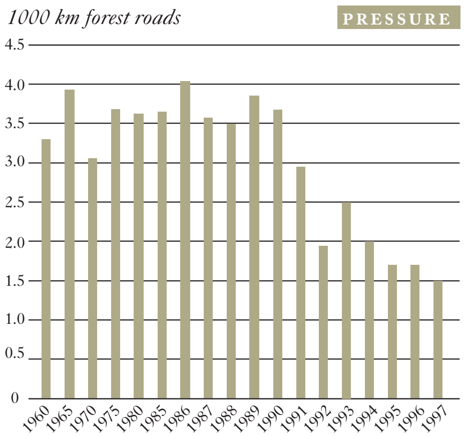


FIG. 4.4 Area of mires in protected areas
(as % of total mire area in parentheses)

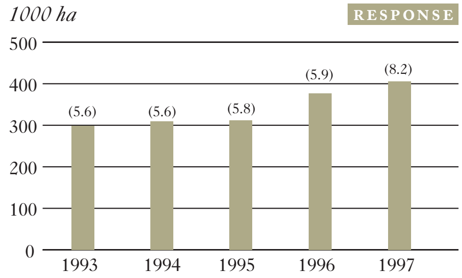
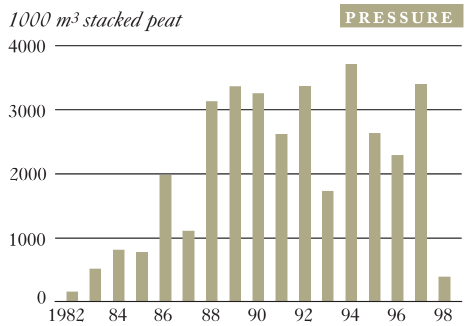


FIG. 4.5 Peat extraction for energy



5. seas

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.

Fishing alters fish stocks

According to biologists, the EU fishing fleet is too large in relation to fish stocks, and quotas are too high. Both fish stocks and Sweden's fishing industry are therefore under threat. Certain fish stocks of importance to Swedish fisheries are judged to be below biologically safe levels.

Bycatch is a major problem. On the one hand, undersized fish of the target species are caught; these are thrown back, but rarely survive. On the other hand, non-commercial species are caught, potentially disturbing the balance of marine ecosystems. In addition, seals and seabirds become entangled in nets.

Recreational fisheries also contribute to the high fishing pressure, particularly at a local level.

Biodiversity affected

In littoral and coastal zones and in rivers, a range of activities damage spawning and nursery grounds for fish. To offset this, waters are stocked with hatchery-bred fish. This may displace local species and alter the genetic make-up of the wild species. In addition, it increases the risk of disease and parasite infestation.

FIG. 5.1 Landings from Swedish sea fisheries

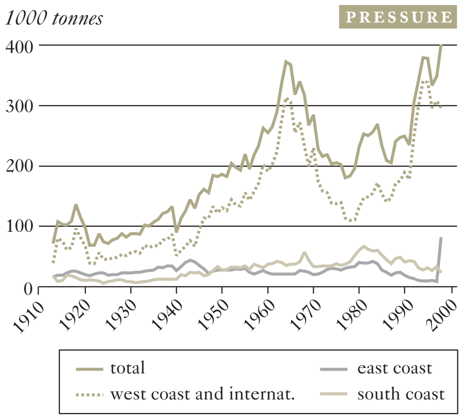
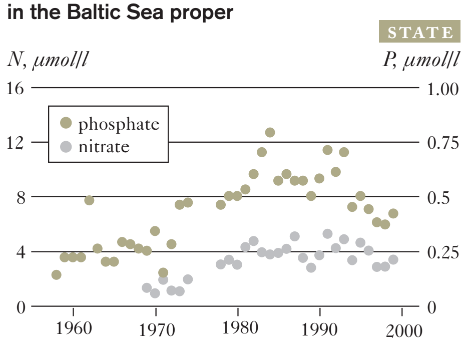


FIG. 5.2 Phosphate and nitrate concentrations in the Baltic Sea proper



Non-native species are introduced into Swedish waters unintentionally, too, e.g. in ballast water or on ships' hulls. Other detrimental environmental effects of shipping include oil discharges, noise disturbance and shore erosion.

Just over 500 species living in the sea or on its shores are threatened or near-threatened.

Maritime cultural heritage

As a result of postglacial land rise, some archaeological remains that used to be near the coast are now a long way inland. Cairns, labyrinths and old harbour sites are particularly distinctive. Fishing villages and small archipelago farms and chapels are other important features. Lighthouses and pilot stations bear witness to coastal shipping routes serving quarrying and fish canning industries. There are also many marine archaeological remains, i.e. remains covered by the sea.

These cultural assets are threatened by the rationalization of fishing, agriculture and coastal shipping that has long been in progress, and by the pressure for change resulting from increased use of coastal areas for second and permanent homes, particularly near large towns. Sustainable development of tourism, on the other hand, offers positive opportunities for many small coastal communities.

Progress towards objective

A number of areas have been set aside to protect valuable coastal and archipelago environments, but only a few of these consist primarily of marine sites.

Sweden's coastal regions are a focus of many conflicting interests, which all influence the prospects of achieving this objective. However, the relevant decisions are taken in Sweden itself. County administrative boards and local authorities need good planning tools and adequate resources. Applications for exemptions from shore protection regulations must be closely scrutinized.

When it comes to pressures on open sea areas, Sweden is dependent on international decisions. The biggest threat here is overfishing.

The marine environment is under severe pressure from eutrophication, toxic pollutants and discharges of oil. Even if sufficient action is taken, recovery will take a long time. To achieve a balanced marine environment, the objectives relating to eutrophication and toxic pollutants must also be attained.

FIG. 5.3 Shipping traffic in around 40 member ports of the Association Ports of Sweden

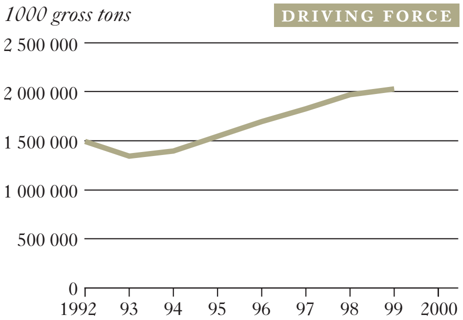


TABLE 5.4 Sweden's fishing quotas, tonnes

RESPONSE

SPECIES	AREA	1997	1998	1999	2000
Anglerfish	N Sea (EC waters)				20
Cod	Kattegat	3 150	2 780		
Dab/flounder	N Sea (EC waters)				10
Spurdog	N Sea (EC waters)				12
Herring	Skagerrak, Kattegat	34 920			
Horse mackerel	N Sea (EC waters)		750	750	750
Lemon sole/witch	N Sea (EC waters)				20
Norway lobster	Skagerrak, Kattegat, Baltic (EC waters)	1 270	1 270	1 270	1 315
Plaice	Baltic (EC waters)	200	200	200	200
Northern prawn	N Sea (EC waters)				316
Sand eel	N Sea (EC waters)				35 000
Sole	Skagerrak, Kattegat, Baltic (EC waters)	70	55	45	
Sprat	Skagerrak, Kattegat	10 140	10 140	10 140	12 680
Sprat	N Sea (EC waters)	1 330	1 330	1 330	1 330
Turbot/brill	N Sea (EC waters)				10
Blue whiting	N Sea (EC and Norwegian waters)		155	155	
Whiting	Skagerrak, Kattegat	430	430	280	140
Whiting	N Sea (EC waters)	10			

6. 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.

Biodiversity affected

Eutrophication (nutrient over-enrichment) is primarily a problem in southern Sweden, but has also been observed in the north. There, the abundance of green algae in mountain streams has increased over the last 20 years.

In many sea areas, excessive nutrient inputs have caused algal blooms, contracting belts of brown algae, oxygen depletion and a complete lack of oxygen at the seabed. Narrow inlets and other areas with restricted water exchange are particularly badly affected. Eutrophication is one of the most serious threats to the marine environment. It is also a major problem in many lakes. It enables certain planktonic algae to multiply rapidly, reducing the transparency of the water. Blooms of toxic algae can represent a serious health hazard to people and animals.

In forests, meadows and pastures, deposition of nitrogen gradually alters the vegetation. A denser growth of grass develops, and species adapted to nutrient-poor habitats are displaced. Nitrate in groundwater in intensively farmed areas causes health problems, particularly in children.

TABLE 6.1 Emissions of ammonia in Sweden, tonnes/year

PRESSURE

	1995	1997
Agriculture	55 200	52 800
Horticulture	100	120
Forestry	50	35
Industrial processes	850	790
Energy plants	1 000	900
Road traffic	2 800	3 300
Pets and individual sewage systems	900	900
Total	60 900	58 800

Water- and airborne inputs

Nutrient enrichment of forest, heath and mire soils is largely due to atmospheric deposition of nitrogen compounds, while that of lakes and running waters can mainly be attributed to phosphorus inputs from agriculture, municipal and private sewage plants, and factories. Open and coastal sea areas are chiefly affected by nitrogen and phosphorus from land-based sources, but roughly a third of the nitrogen input is atmospheric. Coastal waters are richer in nutrients than the open sea, owing to inputs from rivers. Of the river-borne inputs of nitrogen to the Baltic Sea proper, Kattegat and Skagerrak, Sweden is responsible for around 6%, 50% and 10%, respectively. Locally, nutrients from fish farms in lakes and the sea can be a major factor in eutrophication.

Farms and vehicles key sources

Some 80% of atmospheric deposition of nitrogen oxides in Sweden is of foreign origin, with transport the principal source. Most of the nitrogen emitted in Sweden is deposited outside the country's borders. The transport sector is also responsible for some emissions of ammonia, which are rising with the growing use of catalytic converters. However, agriculture accounts for the great majority (90%) of deposition of this pollutant, the main sources being storage and spreading of animal manure and urine. 75% of ammonia deposition in Sweden originates abroad, while around half of the ammonia emitted here remains inside the country.

Agriculture is also a source of phosphorus emissions, which result from both livestock production and use of artificial fertilizers. A significant proportion of phosphorus inputs to water are due to sewage discharges in sparsely populated areas, where there are half a million permanent homes and as many second homes not served by municipal treatment plants.

Progress towards objective

Over a period of many decades, large quantities of nitrogen and phosphorus have accumulated in soils and sediments. Given the inertia of natural systems, it will take a very long time for concentrations of these nutrients to be brought down to acceptable levels again.

In agricultural areas it is in practice impossible to achieve undisturbed conditions in lakes, so long as existing farming practices are maintained. To tackle marine eutrophication, far-reaching international undertakings are required. The time-scale of recovery in the marine environment is very long, and the objective will probably not be achieved until several decades after 2020. Similarly, international agreements are needed to reduce nutrient enrichment of soils.

TABLE 6.2 Number of people served by non-coastal municipal sewage treatment plants

RESPONSE

	BY METHOD OF TREATMENT					TOTAL
	BIOLOGICAL	CHEMICAL	BIOLOGICAL-CHEMICAL			
			CONVENTIONAL	SUPPLEMENTARY	NITROGEN REMOVAL	
1990	24 398	223 640	2 999 389	351 714	13 000	3 611 791
1992	7 524	221 680	2 778 034	361 787	10 500	3 379 525
1995	5 170	222 868	2 676 082	369 872	4 500	3 278 492
1998	14 450	199 818	1 988 057	131 435	860 514	3 194 274

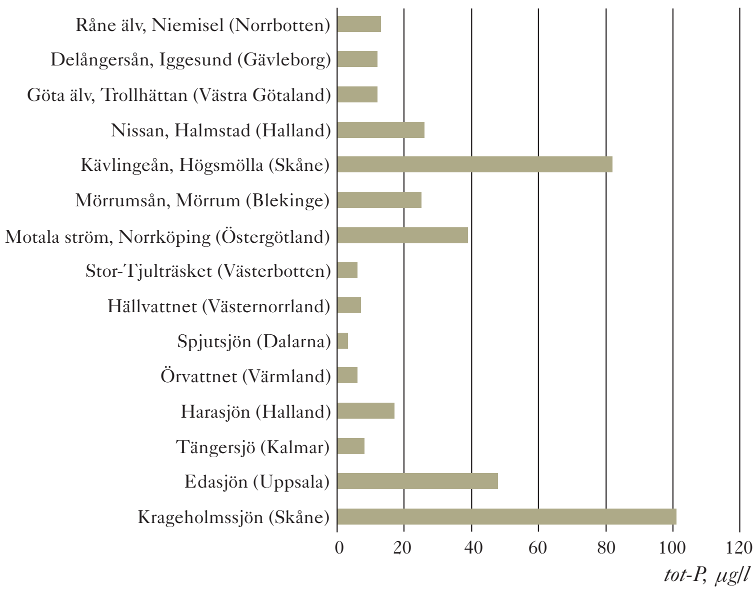
TABLE 6.3 Domestic transport activity by mode, million passenger-kilometres

DRIVING FORCE

MODE	1994	1995	1996	1997	1998
On foot	2 362	2 256	2 085	2 139	2 484
Bicycle	2 261	2 443	2 082	2 413	2 011
Moped/motorcycle	520	790	439	667	359
Car	82 720	84 708	83 211	83 483	80 483
Train	4 378	5 527	4 852	5 892	4 150
Tram/underground/local train	2 579	2 801	2 786	2 913	3 368
Bus/coach	9 140	9 160	9 032	8 344	9 005
Air	5 314	5 350	2 706	4 037	4 885
Sea	749	369	457	426	270
Others	2 759	2 449	3 892	2 568	3 162
Total	112 783	115 852	111 542	112 880	110 176

FIG. 6.4 Mean concentrations of total phosphorus in representative lakes and river mouths, 1999 (counties in parentheses)

STATE



7. acidification

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.

Natural and cultural assets hit

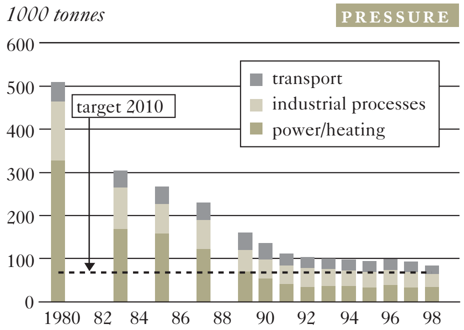
More than a fifth of the total area of forests, mountains and lakes in Sweden is judged to be affected by acidification. The principal victim is the biodiversity of lakes, rivers and streams, with effects for example on fisheries. Groundwater can also suffer acidification. In forests, soil acidity and leaching of vital nutrients increase. This can render trees more susceptible to adverse climatic conditions, disease and insect attack. In addition, acidifying substances cause corrosion of installations such as water pipes, and weathering of buildings and cultural monuments, e.g. rock carvings and buried archaeological remains. Human health can also be affected.

Foreign sources a major factor

The primary cause of acidification is atmospheric deposition of sulphur dioxide, nitrogen oxides and ammonia. These pollutants originate from road traffic, shipping, power stations, factories, mobile machinery and agriculture, in Sweden and the rest of Europe. In 1995, non-Swedish sources were responsible for 90% of sulphur and 80% of nitrogen deposition over the country as a whole. Deposition of ammonia is also largely attributable to foreign sources. Sweden's 'exports' of nitrogen, however, are almost as large as its 'imports'. Some 60% of Swedish nitrogen emissions come from the transport sector, especially road traffic and shipping.

Acidification of forest land is due partly to forestry itself.

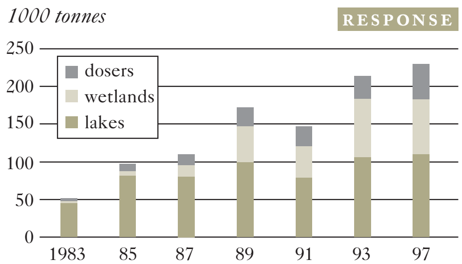
FIG. 7.1 Swedish emissions of sulphur dioxide to air



Liming mitigates effects

Of the 95 000 lakes in Sweden with an area of more than 1 ha, 17 000 are affected by acidification. Of these, 7000, making up some 90% of the total area of acidified lakes, are being treated by liming. Sweden has 300 000 km of running waters. 100 000 km are affected by acidification, and 10 000 km are being limed.

FIG. 7.2 Lime applied to surface waters and wetlands in Sweden



Progress towards objective

Deposition of acidifying pollutants in Sweden has fallen substantially in the last 15 years, but international agreements on further emission reductions are needed. In December 1999 a 'multi-pollutant, multi-effect protocol' was signed under the Convention on Long-Range Transboundary Air Pollution, and in the EU work is in progress on a directive on air pollutant emission ceilings. If this directive is adopted, the area of forests, mountains and lakes exposed to deposition in excess of critical loads will decrease from the 1990 figure of 6.3 million ha to 1.4 million ha by 2010. The directive is expected to result in the following percentage decreases in acid deposition between 1995 and 2010:

REGION	SULPHUR	NITROGEN OXIDES	AMMONIA
S Sweden	50	35	20
C Sweden	35	30	10
N Sweden	25	30	0

Natural recovery of acidified forest land will be facilitated by forestry measures designed to counteract further acidification. However, only if there are no appreciable adverse effects on economic viability will it be possible to adapt forestry practices to the acid sensitivity of individual sites to such an extent that liming and similar compensatory measures are not needed.

Even if pollutant loads are significantly reduced, the recovery of acidified soils and waters could take several decades, and certain areas will perhaps never be fully restored. In soils, recovery will take a long time; in surface waters, it has already begun.

FIG. 7.3 Revenue from nitrogen oxide levy

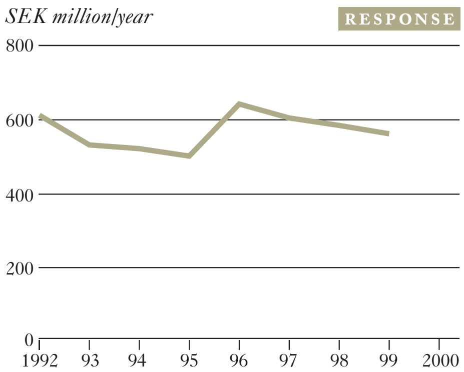


TABLE 7.4 Energy consumption in Sweden

DRIVING FORCE

ENERGY CARRIER/ USER CATEGORY	ENERGY CONSUMPTION BY FINAL USERS, PJ				RELATIVE FIGURES, %			
	1982	1988	1994	1998	1982	1988	1994	1998
Coal and coke	37	47	45	45	3.0	3.4	3.3	3.2
Industry	37	45	45	45	2.9	3.3	3.3	3.2
Transport		0	0	0		0.0	0.0	0.0
Housing, services etc.	1	1	0	0	0.1	0.1	0.0	0.0
Indigenous fuels	156	190	210	229	12.5	13.9	15.3	16.1
Industry	116	156	171	184	9.3	11.4	12.1	12.9
Housing, services etc.	40	34	39	45	3.2	2.5	3.2	3.2
Oil products	623	548	507	507	49.8	40.2	36.8	35.6
Industry	143	89	78	78	11.5	6.5	5.7	5.5
Transport	235	298	301	310	18.8	21.8	21.8	21.8
Housing, services etc.	245	162	127	119	19.6	11.9	9.2	8.3
Gas (natural, town, coke and blast furnace gas)	12	21	26	28	1.0	1.5	1.9	2.0
Industry	10	17	20	21	0.8	1.2	1.5	1.5
Transport	-	-	-	0	-	-	-	0.0
Housing, services etc.	2	4	6	7	0.2	0.3	0.4	0.5
District heating	100	129	143	159	8.0	9.5	10.4	11.2
Industry	11	16	15	18	0.8	1.2	1.1	1.3
Housing, services etc.	89	113	128	141	7.1	8.3	9.3	9.9
Electricity	321	428	446	456	25.7	31.4	32.3	32.0
Industry	140	192	182	194	11.2	14.1	13.0	13.6
Transport	8	9	9	9	0.6	0.7	0.7	0.6
Housing, services etc.	174	227	256	253	13.9	16.6	18.6	17.8
Total	1250	1 364	1378	1 423	100.0	100.0	100.0	100.0
Industry	456	515	511	540	36.5	37.8	36.7	37.9
Transport	243	307	310	319	19.4	22.5	22.5	22.4
Housing, services etc.	551	542	556	565	44.1	39.7	40.7	39.7

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.

8. forests

Biodiversity affected

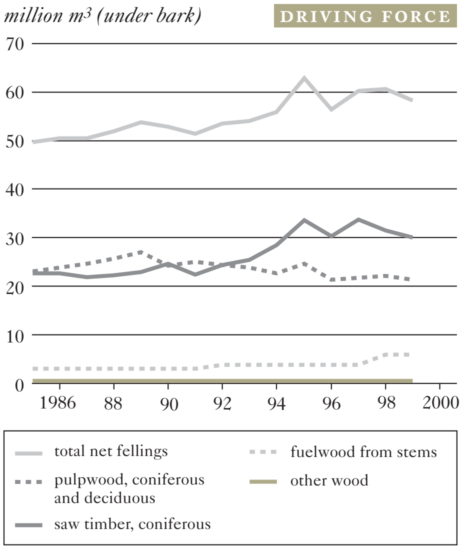
Over a century of rationalization in forestry has resulted in a poorer basis for the conservation of species and habitats in forest areas. Many demanding species, such as woodpeckers, require a deciduous component of at least 25–30% in forests. Some 40% of Sweden's red-listed (threatened and near-threatened) species are dependent on dead wood, which makes up only a few per cent of all the wood in the country's forests. In undisturbed Swedish forests, the proportion of dead wood is 20%. Over 2000 forest species are included on the national Red List.

Pollutants and game affect forests

In the most severely acidified areas, stores of key nutrients in forest soils have been halved over the last 50 years. Acid deposition is mainly attributable to sulphur and nitrogen emissions, chiefly from transport, industry and agriculture in Sweden and the rest of Europe. Harvesting of large amounts of biomass from forests also has acidifying effects.

In many parts of Sweden, populations of ungulates (elk/moose, roe deer etc.) are currently too large in relation to the available supply of forage, resulting in extensive damage to young forests. In the long term, heavy browsing pressure will lead to a shortage of mature aspen, goat willow and rowan trees. If ungulate populations decline, on the other hand, the value of forests for hunting could be diminished.

FIG. 8.1 **Estimated net fellings in Sweden**



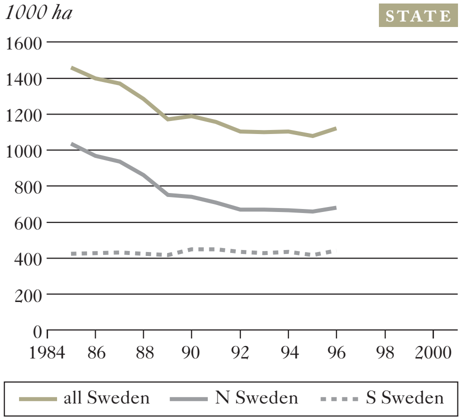
The forest sector is Sweden's most important export industry. In 1998, exports of forest and forest industry products were worth SEK 93 billion.

Cultural heritage threatened

Sweden's forests contain a rich cultural heritage, the result of their having been used for a very long time for crop growing, grazing, forestry, mining etc. This heritage includes derelict crofts and traces of earlier cultivation, tar stacks, shielings, pastures, and trees of particular cultural significance.

Cultural sites and monuments in forests are chiefly threatened by ground preparation (scarification etc.) and clear felling, the abandonment of small farms and shielings, and lack of knowledge.

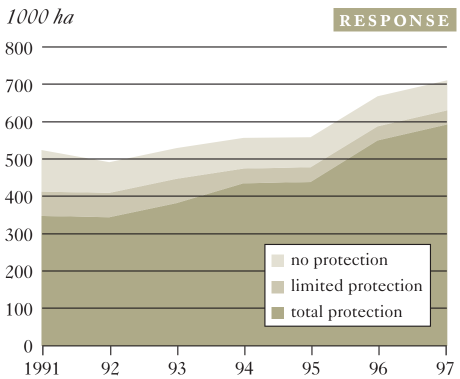
FIG. 8.2 Area of mature forest with at least 25% deciduous trees



Site safeguard of forest land

At the end of 1998, national parks, nature reserves, habitat protection sites and crown forest reserves in Sweden included some 865 000 ha of productive forest land. Another 230 000 ha were safeguarded on a voluntary basis. Some 4.7% of productive forest land has thus been set aside for nature conservation purposes.

FIG. 8.3 Productive forest land with different degrees of protection in nature reserves



Progress towards objective

Greater attention is now paid to site-specific constraints and nature conservation in managed forests than only 10–15 years ago. More forest land is being set aside for conservation on a voluntary basis, as a result of work on landscape ecology plans, 'green plans' and certification schemes. Awareness of the need to safeguard cultural sites and archaeological remains in forest areas has also improved, thanks to training, information and collaborative projects.

In the most severely acidified areas, recovery of the soil will take a long time. Critical loads of nitrogen and sulphur may continue to be exceeded in such areas, despite internationally agreed emission reductions.

To achieve this objective, significant resources need to be invested both by the state and by forest owners. To ensure the long-term conservation of biodiversity, another 800 000 ha of productive forest land below the montane zone should be protected by state and voluntary measures.

Success in achieving the goal of sustainable forests is dependent on the acidification objective being met.

FIG. 8.4 Percentage of archaeological remains damaged in felled forest areas

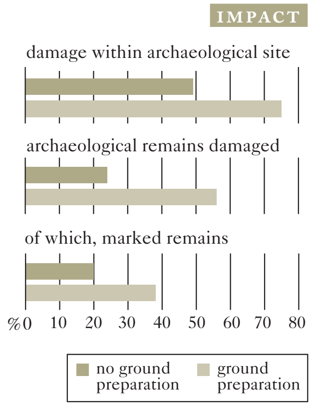


Fig. 8.4 is based on a study of the counties of Skåne, Värmland and Västerbotten, covering a total of 391 archaeological remains in 171 felling areas, of which 70% had been harvested between 1995 and 1999. Over 95% of the damage observed had been caused by forestry.

9. farmland

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.

Farmland area decreasing

As a result of efforts to maximize efficiency in agriculture, since the 1950s the area of arable land in Sweden has decreased by a quarter, pasture land by half, and hay meadows have virtually disappeared.

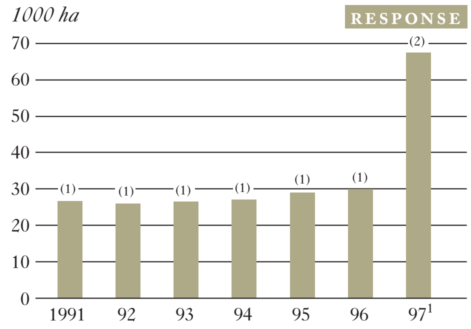
Meanwhile, the total number of cattle has been almost halved, and the number of grazing cattle reduced to just a quarter. Nevertheless, there has been no decrease in production.

In the regions dominated by plains, arable land has in fact expanded – but at the expense of meadows and pastures. In forest regions, the arable area has been reduced, chiefly by encroachment of shrubs and trees. In addition, some of the land has been used for buildings and infrastructure.

Species richness and abundance declining

Just over 2000 threatened and near-threatened plant and animal species are associated with farmland. There is much to suggest that fragmentation of the landscape has reached a critical stage from the point of view of species conservation. In addition, more efficient crop production – with a denser crop cover, more productive varieties, chemical pesticides and fertilizers – is adversely affecting the species richness of the farmed environment. Deposition of sulphur and nitrogen compounds is also having an unfavourable impact on species richness.

FIG. 9.1 Agricultural land in protected areas
(as % of total protected area in parentheses)



1) Incl. unimproved pasture land

Because only a few male animals are used in livestock breeding, valuable genes could be lost.

Genetically modified (GM) plants and animals may not be introduced in Sweden without prior approval. At present, no GM crops are being grown commercially on the country's farmland.

Food production

The biggest threat to the long-term use of arable land for food production is inputs of cadmium, resulting from atmospheric deposition, application of phosphorus fertilizers and sewage sludge, and contamination of feedingstuffs and lime. Cadmium levels in soil are now rising by about 0.1% a year. The use of chemical pesticides also represents a risk.

The heavy machinery used in large-scale agriculture compacts the soil, reducing crop uptake of nutrients. This results in lower productivity, and also increased nutrient leaching, contributing to the eutrophication of lakes, watercourses and seas.

TABLE 9.2 Trials of GM crops in Sweden

STATE

CROP AND AREA, HA	1998	1999
Potatoes for starch production		
industrial cultivation	260	336
seed production	85	57
field trials	0.2	0.4
Sugar beet, field trials	1.3	4.6
Spring oilseed rape, field trials	3.6	5.7
Spring turnip rape, field trials	0.8	-
Winter oilseed rape, field trials	2.3	1.7

Cultural heritage threatened

In the past, farmland has expanded, but we are now seeing a decline in the areas of pasture, hay meadows and arable, which are also of significance in cultural heritage terms. In addition, roads, avenues, buildings, hedges, ditches and fences are falling into disrepair or being removed. Older farming methods and building traditions are making way for modern, efficient ones, and regional characteristics are being lost. What is more, the knowledge on which they rely is itself disappearing. New forests are being planted and the landscape is becoming less open. Parts of traditional environments are being lost or fragmented as a result of urban development and infrastructure. Rural and agri-environmental support schemes are unable to halt this trend.

Progress towards objective

The principal obstacle to achieving this goal is the difficulty of reconciling farm profitability with the conservation of biodiversity and cultural assets.

Thanks to legislation and financial support, meadow and pasture management has improved during the 1990s, and non-intensive beef production is becoming more profitable.

Agri-environmental support for organic farming was paid out in respect of just over 9% of arable land in 1998.

The EU's Common Agricultural Policy will have a major influence on the cost of implementing the measures needed to achieve this objective.

The objective concerning a non-toxic environment must also be attained if the goal of a varied agricultural landscape is to be achieved.

FIG. 9.3 Areas devoted to different crops

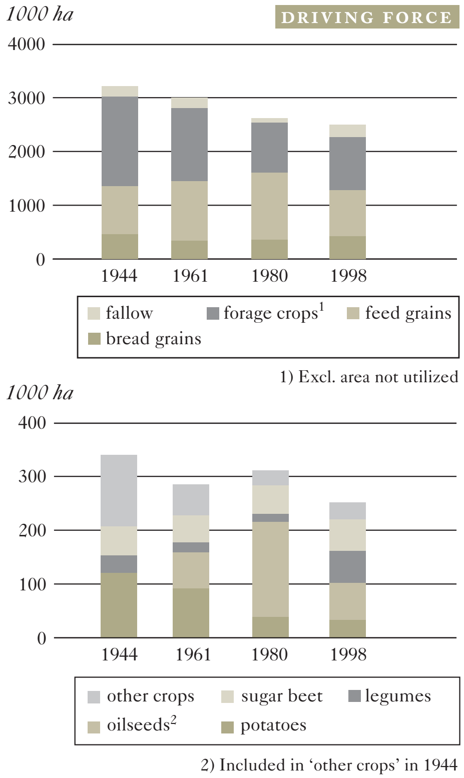
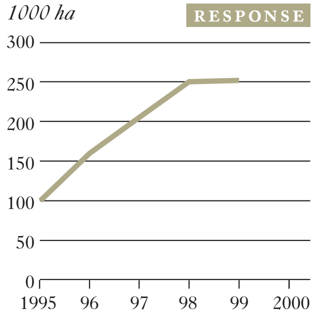


FIG. 9.4 Area receiving agri-environmental payments for organic farming



10. mountains

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.

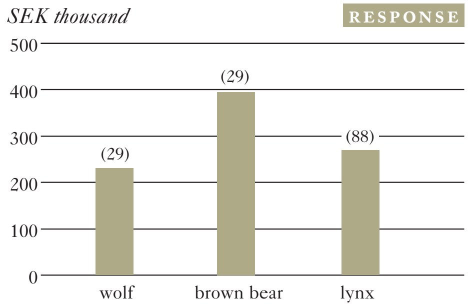
Reindeer grazing good and bad

Sweden's largest continuous areas of unimproved grazing are to be found in its mountain regions. In certain areas, reindeer herding has led to overgrazing, damage to the vegetation cover and ultimately soil erosion. This poses a threat to biodiversity. Insufficient grazing pressure is also a threat to diversity, however, since it permits scrub encroachment.

Of Sweden's threatened and near-threatened species, 166 are found in mountain areas. Several plant species are endemic (i.e. restricted to a given region), including Lapp orchid and black vanilla orchid. Of Sweden's threatened mammals and birds, the wolverine and merlin, for example, are confined almost exclusively to mountain areas.

A conflict exists between the protection of large predatory species and the viability of reindeer herding.

FIG. 10.1 Compensation payments for damage caused by wolves, brown bears and lynxes, 1999
(no. of applications in parentheses)



Off-road driving harmful and noisy

Damage to soil and vegetation, and to prehistoric and other cultural remains, is also caused by the use of off-road motor vehicles on land unprotected by snow. The main legal users of such vehicles outside the snow season are reindeer herders, and to a lesser extent the defence forces and telephone and energy companies. In addition, they are used illegally for recreational purposes.

Furthermore, off-road driving, both on snow-free ground and on snow, produces noise and pollutant emissions, impairing the value of the mountain environment for outdoor recreation. At the same time, the tourist trade itself makes use of snow-

FIG. 10.2 Number of snowmobiles and off-road motorcycles in mountain counties

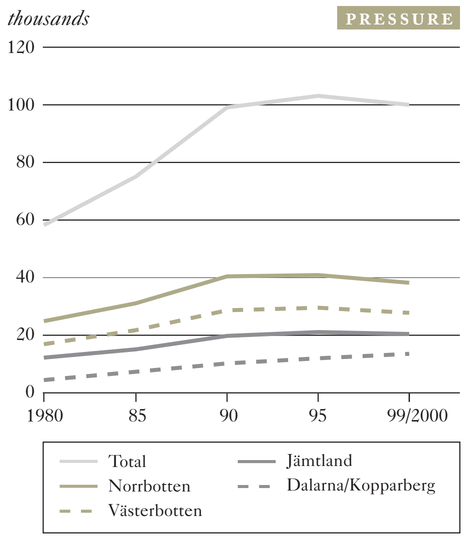
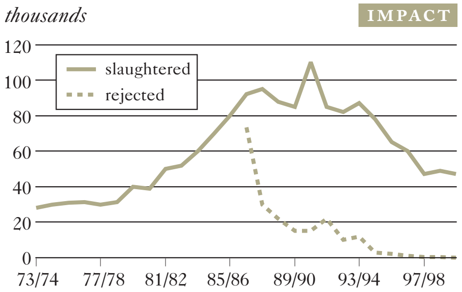


FIG. 10.3 Number of reindeer slaughtered, and number of slaughtered animals rejected owing to excessive caesium levels



mobiles and light aircraft. An important component of this tourism is recreational fishing, which, alongside subsistence fishing by the Sami, is carried on in virtually every lake and stream in the mountain region. Overfishing and uncontrolled stocking of fish could become a growing problem.

The mountain environment is also affected by road building, mineral exploration and production, and power stations. A large proportion of lakes and rivers in mountain areas are directly or indirectly affected by hydroelectric schemes.

Chemical pressures

Eutrophication and acidification are further factors affecting the mountain environment and threatening its biodiversity. Acidification has caused changes in the invertebrate fauna, in turn affecting fish and birds. In the mountain counties of Sweden, snowmobiles were responsible for some 30% of hydrocarbon and carbon monoxide emissions in 1994. Increased UV-B radiation and climate change are also affecting the mountain ecosystem.

Cultural legacy of Sami and settlers

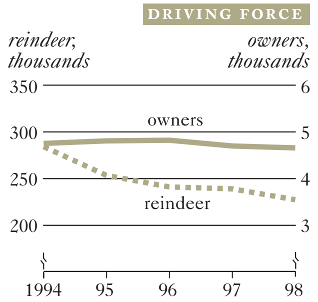
The most notable features of Sweden's mountain cultural heritage are the sites and artefacts left by the Sami from prehistoric to modern times – settlements, cult centres, camp sites, migration routes and corrals – and above all a living tradition of reindeer herding. There are also traces of the furthest outposts of Swedish settlers, in the form of mountain tenant farms and land reclaimed with state support; older remains and present-day manifestations of outdoor recreation and tourism; and old trackways, such as pilgrimage routes. The cultural heritage is chiefly threatened as a result of traditional activities being abandoned, but sometimes also by insensitive development or deliberate damage.

Progress towards objective

The Environmental Protection Agency's assessment is that this objective can be achieved within a generation. There are potential areas of conflict with land use, outdoor recreation and physical planning, but they can be handled in Sweden, independently of developments in the outside world.

Large mountain areas have been designated as national parks and nature reserves.

FIG. 10.4 Number of reindeer owners and reindeer



11. towns

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.

Urban noise and exhausts

Almost 1.5 million people in Sweden are exposed to outdoor levels of noise from road traffic exceeding guide values, and more than half a million to corresponding noise levels from rail and air traffic. Noise makes it difficult to apprehend speech and causes irritation, disturbed sleep and even effects on the cardiovascular system. Vehicle exhausts are another problem in urban areas.

Allergies

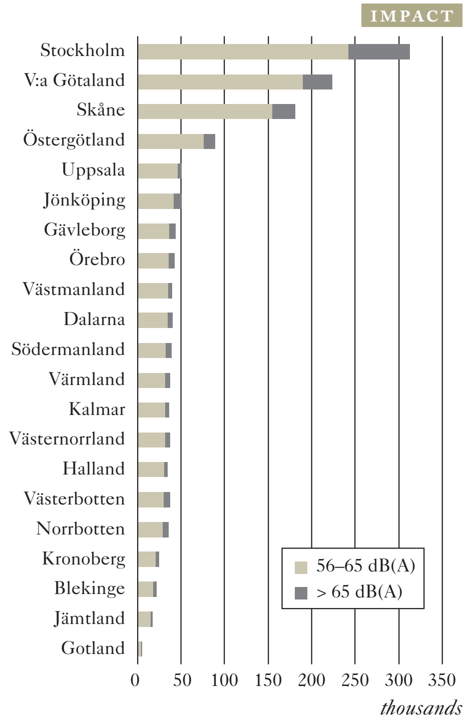
In many cases, the indoor environment causes problems for allergy sufferers. Almost 40% of schoolchildren now have some form of allergy or other type of hypersensitivity. According to the WHO, damp is a problem in 10–30% of the existing building stock. Behaviour patterns, e.g. whether people smoke or keep pets, and how they do the cleaning, are also important. Smoking combined with radon in indoor air increases the risk of cancer by a large factor.

Radon levels in indoor air exceed 200 Bq/m^3 in 350 000 Swedish homes.

Greenspace built up

Between 1960 and 1995 the average area of land per capita in Sweden's towns rose from 630 to 705 m^2, i.e. urban areas have expanded and become more scattered. This has created a greater need for transport and less

FIG. 11.1 Number of people in different counties exposed to road traffic noise outdoors, 1998



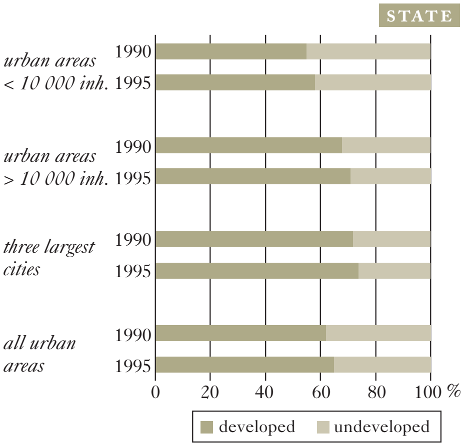
In 1998, 840 000 people in Sweden were exposed to noise in their homes in excess of guide values.

favourable conditions for public transport and services, and could affect the economic viability of district heating.

Buildings and infrastructure have also spread *within* towns, at the expense of greenspace. Less greenspace means less scope for human recreation, plant and animal life, and local treatment of surface runoff. It also impairs urban air quality and climate.

To avoid developing land not already built on, contaminated sites can be remediated and reused for new buildings.

FIG. 11.2 Developed and undeveloped land in urban areas (% of land area)



Use of gravel and energy decreasing

Over the last 15 years, the use of naturally occurring gravel for road and other building projects has decreased in favour of crushed rock. Quarrying of gravel creates problems in terms of water supply and conservation of the natural environment and the cultural heritage. Some 50% of gravel is used to build roads.

The building sector is responsible for 40% of total energy use and 50% of electricity consumption. Energy efficiency has improved over the last 25 years, but at the same time built-up areas have grown by 45%. District heating meets around 40% of total heating requirements and is continuing to expand.

Cultural heritage affected

Symbolic buildings, parks and other open spaces figure significantly in people's memories and in their everyday environment. Well-managed streets and buildings, reflecting a sense of tradition and beauty, allow residents and visitors to feel pride and enjoy rich experiences. Cultural and aesthetic values are threatened by short-sighted development decisions, pressure for change, and inadequate knowledge and expertise.

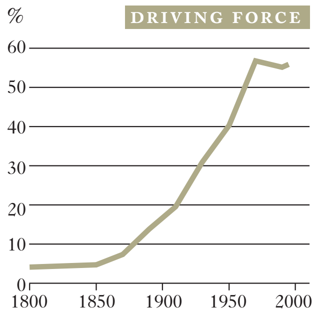
Progress towards objective

Local authorities are the key players in this context, and the comprehensive (structure) plans they draw up are an important instrument. In several municipalities, a shortage of planners and staff to handle ecological, cultural heritage and transport issues is an obstacle to achieving this objective.

The state (e.g. through county administrative boards) plays an important role, by implementing national environmental policy and providing grants for contaminated site remediation and measures to tackle noise and radon problems. The potential for increasing the use of renewable energy and public support for energy saving depends on energy prices, taxes and other policy instruments.

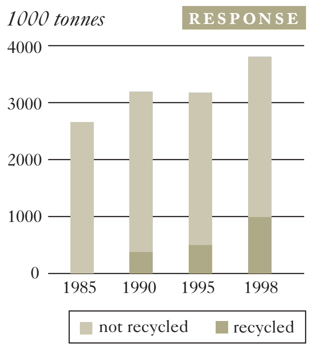
Buildings and other physical structures have a long lifespan. One generation from now, around 90% of existing buildings will still be there. It is therefore judged to be difficult to create conditions for achieving this environmental quality objective by 2020.

FIG. 11.3 Percentage of total population living in towns with more than 10 000 inhabitants



Homes built before 1965 use around 50% more energy than newer ones: on average, 250 compared with 170 kWh/m^2/year.

FIG. 11.4 Household waste, recycled and not recycled



12. 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.

Animals and people affected

Historically, toxic organic pollutants such as DDT, PCBs and dioxins have caused serious reproductive disorders in predatory animals, such as seals and the white-tailed eagle. The high levels occurring in herring and other oily fish have also led to high blood concentrations in fishing communities. Women of childbearing age are advised not to eat oily fish.

DDT and PCB levels in the environment have now fallen, but levels of other toxic organic pollutants are rising. Brominated flame retardants, which have been found in human breast milk, are one example. Certain organic compounds are believed to have endocrine-disrupting effects in people and animals.

Inorganic toxic pollutants also have effects on human beings and the environment. Mercury is still a problem, and pregnant women are advised not to eat certain freshwater fish. This metal can damage the central nervous system of the fetus.

Tens of thousands of chemicals

In Sweden, an estimated 18 000–22 000 chemical substances are to be found in different products. The roughly 60 000 chemical products notified to the National Chemicals Inspectorate's product register contain some 11 000 substances. As for the chemical substances present in other types of products, very little is known. The majority of chemical products (70%) and other goods used in Sweden are manufactured in other countries.

Innumerable chemical substances form in the course of industrial processes, combustion etc. In most cases, their properties are unknown. We do not know to what extent existing pressures on the environment are due to hitherto unidentified substances.

FIG. 12.1 Mercury in perch from Lake Skärgölen and pike from Lake Storvindeln

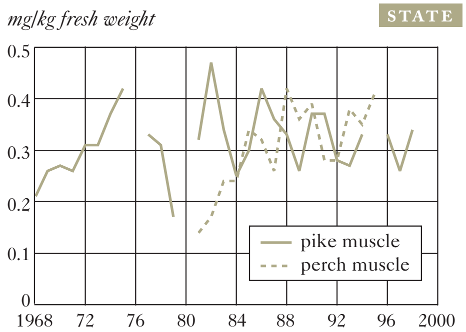


FIG. 12.2 Use in Sweden of fuels and non-fuel chemicals hazardous to health

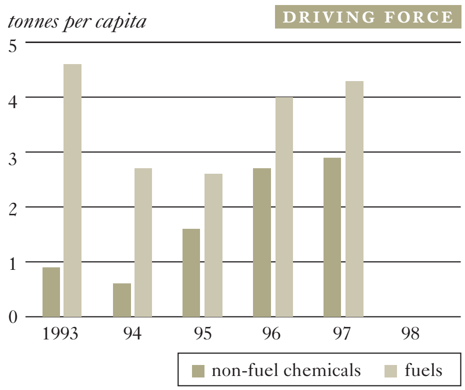
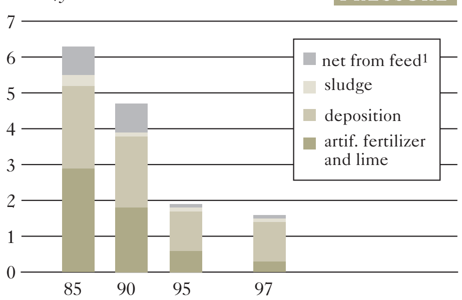


FIG. 12.3 Inputs of cadmium to arable land

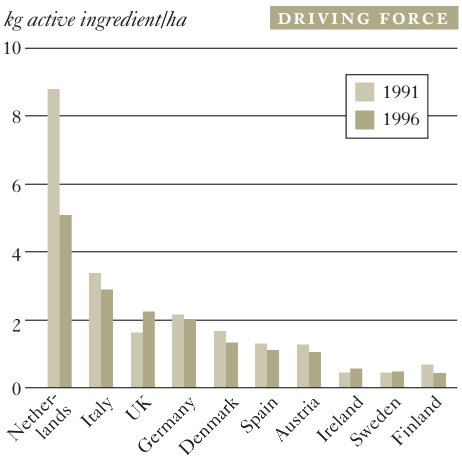


1) Figures shown for 1985 and 1990 refer to 1988/89

The average daily intake of cadmium in food in Sweden is 10–20 micrograms (µg). High levels are found primarily in wheat and root vegetables. The flour-milling industry applies a limit of 0.1 mg/kg. According to estimates, this level is exceeded in 5–10% of the winter wheat harvest.

Cadmium is stored in the kidneys and liver and can cause osteoporosis and decalcification of the skeleton. The WHO recommends that the daily intake should not exceed 70 µg.

FIG. 12.4 Sales of pesticides for agricultural use



Substances being emitted – or already in soil

Chemicals enter the environment as a result of emissions to air and water from industrial processes, but also through diffuse leakage from products, both when they are used and when they become waste.

In addition, pollutants can be leached out by drainage water from old industrial sites and waste facilities. Benthic sediments in lakes and coastal waters contain toxic pollutants that have entered the water via runoff, deposition or direct discharges. Various processes can result in these substances being released into the water again.

Chemical substances also end up in the Swedish environment as a result of long-range transport by currents and winds.

Progress towards objective

Concentrations of toxic pollutants can be reduced by preventive action at the national and international levels. Sweden's Environmental Code regulates chemical products and licensing of environmentally hazardous operations. In the UN and elsewhere, work is in progress to phase out a number of particularly dangerous substances.

Because of past emissions and long-range transport, toxic pollutants will not be eliminated within one generation. Roughly 22 000 sites with contaminated soil need to be cleaned up, but the area concerned is so large that only the highest-risk sites can be dealt with. At others, natural degradation and dilution will continue for many generations to come.

This environmental quality objective will not be achieved in every respect by 2020.

TABLE 12.5 Dietary advice concerning freshwater fish and oily Baltic Sea fish

IMPACT

GIRLS AND WOMEN OF CHILDBEARING AGE

DON'T EAT:

- Cod liver and burbot liver

EAT NO MORE THAN ONCE A WEEK:

- Perch, pike, pikeperch, burbot, eel and halibut

NB: If you are planning to become or are pregnant, or are breastfeeding, you are advised not to eat these fish at all.

EAT NO MORE THAN ONCE A MONTH:

- Herring from the Baltic Sea and the Gulf of Bothnia
- Wild salmon and wild brown trout from Lake Vänern, the Baltic Sea and the Gulf of Bothnia
- Wild Arctic char from Lake Vättern

OTHER CONSUMERS

DON'T EAT:

- Cod liver and burbot liver on a regular basis

EAT NO MORE THAN ONCE A WEEK:

- Perch, pike, pikeperch, burbot, eel and halibut
- Herring from the Baltic Sea and the Gulf of Bothnia
- Wild salmon and wild brown trout from Lake Vänern, the Baltic Sea and the Gulf of Bothnia
- Wild Arctic char from Lake Vättern

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

13. radiation

Skin and lung cancer

The annual incidence of the cancer malignant melanoma in Sweden has risen from a couple of hundred cases in the late 1950s to 1600 in 1998. 350–400 people die of the disease every year. Squamous cell carcinoma, which is rarely fatal, is increasing even more rapidly, with almost 2300 cases in 1998. The rapidly growing incidence of skin cancer is believed to be the result of lifestyle changes affecting people's exposure to the sun.

An annual 300–1500 cases of lung cancer are caused by radon gas in indoor air. This radon comes from the ground, building materials and domestic water.

On the basis of epidemiological studies, it is suspected that electromagnetic fields, especially low-frequency ones, may play a part in the development of cancers and neurological conditions.

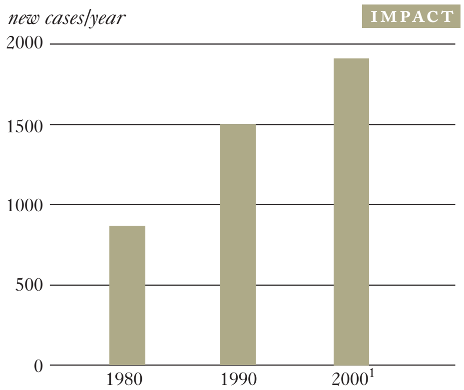
Sources of radiation

Space, the ground and our own bodies are naturally occurring sources of radiation. There is nothing we can do about our exposure to these sources, but we can influence our exposure to other natural radiation sources, e.g. radon in homes, ultraviolet (UV) radiation from the sun and cosmic radiation on board aircraft.

There are also anthropogenic (man-made) sources of radiation. These include nuclear power plants, nuclear waste depositories, the use of radioactive substances in industry and medicine, nuclear reactor accidents and nuclear weapons tests.

Other anthropogenic sources are electromagnetic fields, e.g. in the vicinity of electric power cables and mobile phones.

FIG. 13.1 Number of cases of malignant melanoma in Sweden caused by solar UV radiation



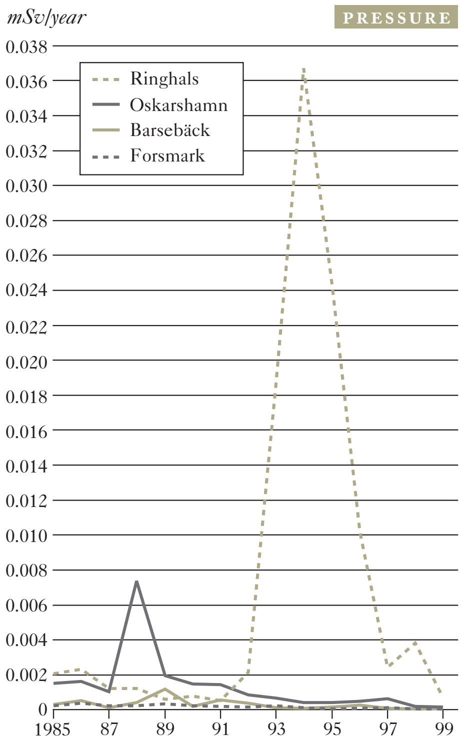
1) Estimated

Radioactive substances in the environment

One of the most significant man-made radioactive substances in terms of the radiation dose to people in Sweden is caesium-137, which has been deposited across the country following nuclear weapons tests and the Chernobyl nuclear reactor accident. Elevated levels of this radioisotope can be found in game, reindeer, fish, forest fungi and berries, vegetables, and milk and meat from livestock from the areas affected.

Radioactive substances may also be present in peat and wood or plant materials from contaminated areas, which may be used as bioenergy sources or raw materials for paper pulp. In addition, peat can contain naturally occurring radioisotopes. Radioactive substances become concentrated in residual products, which may be released into and contaminate the environment.

FIG. 13.2 Radiation dose to individuals in critical group[1] near nuclear power stations



1) The 'critical group' consists of those members of the public who, because of their lifestyle and place of residence, receive the highest radiation dose attributable to emissions from the power station concerned

Progress towards objective

An environmental monitoring and research programme needs to be developed to get an overall picture of the state of the environment in terms of radiation and to protect biodiversity. Using the resultant data, radiation doses to human beings can be calculated and the radiological protection problems associated with different activities identified and addressed. The Swedish Radiation Protection Institute (SSI), for example, has drawn up a policy to limit to 0.01 mSv/year the dose to the general public resulting from recycling of biofuel ash to forests.

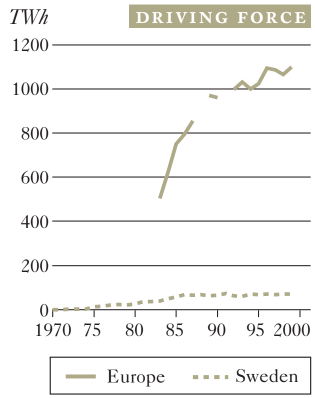
Research is also needed to clarify the risks linked to electromagnetic fields.

Possible obstacles to achieving the objective include inadequate safety programmes at nuclear power stations, especially in eastern Europe, and nuclear test explosions.

The time lag between exposure to UV radiation and the development of skin cancer is believed to be considerable. Even if exposure to solar UV radiation were to be dramatically reduced now, the incidence of skin cancer would probably not begin to fall for another 20 years. It is very difficult to change people's attitudes and behaviour, and this could prove an obstacle to attaining this environmental objective.

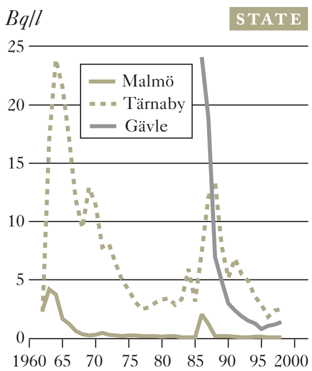
It is estimated that it will cost SEK 3.7 billion to reduce radon levels to below 200 Bq/m^3 in homes, day nurseries, schools and after-school centres by 2020. If remedial action continues at the present rate, it will take another 100 years at least to deal with all existing buildings with radon levels over 400 Bq/m^3.

FIG. 13.3 Supplied energy from nuclear power stations in Sweden and Europe (west and east)



Some 50% of the electricity used in Sweden is generated at nuclear power stations. Spent nuclear fuel is being held for 30–40 years in storage pools, pending a solution to the question of final disposal.

FIG. 13.4 Caesium-137 in dairy milk



The current limit value for caesium-137 in food that is offered for sale is 300 Bq/kg, except in the case of game, reindeer, freshwater fish, forest fungi and forest berries, for which the limit is 1500 Bq/kg.

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

Damage to human health and the environment

Ultraviolet (UV) radiation from the sun causes degradation of both biological and technical materials. Its adverse effects include increased risks of:

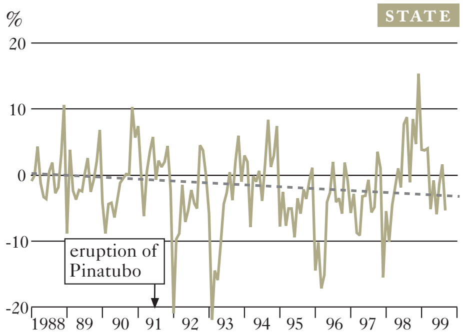
- sunburn and different types of skin cancer,
- damage to the immune system,
- cataracts in humans and animals,
- damage to natural aquatic and terrestrial ecosystems,
- damage to agricultural crops and forest trees.

In the last 15 years, the ozone layer has been depleted by around 5%. The most marked thinning can be noted over the Antarctic, where more than 50% of the ozone layer is lost during the spring months of September–October. Thinning is largely due to the emissions of ozone-depleting substances that have occurred worldwide over the last 30–40 years.

If the ozone layer is depleted by 10%, the incidence of non-melanoma skin cancer will increase by an estimated 25%. The correlation is less clear in the case of melanoma-type cancers. The European Environment Agency estimates that the high level of UV radiation in 1997 will result in 78 million new cases of skin cancer a year worldwide around 2055.

14. ozone layer

FIG. 14.1 Ozone above Sweden, 1988–99, compared with 1951–66
(monthly deviation, %)

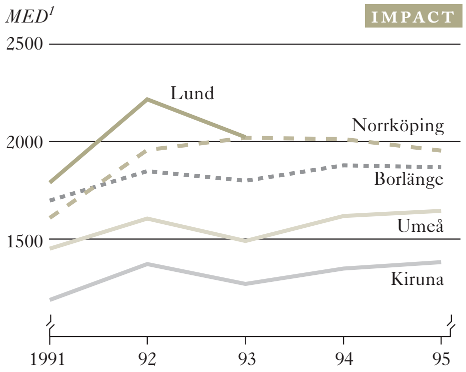


Even when the ozone layer is not depleted, it lets through UV radiation which affects health and the environment. The increase in skin cancer seen over the last 40 years is believed to be due largely to changed attitudes to sunbathing and more frequent travel to sunny countries.

Chemicals and particles key factors

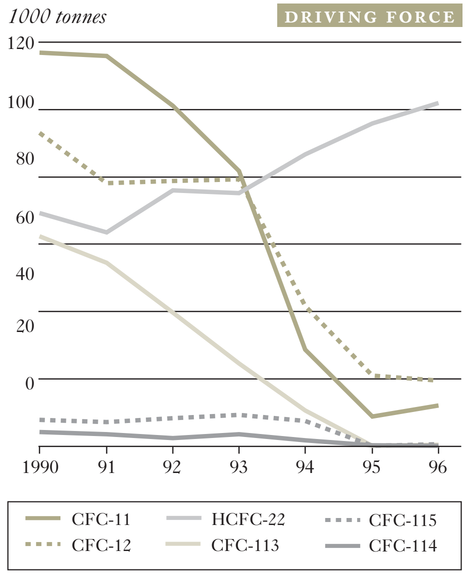
The principal cause of ozone thinning is man-made emissions of chemical com-

FIG. 14.2 Annual amounts of skin-damaging solar radiation in different Swedish towns



1) Minimum erythemal doses (see abbreviations)

FIG. 14.3 Production of selected ozone-depleting substances in the EU[1]



1) Data prior to 1995 do not include Finland, Sweden and Austria

pounds containing chlorine, bromine or hydrogen, and of nitrogen oxides. Volcanic eruptions also affect the ozone layer: the eruption of Pinatubo in the Philippines in 1991 was clearly reflected in stratospheric ozone levels. Other significant factors are temperature and moisture levels in the stratosphere and concentrations of greenhouse gases and other pollutants.

Particulate and gaseous emissions from aircraft could have increasingly detrimental effects as flights at high (stratospheric) altitudes and higher (supersonic) speeds, which cause large emissions per passenger-kilometre, become more common.

Emissions continuing

Sweden has given a lead in phasing out ozone-depleting chemicals. However, there are still large quantities stored in products such as refrigerators and freezers, building materials and fire extinguishing equipment. Ozone depleters escape from these products, both when they are used and when they are scrapped.

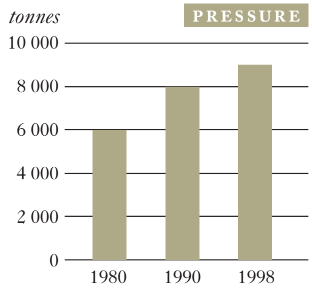
Progress towards objective

Chlorofluorocarbons (CFCs) have an atmospheric life of 50–300 years. This means that concentrations will remain well above natural levels for a long time.

Certain emissions are still permitted under existing international agreements. Assuming that the Montreal Protocol is implemented by all the signatories, levels of ozone depleters in the stratosphere are expected to have fallen to about 2 ppb chlorine by 2050. The natural level, around 0.7 ppb Cl, will in that case be achieved in 100 years' time at the earliest. Since ozone depleters end up in the stratosphere wherever they are emitted, international efforts to protect the ozone layer are crucial.

In Sweden, the use of ozone-depleting substances can be virtually eliminated within one generation.

FIG. 14.4 Emissions of nitrogen oxides from aircraft



15. climate

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.

Warming causes geographical and biological changes

Since the Industrial Revolution, human activities have increased atmospheric levels of gases which contribute to global warming. Over the last century, the temperature at the earth's surface has risen by an average of 0.3–0.6°C.

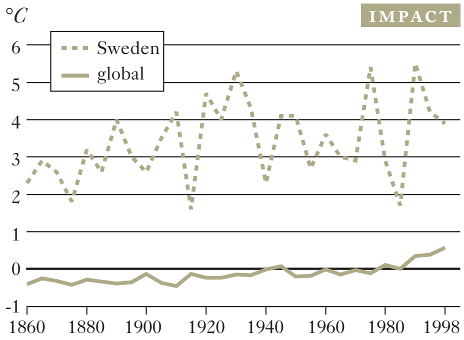
When sea water becomes warmer, it expands. Sea level then rises, and low-lying coastal areas are flooded. Precipitation is also affected. Ecosystem changes can be expected, due both to increased atmospheric levels of carbon dioxide and other greenhouse gases and to the rise in temperature. The most marked effects will result from a combination of higher temperature and an increased carbon dioxide concentration. In Sweden, declining biodiversity in forests in the south and west may be a symptom of climate change.

Combustion biggest source of emissions

In volume terms, the most important greenhouse gas is carbon dioxide. Other important gases are methane and nitrous oxide. During the second half of the 20th century, these gases have been joined for example by chlorofluorocarbons (CFCs) and certain substitute chemicals.

In Sweden, 92% of carbon dioxide emissions occur in the energy and transport sectors (1995). Roughly a third are attributable to the activities of private individuals, originating from central heating boilers, cars, motorboats, lawnmowers etc.

FIG. 15.1 Change in global annual mean temperature[1], and annual mean temperature in Sweden



1) Deviation from mean for 1961–90

The main sources of methane are landfills and livestock (ruminants). Nitrous oxide emissions result for example from the cultivation of humus-rich soils, manure handling and burning of fuels.

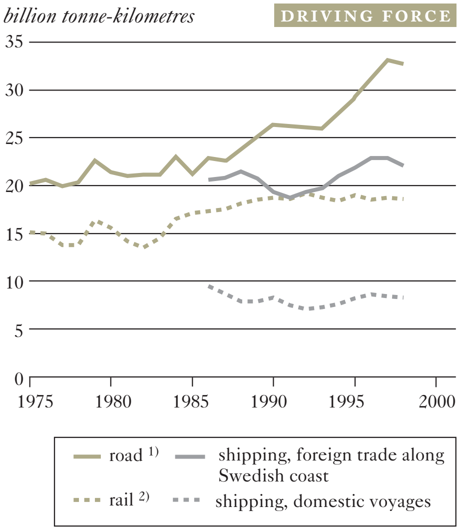
The use of CFCs, which are very potent greenhouse gases, has risen sharply in the course of the 20th century. CFCs are used as refrigerants, propellants, in insulating materials etc.

Emissions of particulates, nitrogen oxides and other gases resulting from combustion also affect climatic processes.

Land use affects emissions

Northern terrestrial ecosystems are an important sink for carbon, large quantities of which are incorporated in plants. However, forest land with a deep humus cover can release carbon dioxide into the atmosphere. When land is drained to harvest peat, sequestration of carbon ceases,

FIG. 15.2 Freight transport activity



1) Swedish-registered vehicles, max. laden weight 3.5 tonnes or more

2) Total freight loaded by SJ and MTAB

methane emissions decrease, and instead carbon dioxide and nitrous oxide are released. The same is true when organic soils are used for crop production. In Sweden, carbon losses from such soils correspond to 5–6% of emissions from fossil fuel use. By ratifying the UN Framework Convention on Climate Change and the Kyoto Protocol, Sweden has undertaken to increase its carbon sinks.

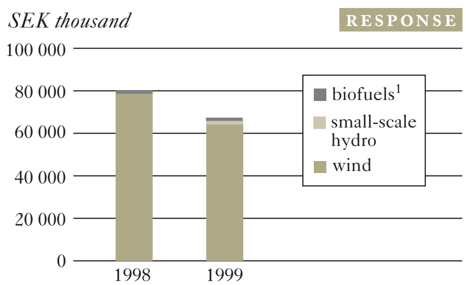
Progress towards objective

Carbon dioxide emissions fell significantly in Sweden in the 1980s, chiefly due to greater energy efficiency, structural changes in industry and an expansion of nuclear power. In the 1990s, the use of fossil fuels for power and heat production and transport increased. Sweden's per capita emissions of carbon dioxide are nevertheless among the lowest in the OECD.

Under the Kyoto Protocol, the EU is to reduce its greenhouse gas emissions by 8% from 1990 levels by 2008–2012. Emission quotas are distributed in such a way within the EU that Sweden is permitted to increase its emissions by 4%. In spring 2000, however, a Swedish parliamentary commission on climate proposed that the country's emissions should be cut by 2%.

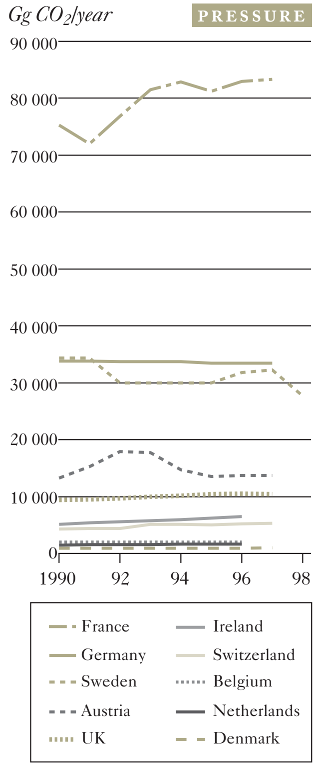
The Environmental Protection Agency's assessment is that carbon dioxide emissions in the industrialized countries need to fall by 60% from 1995 levels by 2050. In the longer term, a decrease of 80–90% is necessary. Sweden must be active at the international level, within both the Climate Convention and the EU, to ensure that these targets are met.

FIG. 15.3 Investment grants awarded for energy production from renewable sources



1) Biofuels include felling debris, certain types of waste, energy crops, reeds, straw, spent pulping liquor and tall oil pitch

FIG. 15.4 Net uptake of atmospheric carbon dioxide by forests



abbreviations

DG	Directorate-General
ECE	UN Economic Commission for Europe
EEA	European Environment Agency
EMEP	European Monitoring and Evaluation Programme
Gg	gigagram; giga- = 1 billion (1 000 000 000)
ha	hectare
IAEA	International Atomic Energy Agency
MED	minimum erythemal dose, the lowest dose of solar radiation causing damage to the skin. 1 MED/hour = 58.3 mW/m^2
mSv	millisievert
MTAB	Malmbanetrafik i Norrland
µ	micro-; 0.000 001
NUTEK	Swedish National Board for Industrial and Technical Development
PJ	petajoule; 1 PJ = 0.278 TWh; peta- = 1 000 million million (1 000 000 000 000 000)
ppb	parts per billion
SGU	Geological Survey of Sweden
SIKA	Swedish Institute for Transport and Communication Analysis
SJ	Swedish State Railways
SLR	Swedish Farmers' Supply and Crop Marketing Association
SLU	Swedish University of Agricultural Sciences
SMHI	Swedish Meteorological and Hydrological Institute
SSI	Swedish Radiation Protection Institute
STPF	Swedish Peat Organization
TWh	terawatt-hour; tera- = 1 million million (1 000 000 000 000)
WHO	World Health Organization

sources of data in figures and tables

Fig. 1.1:	Swedish Environmental Protection Agency; Statistics Sweden
Fig. 1.2:	Swedish Corrosion Institute
Fig. 1.3:	EMEP/MSC-W Report 1/99; Environmental Protection Agency
Fig. 1.4:	Swedish National Energy Administration
Fig. 2.1:	EEA Technical Report No. 22, 1999
Table 2.2:	Environmental Protection Agency; Statistics Sweden
Fig. 2.3:	Geological Survey of Sweden
Fig. 2.4:	Swedish National Road Administration
Fig. 3.1:	National Energy Administration; Statistics Sweden
Table 3.2:	Institute of Freshwater Research, National Board of Fisheries
Fig. 3.3:	Dept. of Environmental Assessment, SLU
Fig. 3.4:	Statistics Sweden
Fig. 4.1:	Environmental Protection Agency
Fig. 4.2:	Environmental Protection Agency
Fig. 4.3:	Swedish National Board of Forestry
Fig. 4.4:	Statistics Sweden
Fig. 4.5:	NUTEK; SGU; STPF
Fig. 5.1:	Statistics Sweden; National Board of Fisheries
Fig. 5.2:	Swedish environmental monitoring/ Baltic Monitoring Programme; SMHI
Fig. 5.3:	Association Swedish Ports
Table 5.4:	National Board of Fisheries
Table 6.1:	Environmental Protection Agency; Statistics Sweden
Table 6.2:	Environmental Protection Agency; Statistics Sweden
Table 6.3:	National Travel Survey, SIKA
Fig. 6.4:	Dept. of Environmental Assessment, SLU
Fig. 7.1:	Environmental Protection Agency; Statistics Sweden
Fig. 7.2:	Environmental Protection Agency
Fig. 7.3:	Environmental Protection Agency
Table 7.4:	National Energy Administration; Statistics Sweden
Fig. 8.1:	National Board of Forestry
Fig. 8.2:	Swedish National Forest Inventory
Fig. 8.3:	Statistics Sweden
Fig. 8.4:	Swedish National Heritage Board
Fig. 9.1:	Statistics Sweden
Table 9.2:	Swedish Board of Agriculture
Fig. 9.3:	Statistics Sweden
Fig. 9.4:	Board of Agriculture, KRAV statistics 1999
Fig. 10.1:	Environmental Protection Agency
Fig. 10.2:	Statistics Sweden; SIKA
Fig. 10.3:	Board of Agriculture
Fig. 10.4:	Board of Agriculture
Fig. 11.1:	National Road Administration
Fig. 11.2:	Statistics Sweden
Fig. 11.3:	Statistics Sweden
Fig. 11.4:	Swedish Association of Waste Management
Fig. 12.1:	Contaminants Research Group, Swedish Museum of Natural History
Fig. 12.2:	National Chemicals Inspectorate
Fig. 12.3:	Swedish Environmental Advisory Council; SLU; SLR; Statistics Sweden; Environmental Protection Agency; National Chemicals Inspectorate
Fig. 12.4:	Eurostat 1998:3
Table 12.5:	Swedish National Food Administration
Fig. 13.1:	*APMIS*, Suppl. 76: Vol. 105:83–99, 1997
Fig. 13.2:	SSI
Fig. 13.3:	IAEA, Nuclear Power, Reference Data Series No. 1; Statistics Sweden
Fig. 13.4:	SSI
Fig.14.1	SMHI; Environmental Protection Agency
Fig. 14.2:	SMHI
Fig. 14.3:	European Commission, Environment DG
Fig. 14.4:	Environmental Protection Agency; Statistics Sweden
Fig. 15.1:	SMHI; University of East Anglia, UK
Fig. 15.2:	SIKA; Statistics Sweden
Fig. 15.3:	Swedish Ministry of Industry, Employment and Communications
Fig. 15.4:	Environmental Protection Agency; UN, Greenhouse Gas Inventory Database

Comments on the texts in *de Facto 2000* have been received from:
The Geological Survey of Sweden, the National Board of Forestry, the Swedish Board of Agriculture, the National Board of Housing, Building and Planning, the National Chemicals Inspectorate, the Swedish Radiation Protection Institute, the National Heritage Board and the National Board of Health and Welfare.

This booklet is also available in Swedish. A somewhat longer version of the Swedish text has been published by Statistics Sweden, in association with the Swedish Environmental Protection Agency, as chapter 5 of *Naturmiljön i siffror 2000* (*The Natural Environment in Figures 2000*). That report contains detailed information about the factors affecting Sweden's environment, its present state, and efforts to protect it. Further details can be obtained from the websites of the two agencies: www.scb.se and www.environ.se.

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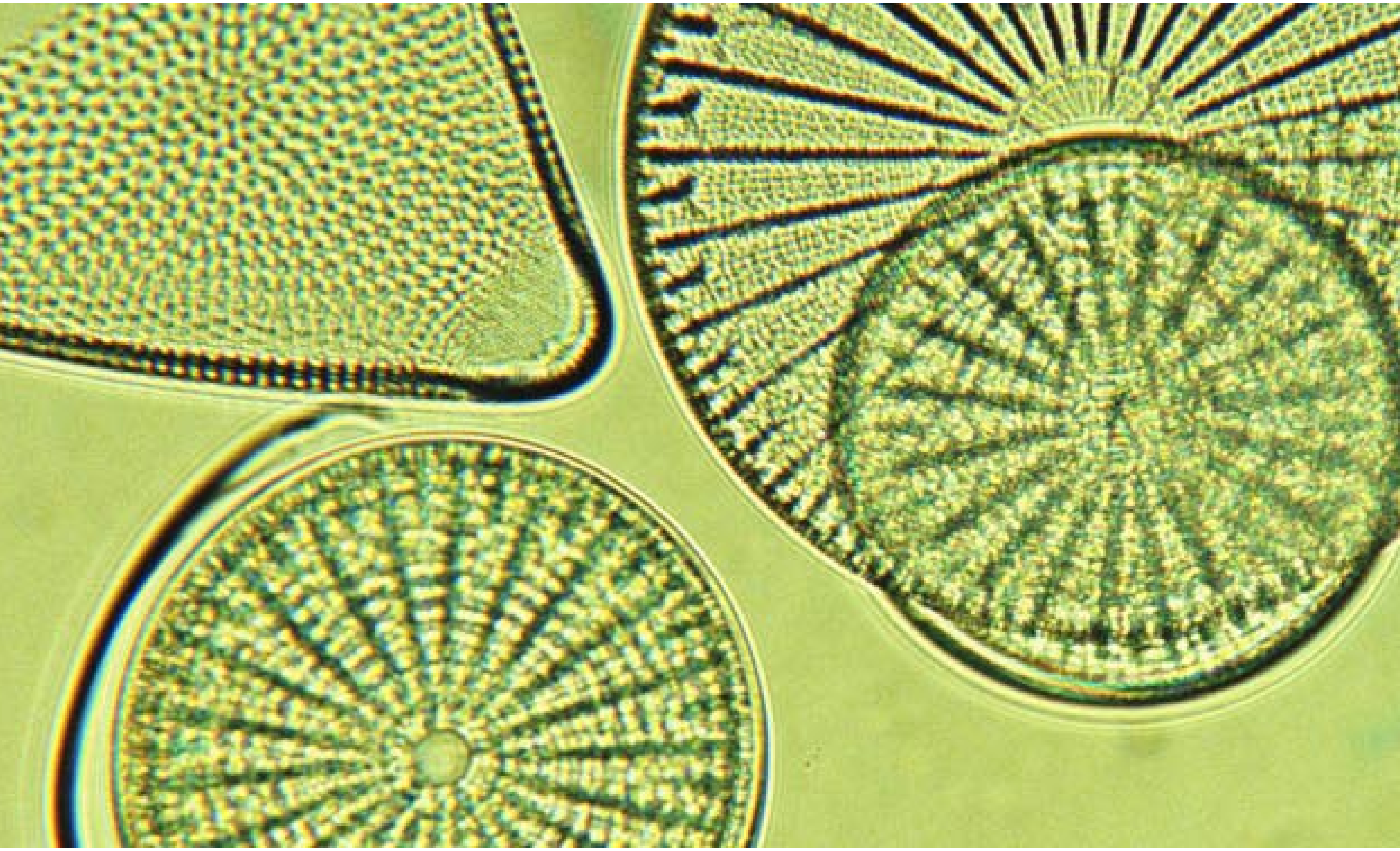
de Facto 2000: Environmental objectives – our generation's responsibility. In many cases, even though far-reaching action has been taken, appreciable improvements in the state of the environment have yet to be seen. This may be because ecosystems have a high degree of inertia: nature has simply not had time to respond to the easing of the pressures on it.

de Facto 2000 provides an outline survey of the environmental situation in Sweden and of when the environmental quality objectives adopted by the Swedish Parliament may be expected to be achieved. The *de Facto* series is being published as part of a Government-commissioned project in which the Swedish Environmental Protection Agency is monitoring overall progress towards these objectives.



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