MINISTRY OF THE ENVIRONMENT SVT Environment and Natural Resources 2000:4 C

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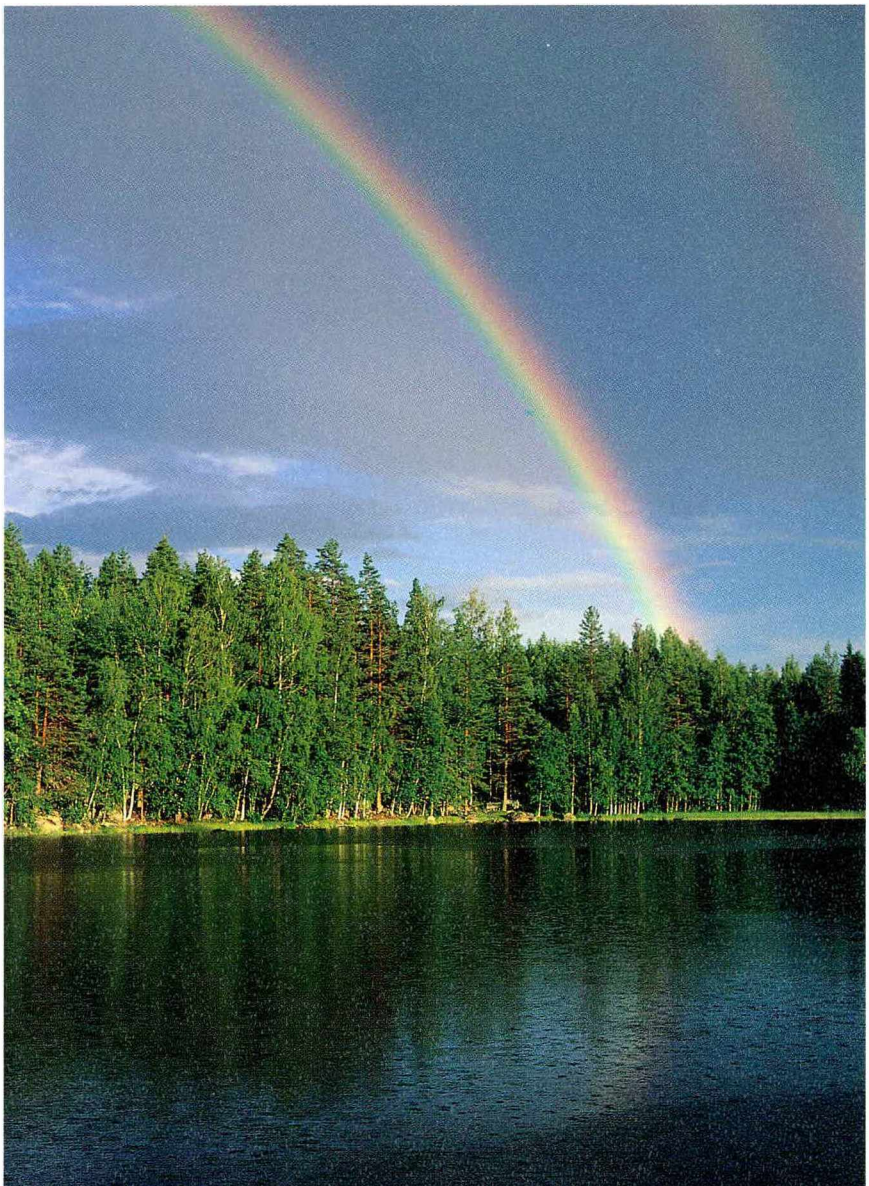
Finland's Natural Resources and the Environment 2000



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Finland's Natural Resources and the Environment 2000

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Inquiries:

Jukka Hoffrén
tel. +358 9 17341

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Foreword

The extensive programme adopted at the UN Development and Environment Conference in Rio de Janeiro in 1992 (Agenda 21) aimed to give a broad definition of the measures that are needed to implement a policy of sustainable development. The European Union's policy of implementing the principles of sustainable development, the so-called Cardiff process that was formulated in 1998, is aimed at integrating sustainable development and environmental considerations into different sectoral policies. During Finland's Presidency of the European Union in the latter half of 1999, important progress was made in many key environmental questions. Agreement was reached for instance on strategies for integrating the environmental dimension into the transport, energy and agriculture sectors. Work on similar strategies has started in the Internal Market, Development and Industry Councils, as well as in the General Affairs, ECOFIN and Fisheries Councils. The Council of Europe in Helsinki also requested that the Commission submit its proposal for the Union's sixth Environment Action Plan and a strategy for sustainable development. These will also be key documents as the European Union prepares for the UN Conference in 2002, the 10-year follow-up to the Rio meeting.

In its programme for 1999-2003 the Finnish Government says that the principles of sustainable development in regard to the environment will be consistently taken into account throughout the various levels of society. To meet the targets set out for the reduction of greenhouse gas emissions in the Kyoto Climate Protocol, the Government will draw up a national climate programme by spring 2001. The Government programme requires that these commitments are met in such a manner that the measures applied do not impair economic growth and actions to strengthen employment nor prejudice steps to reduce the national debt. Implementation of a policy of sustainable development means combining the principles of ecological, social as well as economic sustainability in all social functions and at all levels of decision-making. An integral part of this objective involves the development of an environmental accounting system within the national and public sector economy and the process of environmental auditing. In line with the Government programme for sustainable development, work will be continued in the near future to develop the "Natural Resources and the Environment" as an important tool in establishing a policy for sustainable development.

This review has been compiled by a working group appointed by the Ministry of the Environment and chaired by Markku Nurmi, Director General at the Ministry of the Environment. The other members of the group were Pekka Pelkonen, Special Advisor at the Ministry of Finance; Meri Ostbaum, Senior Financial Officer at the Ministry of Finance; Timo Ritonummi, Senior Advisor at the Ministry of Trade and Industry; Elina Nikkola, Senior Advisor at the Ministry of Agriculture and Forestry; Tia Laine-Ylijoki, Senior Advisor at the Ministry of Transport and Communications; and Jarmo Muurman and Arto Tuominen, Senior Advisors at the Ministry of the Environment. The secretaries to the working group were Jukka Hoffrén, Senior Researcher at Statistics Finland, who has also edited the review, and Maire Repo, Planning Officer and Ulla Rosenström, Senior Scientist at the Finnish Environment Institute.

Helsinki, September 2000

Ministry of the Environment
Minister of the Environment
Satu Hassi

Statistics Finland
Director General
Timo Relander

Contents

1 The economy and the environment

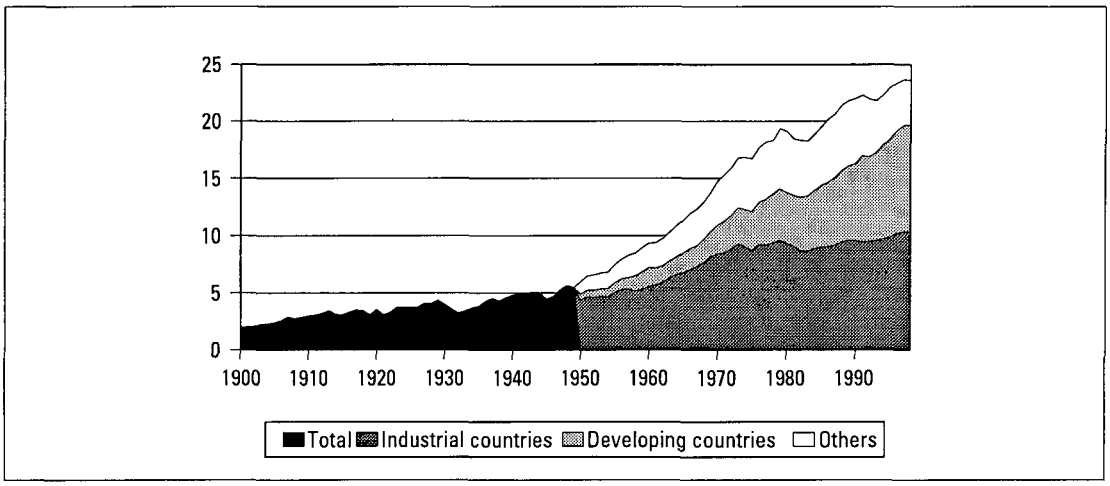
International environmental policy

Environmental policy is distinctively and emphatically about international collaboration. There are by now more than 100 international environmental conventions. Both internationally and nationally, environmental policies today are largely grounded in the policy of sustainable development as defined at the Rio de Janeiro Environment and Development Conference in summer 1992. One of the biggest challenges for sustainable development right now is to prevent the acceleration of the greenhouse effect. In 1960 the carbon dioxide content of the atmosphere was some 13 per cent higher than in the pre-industrial era, by 1999 the figure had climbed to 32 per cent. At the same time the mean world temperature has risen from 14.0 degrees Celsius in 1960 to 14.6 degrees in 1998, which is the highest figure on record.

As part of the process that began in Rio, the first binding global agreement on reducing greenhouse gas emissions was concluded at the UN Climate Meeting in Kyoto in December 1997. This agreement has by now been signed by over 80 countries. Under the Kyoto Protocol, industrial countries are required to reduce their greenhouse gas emissions by an average of 5.2 per cent from the 1990 level by the period 2008-2012; the requirement for the United States is a reduction of seven per cent, for EU Member States eight per cent and for Canada and Japan six per cent. No obligations have been imposed on developing countries. The emission reductions specified in the Kyoto Protocol are not enough to halt the acceleration of the greenhouse effect. That, according to researchers, would require reductions in the region of 50-90 per cent.

Following up the Kyoto process, the United Nation Climate Change Conference held in Bonn in autumn 1999 reached agreement on a working programme and procedures. The aim is to speed up the negotiation process so that the next meeting in The Hague in November 2000 could proceed to make decisions on the Kyoto mechanisms, joint implementation, a Clean Development mechanism, the principles of emissions trading and the rules for monitoring compliance with the Climate Convention. This would improve the prospects of the Protocol being ratified and implemented.

Figure 1. World carbon dioxide emissions from fossil fuels in 1900-1998 (billion tonnes))

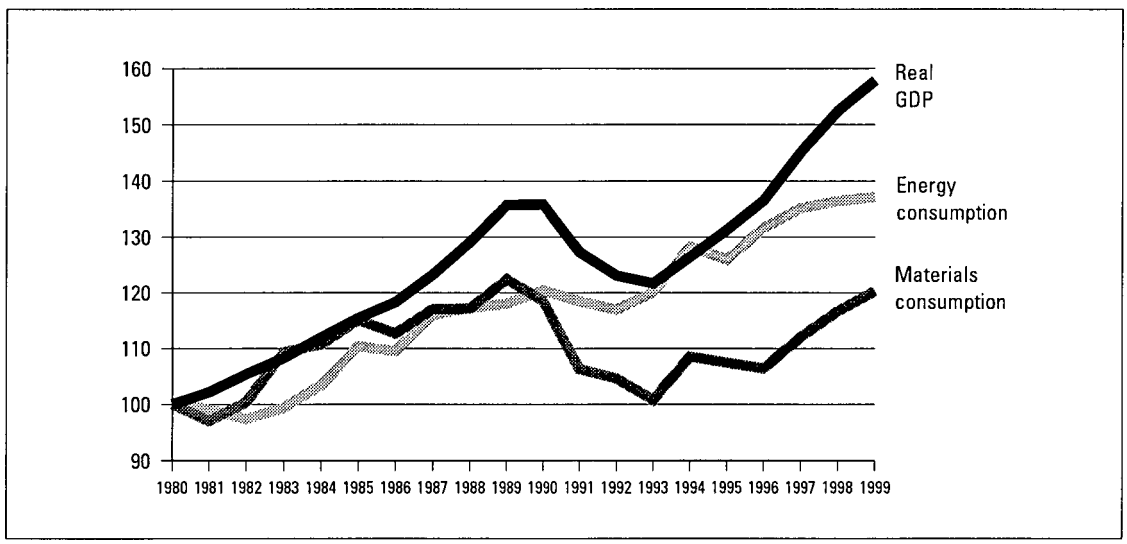


The European Union has played a prominent part in the climate negotiations, and in 1999 the accent in the EU's own environmental policy was heavily on climate issues. Priority issues during Finland's Presidency of the EU in the latter half of 1999 included the incorporation of sustainable development in all Community policies in line with the Amsterdam Agreement, the implementation of the UN in Kyoto protocol and the development of its mechanisms, the intensification of international and regional cooperation in environment issues and the development of European environmental legislation.

The European Council meeting in Helsinki in December 1999 considered it important that the Kyoto Protocol of the UN Climate Convention be ratified by 2002. It was stressed that the climate meeting in The Hague in autumn 2000 will need to invest special efforts in making progress so that results can be achieved. The Helsinki meeting also carried forward the process that was started in Cardiff for the closer integration of environmental considerations into other sectors. Agreement was also reached on the development of follow-up and evaluation tools as well as the necessary knowledge base. The Council of Europe in Helsinki also requested that the Commission submit its proposal for the Union's sixth Environment Action Programme by the end of 2000. The action programme lays down binding environmental targets for Member States, the attainment of which depends crucially on sectoral measures.

A protocol to the International Convention on Long-Range Transboundary Air Pollution was signed in Gothenburg in December 1999. The purpose of the Protocol is to protect the environment and people's health against the effects of acidification, eutrophication and ground-level ozone. In practice, the protocol sets out specific targets for the reduction of emissions of sulphur, nitrogen oxides, ammonia and volatile organic compounds for each party to the Protocol. It is estimated that implementation of the Protocol will reduce the area where critical loads of acidification were exceeded in 1990 by over 80 per cent. Furthermore, it is estimated that the reduced level of ozone and particulates in the air will save almost 50,000 people from premature death.

Figure 2. Trends in real GDP, energy and materials consumption (1980=100)



Sustainable development in Finland

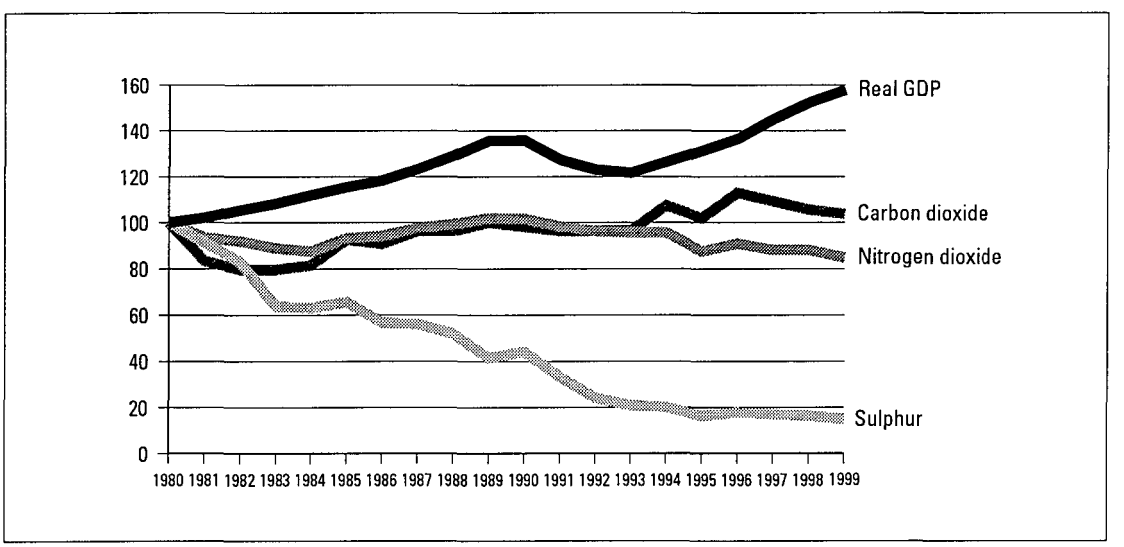
In its programme for 1999-2003 the Finnish Government says that the principles of sustainable development in regard to the environment will be consistently taken into account throughout the various levels of society. In addition, the Government will be making efforts within the EU to promote the integration of environment policy in different sectors and to emphasise the significance of environmental protection in the Northern Dimension.

Finland was one of the first countries to adopt a programme for sustainable development in June 1998. Key objectives of the programme include slowing down the process of climate change, influencing production and consumption habits, reducing the use of non-renewable natural resources, and maintaining biodiversity. As far as production and consumption are concerned the aim is to reduce the strain on the environment caused by production and consumption to a level tolerable to nature, and to promote the effective use of natural resources in the production of goods and services. Sustainable development is also promoted by the Finnish Committee on Sustainable Development, which serves as a forum for public debate and submits initiatives to the relevant authorities for drafting. In keeping with the five-year work programme of the UN Committee on Sustainable Development (CSD), the national Committee's term runs until the end of 2002.

The various administrative sectors and other relevant actors will be submitting their progress reports on policy implementation to the CSD by summer 2001. Work is also under way to develop improved tools of evaluation by means of national indicators of sustainable development, and an Finland's Natural Resources and the Environment report, national accounting methods and systems for monitoring the use of natural resources. A list of national indicators of sustainable development was issued in spring 2000.

Drawing on the reports by the various administrative sectors and other investigations and development projects, the Finnish Committee on Sustainable Development will compile an overall evaluation of the effectiveness of Finland's sustainable development programmes and the state of sustainable development in Finland. This evaluation is scheduled for completion by Earth Summit

Figure 3. Trends in real GDP and atmospheric emissions in Finland (1980=100)



+10, the follow-up to the Rio Environment and Development Conference, in 2002.

In its programme the Finnish Government undertakes to draw up and implement a national plan on how Finland will meet its minimum obligations on greenhouse gases reached at the Kyoto conference on climatic impacts. In line with the division of burdens agreed upon within the European Union, average annual emissions in 2008-2012 must not exceed the 1990 level. The Government programme requires that these commitments are met in such a manner that the measures applied do not impair economic growth and actions to strengthen employment nor prejudice steps to reduce the national debt.

Coordinated by the Ministry of Trade and Industry, work to draw up a national climate programme was started in summer 1999. The programme will be submitted to Parliament in spring 2001. Each administrative branch has responsibility for preparatory work on the measures to be applied in reducing greenhouse gas emissions within that particular sector. These proposed measures will be integrated with the national climate programme into clusters of measures. Every effort will be made to put these measures into effect in such a way that any detrimental impacts on the national economy are minimised. For this reason the measures will be introduced in order of cost-effectiveness, taking into account their impacts on the national economy and the public economy, the environment, employment and regional policy.

Instruments of environmental protection

Government control has clearly been stepped up in recent years in the realm of sustainable development. New legislation on environmental protection took effect at the beginning of March 2000, updating and harmonising existing legislation and licensing procedures. The aim of the new law is to harmonise methods of restricting and controlling emissions from different kinds of activities. Special attention is paid to the principle of applying the best available technology (BAT), risk management and the efficiency of energy use.

A new Land Use and Building Act came into force at the beginning of 2000. Key objectives of the law include the promotion of a good living environment and sustainable development in communities as well as increasing citizen involvement and influence at the grassroots level. A Government decision-in-principle in December 1998 to launch a programme for ecologically sustainable development has the same goal of containing the environmental damage caused by building and property maintenance: the programme is aimed at improving energy and water efficiency, waste management and indoor air quality as well as increasing the longevity of buildings.

The Act on Compensation for Environmental Damage, which provides for compensation by means of, environmental damage insurance came into force at the beginning of 1999. In addition, the Act on the Assessment of Environmental Damage was amended as of the beginning of April 1999 to comply with the revised EU directive, and a decree was given to support the interpretation of the Act. Other relevant legislation includes the Waste Act (1994), the Forest Act (1997), the Nature Conservation Act (1997) and the Extractable Land Resources Act (1997).

These new legislative instruments have been complemented in the 1990s by a range of economic steering mechanisms, such as environmental taxes, environmental labelling schemes as well as voluntary agreements. Measured in terms of the amount of environmental taxes levied relative to GDP, Finland ranks well above the average for the OECD countries. In 1999 these taxes and fees amounted to 3.4 per cent of GDP in Finland. In all countries the major source of government revenue from environmental taxes is taxation on fossil fuels, particularly petrol and diesel. On average traffic accounts for

1. Environmental taxes and fees (FIM million)

	1993	1994	1995	1996	1997	1998	1999	2000	2001
	A	A	A	A	A	A	A	B	BP
Alcoholic beverage surtax	16	48	88	52	55	60	73	50	70
Soft drink surtax	19	16	15	9	10	9	7	9	7
Fertiliser tax	516	267	–	–	–	–	–	–	–
Pesticide fee	6	6	6	6	9	10	10	10	10
Electricity tax	656	56	–	–	–	–	–	–	–
Energy taxes	8 404	9 815	11 628	12 714	13 895	15 306	15 765	16 600	16 185
Oil waste tax	21	19	21	20	20	20	19	20	20
Motor vehicle tax	1 609	2 054	2 685	3 611	4 210	5 259	6 115	6 400	6 700
Charter flight tax	111	80	–	–	–	–	–	–	–
Water protection tax	2	2	3	3	2	3	3	3	2
Oil pollution control fee	34	31	34	29	33	33	35	35	36
Vehicle licence tax	–	618	1 046	1 110	1 129	1 198	1 245	1 270	1 345
Diesel engine vehicle tax	885	844	668	929	979	1 042	1 101	1 090	1 190
Waste tax	–	–	–	41	127	182	202	190	200
Total	**12 279**	**13 856**	**16 194**	**18 524**	**20 469**	**23 122**	**24 575**	**25 677**	**25 765**

A = Final accounts. B = Budget. BP = Budget proposal. – = not in use. .. = data not available.

over 90 per cent of all environmental tax revenues in OECD countries, for Finland the figure is around 83 per cent. Consumer prices for household oil products show little variation in northern and western Europe, and prices and taxation rates in Finland are around the average in this comparison. In 1997 environmental taxes as a proportion of total taxation increased to around 7 per cent in the OECD countries.

A Government survey in February 2000 indicated that environmental taxes had helped to check carbon dioxide emissions in the 1990s: in 1998 emission volumes were a few million tonnes smaller than they would have been otherwise. However, the working group noted that any increases in energy taxation place a particularly heavy burden on energy-intensive industries and low-income households.

Environmental protection in central government

The Government programme states that ecologically sustainable development shall be promoted by an environmentally conscious purchasing policy in the public sector, which is indeed a major purchaser of investment and consumer goods. Environmental considerations can be taken into account in the choice of the items to be purchased as well as in listing technical specifications. In addition, environmental impacts and costs can be weighed in assessing how different quotations compare overall, while still complying with such requirements as impartiality and non-discrimination.

Central administration plays a very major role in conducting and funding environmental research and development. Environmental research is funded among others by the Academy of Finland, the National Technology Agency TEKES as well as ministries in the environment, energy and natural resources sectors. It is estimated that 33 per cent of environmental research in universities is funded from these sources. Over half (56%) of the monies come from universities' core funding. These funds from budget sources and other (mainly private) funding are not included in the figures shown in Table 3. Environmental protection funds are primarily allocated to industry and local au-

2. Government expenditure and MoE environment expenditure 1998-2001 (FIM million)

	Govt spending total	MoE environmental spending	Per cent
1998	194 292	1 095	0.56
1999	211 713	1 066	0.50
2000	219 120	1 133	0.52
2001	209 172	1 108	0.53

3. Government environmental expenditure (FIM million)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001**)
Environmental administration	426	389	402	440	469	479	506	510	547	558
Central government	*108*	*95*	*128*	*127*	*135*	*139*	*153*	*151*	*157*	*152*
Local government	*318*	*294*	*274*	*313*	*334*	*340*	*353*	*359*	*390*	*406*
Development cooperation	..	..	..	276	243	295	295	355	..	..
Cooperation with neighbouring areas	86	55	57	57	57	62	66	58	57	57
Nordic Environment Finance Corporation	8	9	9	8	7	7	7	7	7	7
Research and development*)	576	585	652	717	781	919	952	1 038	1 160	1 182
Environmental conservation and management[1)]	*175*	*168*	*205*	*170*	*229*	*256*	*267*	*289*	*329*	*339*
Use and management of natural resources[2)]	*98*	*88*	*85*	*119*	*128*	*143*	*149*	*178*	*190*	*140*
Universities	*166*	*166*	*184*	*204*	*227*	*235*	*245*	*251*	*261*	*273*
Development of environmental technology[3)]	*110*	*136*	*149*	*193*	*168*	*255*	*261*	*290*	*350*	*400*
Other environmental researchs[4)]	*27*	*27*	*29*	*31*	*29*	*30*	*30*	*30*	*30*	*30*
Grants to environmental NGOs	6	6	6	6	6	6	6	6	7	6
Environmental protection	92	119	152	85	119	189	174	155	129	140
Clean air and waste management	*25*	*38*	*47*	*45*	*41*	*56*	*53*	*49*	*29*	*46*
Water protection	*24*	*25*	*22*	*8*	*33*	*32*	*7*	*13*	*13*	*12*
Environmental management and decontamination	*43*	*56*	*83*	*32*	*45*	*101*	*114*	*93*	*87*	*82*
Nature conservation	235	264	366	312	325	479	567	407	355	*359*
Promotion of energy saving	8	6	10	6	8	9	15	15	15	15
Renewable energy investment support*)	87	77	99	37	33	51	117	120	120	150
Environmental protection of road traffic*)	123	123	131	139	128	78	105	79	78	73
Rail transport*)	..	..	..	..	79	93	93	101	102	102
Manure pit investment support	47	5	84	–	80	65	36	18	15	15
Environmental support for agriculture	–	–	–	1 420	1 570	1 631	1 690	1 607	1 287	1 394
Basic support	–	–	–	*1 330*	*1 367*	*1 372*	*1 410*	*1 388*	..	..
Special support	–	–	–	*90*	*203*	*259*	*280*	*219*	..	..
Environmental support for forest management	–	–	–	–	10	15	13	22	8	25
Total	**1 694**	**1 688**	**1 968**	**3 503**	**3 915**	**4 378**	**4 642**	**4 498**	**3 887**	**4 083**

– = not in use. .. = data not available. *) = estimate. **) = forecast.
1) Environmental Administration and Academy of Finland. 2) Agriculture and Forestry Administration.
3) Technical research. 4) Other administrative branches.

thorities for purposes of improving the state of the environment and repairing environmental damage, nature conservation expenditure goes mainly towards the purchase and management of conservation areas. The biggest single expenditure item in the government's environmental protection budget is the environment support paid to agriculture, which will be discussed in closer detail in Chapter 2.

Development cooperation

The consequences of global and local environmental problems are most acutely felt by the world's poorest nations and groups of people. The problems experienced in developing countries may be due to unsustainable resource use either by themselves or by industrial countries, leading to the impoverishment of arable land, desertification, the loss of forests and water contamination. Virtually all of the main partners in Finland's bilateral development cooperation programmes have projects aimed at environmental protection and nature conservation. Finland is also supporting a dozen or so forestry projects or programmes in objective which environmental protection is an important or the primary one.

During Finland's Presidency of the European Union, the EU development Council adopted several significant documents concerning the environment. The most important of these were the conclusions adopted at Finland's initiative concerning climate change issues and how they should be taken into account in development cooperation.

Finland supports the Global Environment Facility (GEF), a financial mechanism that provides funds for projects and other activities

4. Environmental support in development cooperation (FIM million)

	1995	1996	1997	1998	1999	2000
Bilateral development cooperation*)	240.3	206.9	259.4	223.3	321.2	..
Support to GEF	31.0	31.0	31.0	31.0	29.0	29.0
Ozone Fund	5.0	5.0	5.0	5.0	5.0	5.0
Total	**276.3**	**242.9**	**295.4**	**259.3**	**355.2**	..

.. = data not available. *) Bilateral development projects primarily concerned with the environment.

that concern climate change, biodiversity, international waters, as well as reducing the production and consumption in transitional economies of substances depleting the ozone layer. In 1998-2001, Finland has committed a total of FIM 116.7 million to the GEF. Finland's annual contribution to the Multilateral Ozone Fund is around FIM 5 million.

In 1999 Finland joined the Prototype Carbon Fund (PCF), which has played a major pioneering role in the application of the so-called Kyoto mechanisms (clean development mechanisms and joint implementation). Established by the World Bank, this investment fund supports projects in developing countries and transitional economies that promote the so-called flexibility mechanisms of the Kyoto Protocol under the Convention on Climate Change, such as international emissions trading and joint implementation. Subscriptions are invited from governments and companies, which in exchange for their investment receive certificates on emission reductions achieved that can be used towards meeting their reduction targets set out in the Kyoto Protocol. The view taken within the European Union is that investment in the carbon fund is not an official form of development aid. The fund was launched in April 2000.

The Finnish decision to join the fund has been motivated by the fact that Finland will probably be needing mechanisms to meet its obligations. Also, Finland has no earlier experience of these kinds of projects. Other governments that have invested in the fund are Sweden, Norway, Holland, Canada and Japan; 15 companies have also approved participation. A Government subscription costs USD 10 million, companies pay USD 5 million. Finland's subscription will be paid in three instalments, FIM 20 million in 1999 and 2000 and the remainder in 2001.

Cooperation with neighbouring regions

In 1997 the European Union adopted the Northern Dimension as an official objective in the hope that this would have a favourable impact on the level of environmental protection, above all in the Baltic region and northern Russia. Finland has worked consistently to promote environmental improvement in its neighbouring regions and the state of the Baltic Sea since 1991 by supporting environmental protection in northwestern Russia, the Baltic states and Poland. The collaboration in the Baltic region aimed at environmental improvement is described as good. The most important areas of cooperation have included the development of environmental administration, water and air protection as well as waste management. The long-term objective in project cooperation has been to improve the readiness of the countries involved to resolve existing environmental problems and to prevent the development of new ones. During 1999 Finland has stepped up cooperation with the Nordic Investment Bank (NIB) and with the Nordic Environment Finance Corporation (NEFCO). The decisions by Estonia, Latvia, Lithuania and Poland to gear up for EU membership have also influenced the content of Finland's cooperation. During the planning period 2000-2006 the main determinants of that cooperation will indeed be the EU directives concerning the treatment of drinking and waste water and waste management.

Between 1991 and the first quarter of 2000 Finland has supported more than 300 invest-

5. Finland's contribution to projects in neighbouring regions by country 1991-2000 (FIM million)

	Investment projects	Technical aid projects
Estonia	147.5	25.0
Latvia	51.5	6.4
Lithuania	33.3	5.7
Russia	102.8	50.0
Ukraine	8.2	0.1
Poland	95.7	0.5
Joint projects	0.5	60.2
Total	**439.4**	**147.9**

ment projects and some 830 technical aid projects related to environmental protection. During this period Finland has invested a total of around FIM 590 million in environmental projects conducted in the target areas. The primary goal of technical aid cooperation is to support the environmental investments made. Finland and Russia have aimed in their environmental cooperation at reducing environmental damage in northwestern Russia and in the Barents Sea and the Baltic Sea region. Finland and Estonia have concentrated on water and air protection as well as on waste management projects, the focus in cooperation with Latvia and Lithuania has been on cleaning and reducing waste water.

As well as working to promote environmental protection in its neighbouring regions, Finland has contributed to improving the state of the Baltic Sea through the protection programme adopted in 1992 by the Baltic Marine Environment Protection Commission. This programme has identified 132 hot spots that call for urgent measures of protection.

Environmental protection by local authorities

Signed in Aalborg, Denmark, in 1994, Local Agenda 21 is an international agreement that requires local authorities to draw up a local plan of action for sustainable development. In Finland there are currently 245 local municipalities with ongoing projects related to Local Agenda 21, covering almost 80 per cent of the population. According to a bill submitted by the European Commission in December 1999 for the promotion of sustainable development in urban areas, good municipal management and the reinforcement of local self-government are crucially important to achieving an ecologically sustainable development at the local level. In Finland legislation concerning the local administration and organisation of environmental protection was extended in 1997. The local authority may assign the duties of the environmental protection authority to joint municipal bodies, but it will still remain responsible for taking environmental considerations into account in the municipality's activities. The new Land Use and Building Act also gave local municipalities increased decision-making powers and responsibility in planning.

The EU initiative on local-level indicators of sustainable development was introduced in Hannover in February 2000. The aim of the initiative is to create a more integrated system for monitoring the sustainability of development in European cities. Individual cities and local authorities may inform the Commission of their decision to adopt the indicators. In Hannover five Finnish cities and towns signed an agreement indicating their commitment, i.e. Helsinki, Tampere, Turku, Pori and Kouvola. In addition, the environment barometer project launched by the Association of Finnish Local Authorities is aimed at establishing an indicator system describing the performance of local authorities in terms of environmental protection. The purpose of the system is to describe the progress made in each municipality and in this way to encourage movement towards ecologically sustainable development.

The local authorities' campaign to reduce greenhouse gas emissions was launched in autumn 1997 and will run until autumn 2000. This campaign is part of an international project aimed at reducing urban greenhouse gas emissions. The campaign currently involves 34 municipalities, including some of the country's biggest cities such as Helsinki, Espoo, Vantaa, Tampere, Lahti

and Oulu. Around 40 per cent of the country's population live in areas covered by the campaign. The purpose is for each participating municipality to draw up a greenhouse gas balance and emission forecast for the next 10-20 years on the assumption that the current trends will continue, together with concrete proposals for stemming the increase in greenhouse gas emissions and eventually reducing them. Special attention is paid to energy generation, transport, industrial plants and landfill sites.

Community waste disposal has undergone major structural changes during the 1990s. Key factors behind these changes have included the entry into force of a new Waste Act, a number of new statutes governing waste disposal, the establishment of national and local the waste management plans and the introduction of a waste tax. The number of landfill sites has been reduced and their size increased, which allows for greater efficiency both in building and maintaining the sites. At the same time waste recycling has increased and waste treatment intensified. Several new treatment plants have been set up alongside landfill sites, some of them on the sites themselves.

Important steps have also been taken to improve and concentrate the management of municipal waste, which is now more and more often coordinated through a joint authority. As many as 323 local authorities and 83 per cent of the population are now covered by this form of cooperation, compared to no more than 20 or so local authorities at the beginning of the 1990s. At the same time waste disposal and recycling systems have also been improved. Wastes can now be sorted into an increasing number of components, and work has continued to set up new recycling centres, collection points for hazardous wastes and regional collection systems. The broader application of the principle according to which the producer or manufacturer is responsible for waste disposal has removed many items from the statutory system of municipal waste management: these include refrigerators, scrap vehicles, car tyres, newspapers, glass bottles and other types of packaging.

6. Local authority expenditure on environmental protection (FIM million)

	1993	1994	1995	1996	1997	1998	1999*)
Waste management							
Investments	51	98	87	71	97	112	91
Operating costs	415	409	404	476	542	607	624
Water supply							
Waste water treatment							
Investments	287	224	203	216	213	204	204
Operating costs	849	768	760	668	587	602	623
Sewerage							
Investments	557	512	469	523	516	494	493
Operating costs	1 038	919	910	780	687	703	728
Energy supply							
Clean air							
Investments	655	169	23	86	223	..	..
Operating costs	143	156	158	139	154	..	..
Environmental management							
Investments	16	29	20	38	21	26	26
Operating costs	188	188	200	209	244	250	278
Total	**4 299**	**3 472**	**3 234**	**3 206**	**3 284**	**2 998**	**3 067**
of which							
Investments	1 666	1 032	802	934	1 070	836	814
Operating costs	2 633	2 440	2 432	2 272	2 214	2 162	2 253

*) = preliminary data. .. = data not available.

The biggest expense items for local authorities, joint municipal boards and municipal corporations in their environmental budgets are sewerage and waste water treatment. Most of the costs arising from waste management, sewerage and waste water treatment are covered by fees collected from users, but part of the monies for investments in these projects come from the national budget. Expenditure on environmental management is financed out of the local authorities' tax revenues and through government grants.

Environmental health

A recent report by the European Environment Agency (EEA) and the World Health Organisation (WHO) indicates that several environmental problems are clearly reflected in people's health. The main health hazards, according to the EEA and the WHO, are related to

air pollution, water contamination and traffic accidents. For instance, the WHO's estimate is that air pollution, chiefly in the form of small particulates, causes 100,000 premature deaths each year in Europe alone.

The main accent in environmental health care was traditionally on preventing the health risks presented by different kinds of chemicals. Today, individual chemicals are no longer regarded as major environmental risks: the focus of attention has shifted away from the toxic compounds produced by the chemical industry and moved instead to microbes and the complex mixtures produced mainly by human activity, such as pollutants in outdoor air.

Finland has an excellent environmental health record in the areas of household water supply, foodstuffs hygiene and radiation safety. By contrast there is still room for improvement in the quality of indoor and outdoor air, in noise reduction, accidents and in containing the psychological and social health risks in the environment. Key challenges for environmental health care are to halt climate change and the depletion of the ozone layer, the incorporation of health considerations in urban planning and development, the promotion of grassroots participation as well as research and product development.

7. Environmental Health Committee's assessment of risk factors in Finland (Number of people)

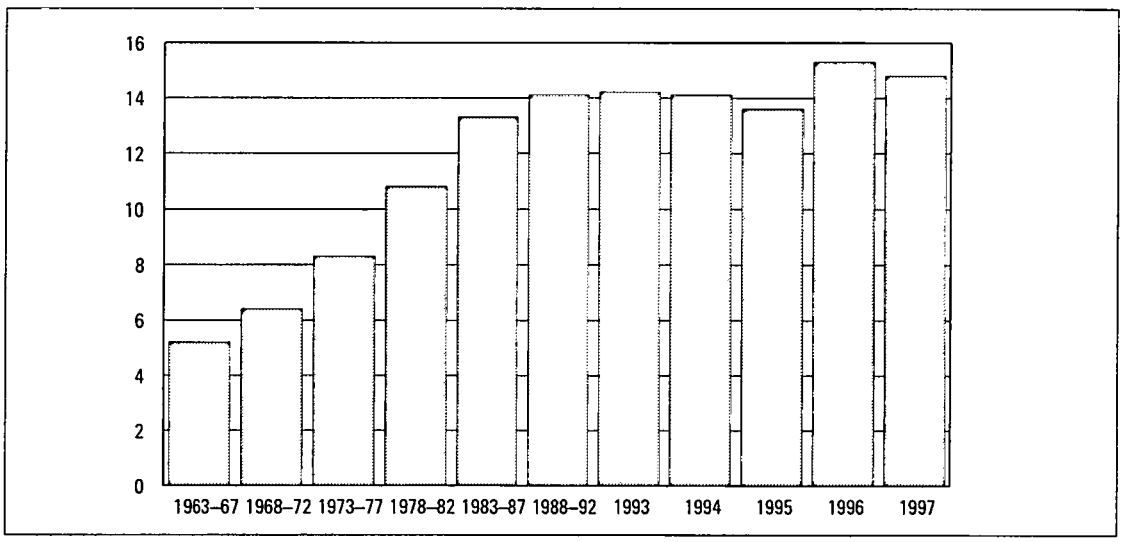
Factor	Exposed	Killed	Falling ill
Microbes in indoor air	1 500 000	..	50 000
Allergens	5 000 000	..	..
Radon in indoor air	50 000–160 000	20–700	20–700
Forced smoking	1 500 000	760	20 000–30 000
Outdoor air	1 900 000	200–400	30 000–40 000
Microbes in foodstuffs	5 000 000	..	500 000
Microbes in drinking water	300 000	..	30 000
Climate change	5 000 000	..	..
UV radiation	5 000 000	100	..

.. = data not available.

8. Trends in environmental health expenditure (FIM million)

	Government institutions	Grants to local authorities	Local authority expenditure	Expenditure total
1990	193.1	205.1	205.1	603.3
1991	237.5	224.0	224.0	685.5
1992	282.8	214.7	214.8	712.3
1993	165.0	152.0	152.0	469.0
1994	224.3	146.0	145.0	515.3
1995	247.3	152.0	152.0	551.3
1996	231.1	149.6	149.9	530.6
1997	225.3	152.0	152.0	529.3
1998	226.6	152.0	152.0	530.6

Figure 4. Incidence of melanoma in 1963-1997 (per 100,000 population)



2 Natural resources

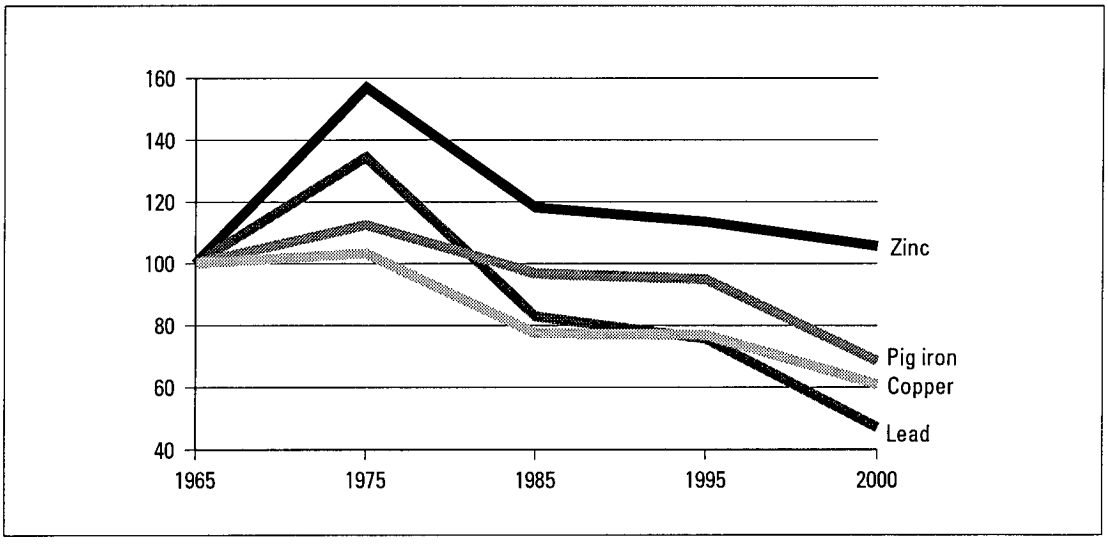
Towards increased efficiency in the use of natural resources

The continuing growth of the world population is leading to increased material consumption, which is one of the key components of welfare. One of the greatest challenges for sustainable development is indeed to change existing production and consumption habits without allowing those changes to affect economic competitiveness, because the environmental damage caused by the accelerating use of fossil fuels and natural resources is seriously jeopardising the renewal and tolerance of the natural environment. In the light of what we know today there is no threat of natural resources being depleted over the next few decades: the production of most raw materials has steadily increased and their real prices have declined in the 1980s and 1990s.

Market prices do not allow for the so-called external costs that result from the inadequate proprietary rights and underpricing of natural resources, and this gives rise to inefficient resource use and welfare losses. A solution is now being sought in the concept of eco-efficiency, which combines the sparing use of natural resources, economic efficiency and considerations of environmental protection, the ultimate aim being to reduce the excessive use of natural resources with a view to alleviating the adverse environmental consequences that exceed the tolerance of the global ecosystem.

The Government Programme states that during the first years of the 21st century, particular attention will be paid to increasing the efficiency of natural resource use both in production and consumption. The ultimate aim is to improve the country's eco-efficiency and to change the structure of consumption for greater efficiency. In 1999 Finland consumed close to 200 million tonnes of primary materials, 119 million tonnes of non-renewable and 80 million tonnes of renewable natural resources. Direct overall consumption of natural resource per GDP unit has declined steadily in the 1980s and 1990s. In other words, greater wealth and affluence has been produced with less resources.

Figure 5. Trends in world market prices of selected metals (1965=100)



Ores and other extractable resources

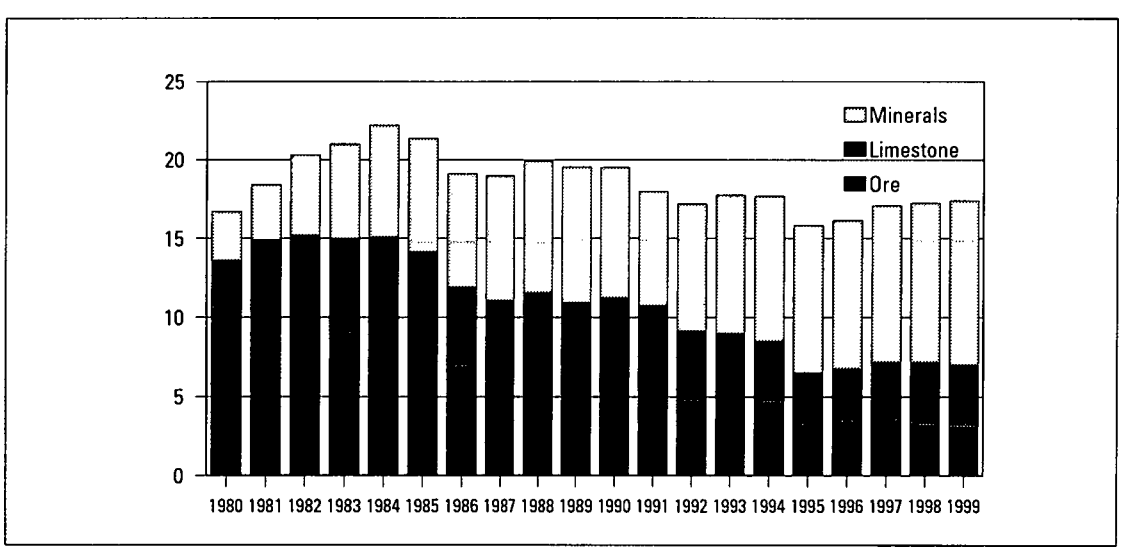
Finland is self-sufficient in just two metallic minerals, i.e. chromium and zinc, but other known ore deposits are becoming rapidly depleted. However, experts say there is still considerable potential for the discovery of new deposits in the Finnish bedrock. Since the metallurgical industry in Finland is modern and highly competitive, there is every reason to believe that the processing of metals will continue in the country for quite some while, even though it will largely have to rely on imported raw materials and recycling. For instance, most of the steel that is produced in Finland is manufactured from concentrates imported from Sweden and Russia and from scrap iron.

While ore production in domestic mines has declined quite considerably in the 1990s, metal imports have increased very sharply. In 1999 ore production in Finland amounted to 3.1 million tonnes, metal imports totalled 5.5 million tonnes. Limestone production was 3.9 million tonnes and domestic industrial mineral production 10.4 million tonnes. The most important metals are chromium, zinc, nickel, copper and gold; the main industrial minerals are limestone, granite and talc.

Consumption of gravel and other aggregates declined from the record level of 97 million tonnes reached in 1989 by one-third during the recession of the early 1990s. The figures started to rise again towards the late 1990s with the revival of the building sector. In 1999, consumption was estimated at 80 million tonnes. In recent years the use of natural rock as a substitute for gravel has sharply increased as gravel resources close to residential areas are becoming depleted. In 1990 rock materials accounted for 27 per cent of total consumption, in 1999 the figure was 45 per cent.

The Extractable Land Resources Act was amended in June 1997 to conform more closely with the principles of sustainable development. The law applies to the extraction of stone, gravel, sand, clay and soil. The aim is to ensure their continued availability and to safeguard supplies of groundwater occurring in the related landforms without endangering the biodiversity. Also, the purpose is to ensure restrained, economically practicable use of soil resources, to promote recy-

Figure 6. Mining of ores, industrial minerals and quarrying of limestone in 1980-1999 (million tonnes)



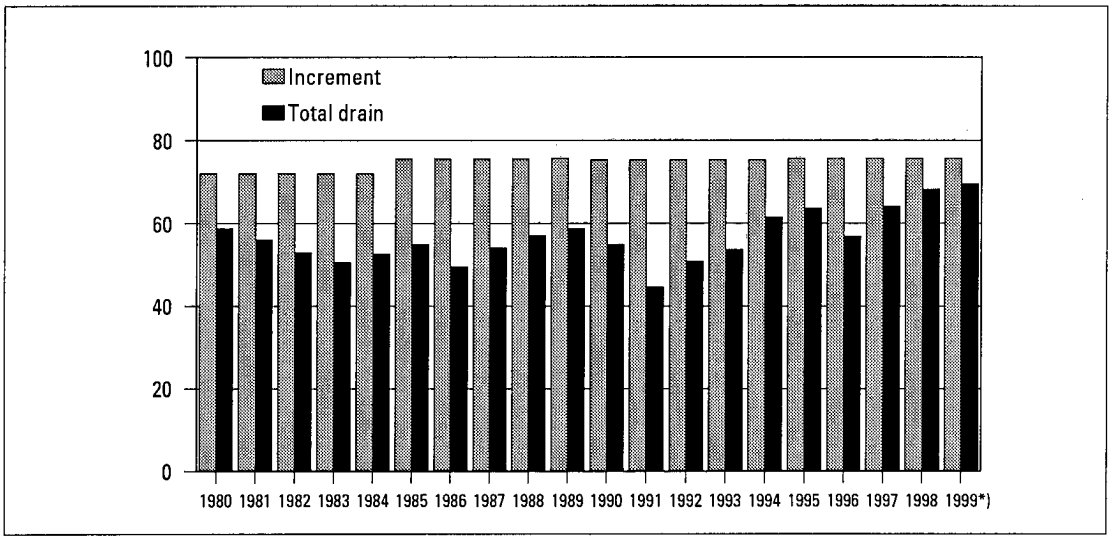
cling and to encourage the use of substitute materials. The follow-up obligation incorporated in the Act also facilitates data collection on the volumes of material extracted and lays the foundation for the development of an accounting system.

Forest resources

The forests are Finland's most important natural resource. Most of the country is covered by naturally regenerated forests that are in commercial use: Finland has over 26 million hectares of forestry land, accounting for 86 per cent of its total land area. Forest land proper amounts to 20 million hectares. Over half or 54 per cent of the forest land is in private ownership, 33 per cent is owned by the state, 8 per cent by business companies and 5 per cent by others. The figure for state-owned forest land also comprises areas set aside for conservation. The total volume of growing stock is just under two billion cubic metres. Over two-thirds or 69 per cent of this is owned privately, 18 per cent by the state, 8 per cent by business companies and 5 per cent by others. The total annual increment of 75.8 million cubic metres exceeds the total drain. A record figure of 60.9 million cubic metres was felled in 1999 for industrial and other uses. Allowing for waste and natural losses, the total drain was 69.4 million cubic metres. Timber imports to Finland in 1999 reached a new record of 13.2 million cubic metres (solid measure).

The purpose of the Government's National Forest Programme 2010 is to develop the management, use and protection of the country's forests so that considerations of economic, ecological, social and cultural sustainability are taken into account in the exploitation of forests. The target identified in the Forest Programme is gradually to increase the total cut to 63-68 million solid cubic metres a year by 2010, without compromising the high standards of silviculture and environmental management. Felling at targeted levels would fix the total volume of growing stock at its current level. By increasing cutting volumes and raising the degree of processing, the forest industry hopes to double its export revenues. All stakeholders and interest groups have been involved in preparing the programme.

Figure 7. Growing stock increment and drain (million solid cubic metres)



*) = preliminary data

The way that Finland's commercial forests are managed is of key significance to preserving the country's biodiversity. Intensive silviculture has detracted from the diversity of the forest nature, reducing for instance the amount of old-growth forests as well as rotting wood. However, current silviculture recommendations also take into account the requirements of biodiversity. According to inspections carried out in 1999 by the Forestry Development Centre Tapio and the Forest and Park Service, 92 per cent of all nature sites in commercial forests were unaffected or almost unaffected by felling and other silvicultural measures. The results suggest that the quality standards of silviculture have steadily improved throughout the five-year follow-up.

Drawn up for the first time in 1997-98, the aim of the statutory regional target programmes for forestry is to reconcile the objectives set for the different uses of commercial forests. Compiled jointly with forest owners and various stakeholders, the programmes provide an overall picture of the state of forestry in each district administered by forestry centres, the development needs within that district and the sector's development potential more generally. The programmes also include surveys of forest resources, forest protection and diversity, the employment effects of forestry and related business. The National Forest Programme is based essentially on these target programmes.

Certifications based on the Finnish Forest Certification System (FFCS) were started in summer 1999. However, there are some environmental organisations that have not yet accepted this system, but are campaigning instead in favour of the FSC system. The aim of FFCS certification is to demonstrate impartially and reliably that Finland's forests are used and managed in a sustainable manner. The system has been specifically designed with a view to the needs of small-scale forestry in Finland. Seven forest certificates were awarded in 1999, covering an area of over 13.5 million hectares or 60 per cent of the country's total forest area and 180,000 forest owners. The aim is to gain nationwide coverage during 2000, with an estimated 22 million hectares covered by the end of 2000. Finland's national forest certification system was adopted as part of the Pan European Forest Certification Scheme (PEFC) in May 2000. The PEFC logo will be introduced during 2000.

In recent years the official body responsible for the administration of state forests, the Finnish Forest and Park Service, has made greater allowance for social and environmental considerations by working closely with stakeholders and local residents to draw up natural resource plans for areas covering 0.5-2 million hectares. These plans seek to reconcile the different uses of forests in a manner that is widely approved. The plans also provide the framework for the Service's landscape ecology, which deals with large forest areas covering between 40,000 and 100,000 hectares as single entities. Regional landscape ecology ensures that larger amounts of rotting wood and more protective zones are left in forests. Valuable forest sites are left intact and where necessary ecological corridors are established to connect these areas. The Forest and Park Service hopes to complete the planning exercise for all its land areas by the end of 2000. The cost of preparing these plans will run up to around FIM 40 million, and it is estimated that their implementation will cut the Service's annual revenues by some FIM 130 million.

Cultivated resources

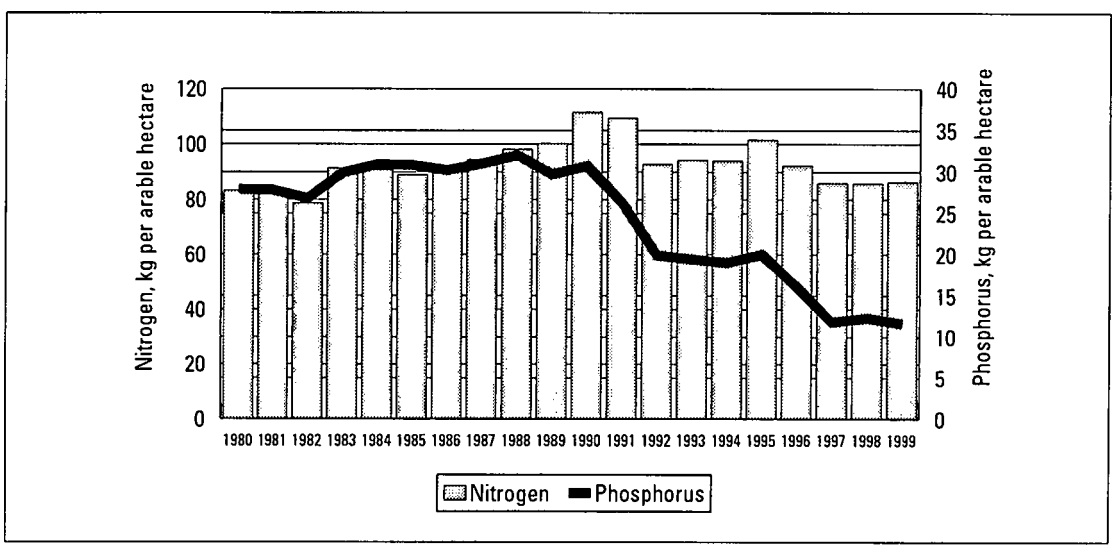
Some eight per cent of Finland's land areas is in agricultural use. There is a total of some 2.2 million hectares of farmland, i.e. fields and gardening land, of which 1.98 million hectares were under cultivation in 1999. In 1998 there were a total of 153,433 farms with more than one hectare under cultivation, with a mean cultivated area of 16.3 hectares. Over half or 57 per cent of Fin-

land's farms are in active production, and their mean arable land area is 24 hectares. Only one-third of all farms are now run on a full-time basis. According to a survey by the Agricultural Economics Research Institute, the number of farms is set to decline to less than half the current figure by 2008. Agricultural production in Finland is based primarily on animal husbandry, and 80 per cent of the arable land is devoted to growing grass, silage and fodder crops or used for grazing. Dairy products and meat account for almost half of total agricultural production. In 1998 total agricultural turnover in Finland was FIM 18.8 billion, of which subsidies accounted for 44 per cent or FIM 8.3 billion.

The adverse effects of agriculture on the environment include the runoff of nutrients from fertilisers and farmyard manure into lakes, rivers and groundwater. Apart from cultivation and animal husbandry, other, more diffuse sources of waterway pollution include natural runoff, forestry as well as settlement in sparsely populated areas and holiday homes. Estimates by the Finnish Environment Institute indicate that in 1997, around 60 per cent of the total phosphorus load and about 50 per cent of the nitrogen load caused by human activity can be traced to agriculture. The impacts of agriculture on eutrophication are most clearly visible in coastal areas and in small rivers. Under a resolution passed by the Council of State in 1998, the passage of nitrates of agricultural origin into lakes and rivers shall be restricted in accordance with the EU Nitrate Directive (91/676). The decision includes regulations concerning the size of manure storage facilities, periods during which manure may not be spread on the land as well as the maximum nitrogen content of manure and fertilisers.

The environmental programme for agriculture (1995-1999) has helped to improve the standard of water protection on farms, to reduce harmful emissions into the atmosphere and to maintain the traditional rural landscape and its biodiversity. Since 1995 a total of FIM 1.5-1.7 billion has been paid out each year to farmers in the form of environmental support, with the EU putting up half of the monies. This has compensated farmers for the costs and loss of income resulting directly from implementation of the programme and guaranteed them a living in the changing environment. Participation in the programme has been voluntary, but 90 per cent of active

Figure 8. Use of fertilisers in agriculture



farmers have in fact complied with the conditions for basic support; this amounts to around 90 per cent of the arable land under cultivation. In order to qualify for basic support, farmers are required to draw up an environmental management plan, to reduce their use of fertilisers and to establish protective zones and embankments between their arable land and any lakes, rivers and major ditches.

Adopted in 1999, Agenda 2000 represents a major reform of the European Union's agricultural policy, giving greater prominence to environmental considerations in common agricultural policy. The aim is to encourage an integrative and comprehensive approach to agriculture and the development of rural areas, the protection of the environment and the maintenance of the European rural heritage. During Finland's Presidency, the Member States drew up their strategy for the inclusion of environmental considerations and sustainable development in a common agricultural policy, which was introduced to the Helsinki meeting of the European Council in December 1999.

In summer 2000 the EU Commission approved Finland's proposal for a horizontal rural development plan, which also comprises a new environmental aid scheme for agriculture in 2000-2006. Total appropriations for environmental aid will be reduced from the current level of FIM 1.7 billion to FIM 1.4 billion because LFA grants will be made available in the whole country. The coverage target for the new aid scheme is 75 per cent of total land area. The structure of the system will be so revised that it is easier to take account of differences in environmental management between individual farms, even though the measures required will largely remain unchanged. It is estimated that in the long term, the environmental support provided to agriculture in 1995-2006 will reduce the phosphorus and nitrogen load on the waterways by some 50 per cent compared to the situation at the beginning of the 2000s.

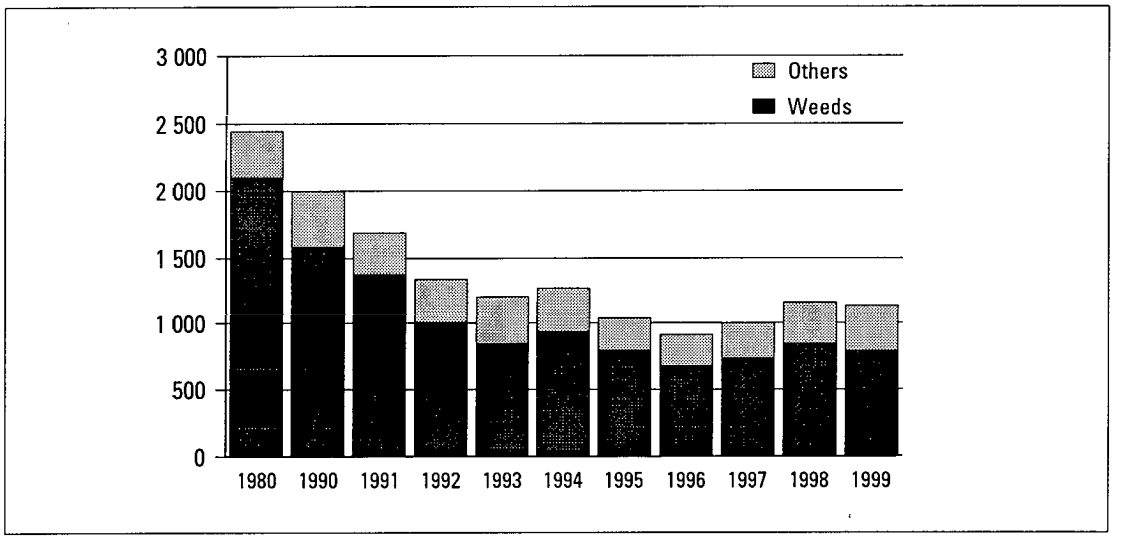
One of the areas receiving special support under the scheme is organic farming: this is an area whose growth is encouraged. Organic farming methods imitate and make use of nature's own processes by means of diverse crop rotation. Organic farms are not al-

9. Environmental support for agriculture (FIM million)

	1995	1996	1997	1998	1999	2000	2001
	A	A	A	A	A	B	BP
1. Basic support	1 329.7	1 367.0	1 372.0	1 410.0	1 387.5	..	..
2. Special support	76.5	158.0	195.0	222.5	210.3	..	..
2.1 Organic production	36.5	99.5	123.5	134.9	113.6	..	..
2.2 Protective zones	1.1	2.8	5.3	7.1	7.1	..	..
2.3 Treatment of runoff	33.2	41.7	47.2	55.2	61.3	..	..
2.4 More efficient use of manure	0.9	1.1	1.2	1.8	1.9	..	..
2.5 Landscape management and biodiversity	2.3	9.4	14.4	0.9	22.9	..	..
2.6 Diversification of production	0.1	0.1	0.1	0.2	0.2	..	..
2.7 Native breeds	2.4	3.4	3.5	3.6	3.3	..	..
3. Training and advisory services	8.7	10.0	7.0	7.0	6.4	..	..
4. Experimental projects	5.0	8.0	6.0	0.0	1.7	..	..
5. Other environmental management programmes	–	27.0	51.0	50.5	–	..	..
Total	**1 419.9**	**1 570.0**	**1 631.0**	**1 690.0**	**1 605.9**	**1 287.0**	**1 394.0**

A = Final accounts. B = Budget. BP = Budget proposal. – = not in use. .. = data not available.

Figure 9. Use of pesticides in agriculture 1980 – 1999 (1000 kg of active ingredient)



10. Organic farming and transition phase area in EU Member States in 1998

	Hectares	Per cent of arable land
Austria*)	345 375	9.9
Finland	**126 175**	**6.0**
Italy	830 000	4.8
Sweden	127 000	4.5
Denmark	99 163	3.7
Germany	357 715	2.1
Spain	269 465	1.0
The Netherlands	19 300	1.0
Belgium	11 350	0.9
France	234 800	0.8
Portugal	24 902	0.7
Ireland	28 704	0.5
United Kingdom	78 833	0.5
Greece	14 628	0.5
Luxembourg	678	0.5

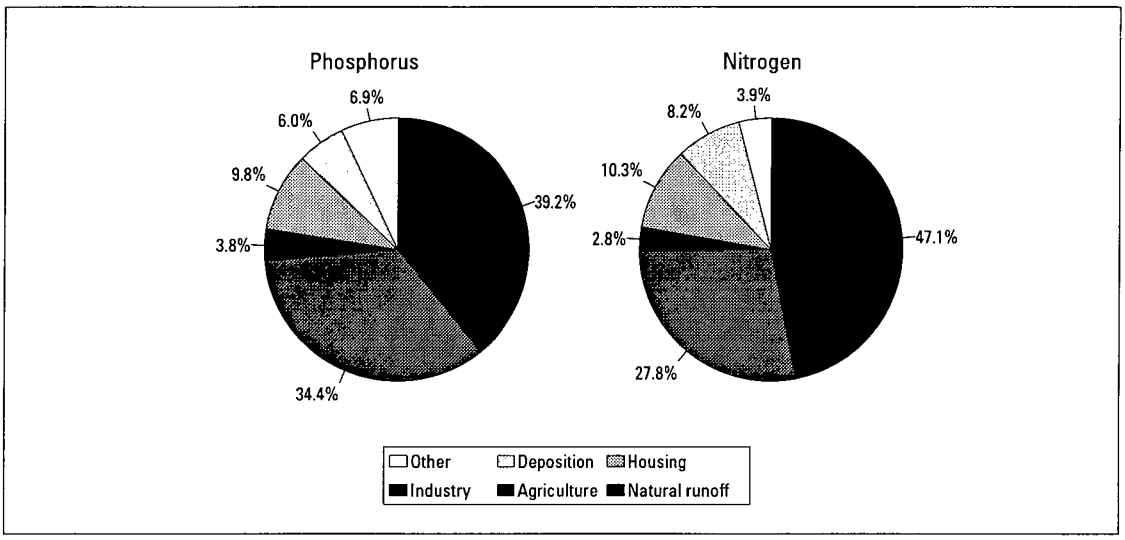
*) = 1997.

lowed to use fertilisers or synthetic pesticides, and they are regularly inspected at least once during the growing season. In 2000 a total of some 140,523 hectares were organically farmed in Finland, representing 7.1 per cent of the total arable land under cultivation.

Water resources

Finland has abundant surface and groundwater resources in proportion to its population and water consumption. Inland waterways cover some 10 per cent of the country's total area, i.e. 33,500 square kilometres, and territorial waters amount to 36,000 square kilometres. The total groundwater yield is estimated at 10-30 million cubic metres a day, of which approximately 6 million cubic metres is suitable for water supply purposes. Around 15 per cent of this latter figure is actually utilised. Almost 60 per cent of the water used by waterworks consists of groundwater or artificial groundwater. In 1998 consumption of water distributed through the public water supply system was 248 litres a day per subscriber outlet, of which household consumption represented 150 litres. In sparsely populated areas households obtain most of their water from their own wells, although there are frequent problems with the adequacy of the water supply in all conditions. Water consumption by industry, communities, and energy production totals around 2,500 million cubic metres a year. Each year 2-4 per cent of Finland's accessible water resources are utilised.

Figure 10. Vesistökuormituksen lähteet 1998



Aquifiers in Finland are typically rather small, shallow, and usually isolated from one another. Total consumption of groundwater amounts to around 258 million cubic metres a year. All groundwater sources are extremely sensitive to acidification as the Finnish bedrock is composed of acidic rock types. The soil layers protecting the aquifiers are also relatively thick, which in many places increases the risk of contamination.

There is considerable variation in the quality of groundwater from one area to another. Depending on the bedrock and soil type, groundwater may occasionally contain detrimental quantities of arsenic, fluoride, radon, and so on, while the consequences of human activity are reflected in the form of elevated nitrate, chloride, hydrocarbon and heavy metal concentrations. Risk factors for groundwater contamination include agriculture, the use of de-icing salt on roads, the transport and storage of oil products and other toxic substances, industrial emissions, urban development, sand and gravel extraction and the percolation of waste water into the ground. In addition, air pollution has to some extent begun to affect groundwater quality in southern and southeastern Finland.

11. Use of water resources in selected European countries (million cubic metres per year)

	Renewable water resources	Water supplies	Utilisation intensity (%)
Belgium	12 500	9 030	72
Spain	117 000	36 900	32
Italy	175 000	56 200	32
Estonia	15 000	3 300	22
England	120 000	14 237	12
Greece	58 650	6 945	12
Denmark	13 000	1 200	9
Russia	1 500 000	106 227	7
Finland	**108 000**	**3 001**	**3**
Sweden	168 000	2 932	2
Switzerland	54 000	1 166	2
Norway	39 200	2 025	1

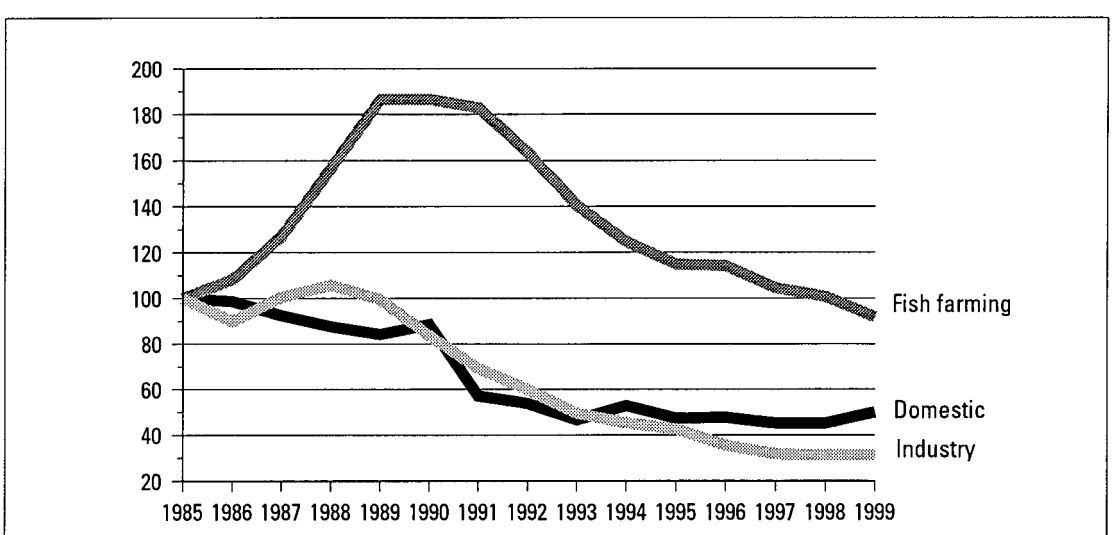
By international comparison the quality of inland waters in Finland is rather good. The most significant threat in this regard is eutrophication, which is steadily progressing in areas affected by nonpoint source pollution. The situation gives cause for concern most particularly in the coastal waters of the Gulf of Finland and the Archipelago Sea. The water quality of some 80 per cent of

Finland's total lake area is classified as good or excellent; around 4 per cent of the area is polluted and has a fair water quality, 0.3 per cent is heavily polluted with a very poor water quality. The quality of water in rivers is generally somewhat poorer than in lakes. The water quality of around 40 per cent of the total length of Finnish rivers is excellent or good and for 30 per cent of the total length the quality of water is satisfactory. The natural state of around one-third of Finland's river water is clearly disturbed. The vast majority or 88 per cent of the total area of Finland's coastal waters is classified as good or excellent in terms of water quality, 11 per cent is classified as satisfactory and around one per cent as heavily polluted. The total surface area of heavily polluted waters has decreased in recent years particularly in areas affected by communities and industry. At the same time, however, the area of completely unpolluted water has also decreased on account of increasing nonpoint source pollution.

The target set for water protection is to achieve, by 2005, a reduction of 30-55 per cent in the phosphorus and nitrogen load caused by human activity compared to the levels recorded in the early 1990s. Efforts to reduce the nitrogen loads that are causing further eutrophication in the Baltic Sea will be concentrated on the coastal regions and along the rivers that flow into the sea. As for inland waters, measures aimed at reducing nitrogen emissions by industry and communities will be considered on a case-by-case basis. Nitrogen emissions from agriculture will be controlled within the framework of the target programme, the EU Nitrate Directive and the agricultural environment programme.

Work was started in spring 2000 to set up a conservation programme aimed at restoring the ecological balance of the Baltic Sea. The programme is based on the implementation of two existing mechanisms, viz. the national water protection programme and the Baltic Sea sustainable development programme. Already international collaboration to protect the Baltic Sea has yielded results in that the eutrophication process was halted around the turn of the 1980s and 1990s after decades of accumulation. The immediate effects of the decrease in the nutrient load is restricted to coastal water close to the sources, but a substantial reduction in the loads will also help to alleviate the situation in the Baltic basin, even though it may take decades before any marked improvement will be seen.

Figure 11. Phosphorus load from industry, households and fish farming sources (1985=100)



Eutrophication increases in the Baltic Sea areas that surround Finland from the northern stretches of the Gulf of Bothnia through the Archipelago Sea down to the Gulf of Finland. In the eastern parts of the Gulf of Finland where the loads are highest, algae concentrations in the summertime are on average three times greater than in the open seas up in the Gulf of Bothnia. Many of the bays and island areas along the coast suffer from eutrophication to a much greater extent than open sea areas on account of local point source inputs and low levels of water turnover. Especially in the coastal waters of the Gulf of Finland that are dotted with small islands, a number of separate areas with presumably local eutrophication effects appear to be activated towards the end of the summer as nutrients are released from the load that has accumulated in the bottom mud over the decades. The extensive blooms of algae during the latter half of the 1990s, and during the summer of 1997 in particular, were a consequence of an intensified internal nutrient load in the open seas. Observations during winter 2000 indicate that the phosphorus concentration in the sea areas has dropped back to the levels recorded at the beginning of the decade.

12. Trends in A-chlorophyll content describing nutrient content of surface waters (mg/m^3)

	Lake Päijänne	Eastern Gulf of Finland	Gulf of Bothnia
1985	15.0	4.1	3.3
1986	11.0	4.7	2.6
1987	8.5	5.5	4.1
1988	13.0	4.8	3.9
1989	16.0	6.3	2.6
1990	7.5	4.6	3.7
1991	10.6	5.5	3.4
1992	8.2	6.0	3.9
1993	8.0	5.8	4.3
1994	6.7	4.0	5.4
1995	6.6	8.1	3.2
1996	7.2	6.0	3.4
1997	7.1	6.2	3.8
1998	6.7	6.3	5.3
1999	..	6.7	2.2

.. = data not available.

It is possible by means of domestic measures to combat the problems caused by excessive algae in the coastal waters of the Gulf of Finland, including slimy beaches and muddy waters. However, it is estimated that measures taken in St. Petersburg would be 40 times as cost-effective as those taken in Finland in terms of reducing these problems in Finnish territorial waters. More effective removal of phosphorus at St. Petersburg's current sewage treatment plant would reduce the phosphorus load that the Gulf of Finland algae can use by 16 per cent or 570 tonnes a year, which is almost ten times the reduction that will be achieved in this area through the water protection target programme.

The EU framework directive on water policy, the purpose of which is to reform community legislation governing surface and groundwater sources, was adopted in June. The primary objective is to ensure good ecological standards of water in lakes, rivers and coastal areas. The actions to be taken, monitoring and administration should focus on entire catchment areas at a time and coordination within them. In the definition of the state of water areas and the measures required, the accent should be on the ecological viability of the biocommunities and the presence of hazardous substances.

3 Nature conservation

Intensive forestry and agriculture are the main culprits behind the loss of biodiversity in Finland. According to a survey completed in May 2000 on endangered species in Finland, one in ten of the 15,000 or so species included in the study or a total of 1,505 species are currently endangered. There are 186 species that have been made extinct, 1,060 species need to be closely watched. The most important habitat for endangered species is the forest, but the threat of extinction has increased most among species living in different kinds of traditional biotopes. Many of the traditional habitat types maintained by agriculture, such as meadows and enclosed pastures, have decreased quite radically, severely restricting the living space of many species.

Nature conservation is aimed at maintaining biodiversity by setting up conservation areas to preserve unspoilt environments, by protecting endangered species and by integrating the interests of nature conservation with the demands of

13. Endangered species by habitat type in 1985, 1990 and 1999 (per cent)

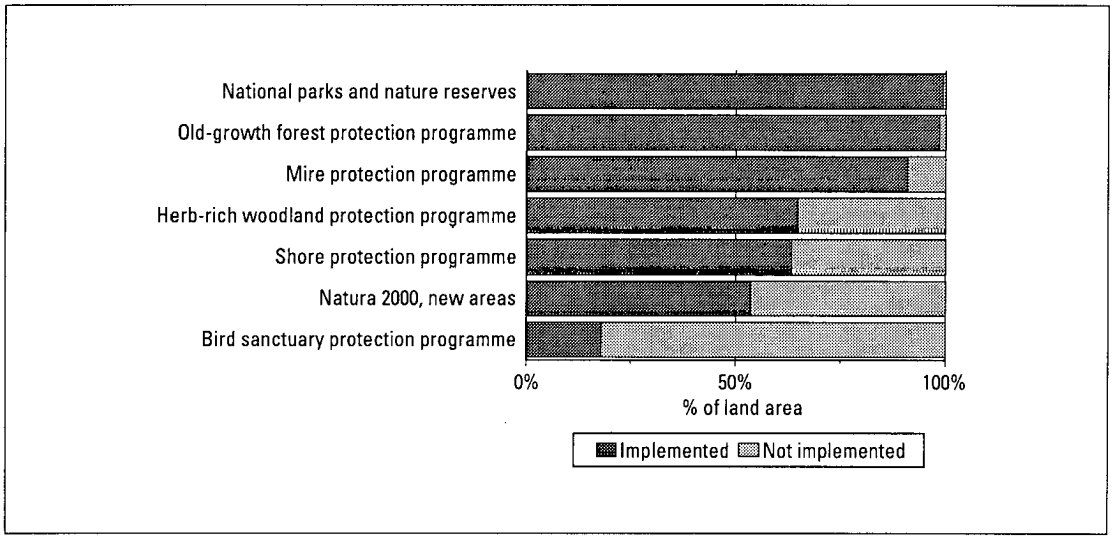
	1985	1990	1999
Forests	43.6	43.0	37.8
Mires	5.7	4.9	4.3
Water	9.7	9.0	6.8
Shorelines	7.0	8.2	10.7
Rocks	9.5	9.3	8.3
Felltops	9.3	4.1	4.2
Traditional biotopes	8.3	21.4	27.9

14. Funding for nature conservation areas and programmes 1995-2001 (FIM million)

	1995 A	1996 A	1997 A	1998 A	1999 A	2000 B	2001 BP
Purchase of land	183	184	321	362	214	184	192
Purchase of private land	*89*	*87*	*111*	*117*	*84*	*74*	*102*
Land exchanges	*87*	*80*	*110*	*150*	*70*	*60*	*50*
Income from sale of land	*7*	*17*	*100*	*95*	*60*	*50*	*40*
Management of conservation areas	75	69	75	75	82	83	78
Compensation payments	19	19	43	47	77	69	69
Protection of rapids	35	45	25	45	10	9	5
Life (Natura)	–	8	15	39	24	10	15
Total	**312**	**325**	**479**	**567**	**407**	**355**	**359**

A = Final accounts. B = Budget. BP = Budget proposal.
– = not in use.

Figure 12. Implementation of nature conservation programmes on private land, 1 Jan 2000



land-use planning. "Strictly" protected areas and areas in which cautious harvesting is permitted amount to 1,739,000 hectares, i.e. 7.6 per cent of Finland's total forest and low-productivity forest land. The area of strictly protected forest and low-productivity forest land totals 1,528,000 hectares, or 6.6 per cent; the figures for forest land proper are 714,300 hectares and 3.6 per cent. The country's network of nature conservation areas has been gradually expanded since the late 1970s to include different biotopes and habitats. The oldest of the nature conservation programmes, providing for the creation of national parks and nature reserves, has by now been more or less completed. Nature conservation areas covering some 1.4 million hectares and protected wilderness areas totalling some 1.4 million hectares have been established on state-owned and private land. The Government still has plans for the conservation of some 220,000 hectares, including the Natura 2000 areas to be conserved under the Nature Conservation Act. The aim of the overall funding plan already ratified for the nature conservation programmes is to have them completed by 2004, with funding extending to 2007 due to the staggering of payments.

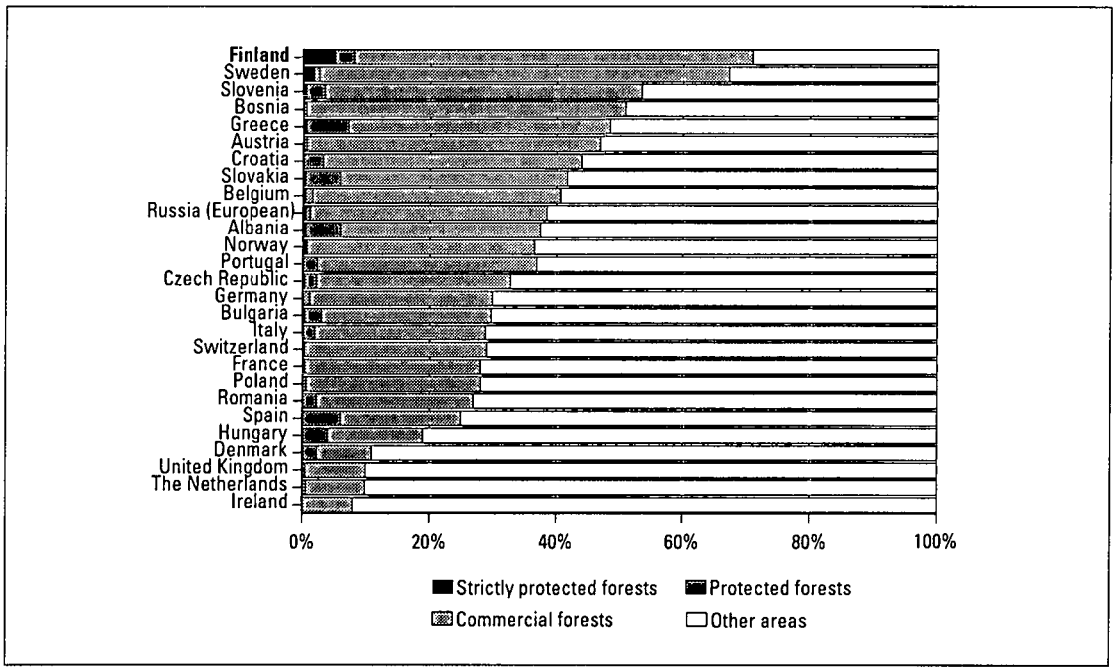
Finland is committed to implementing the EU habitats directive by creating a network of protected areas known as Natura 2000. The Finnish proposal for the areas to be included in the network was submitted to the EU Commission in December 1998. The proposal for Finland's Natura 2000 network contains a total of 4.78 million hectares, of which 3.224 million hectares are state land and 41,000 hectares have not been previously protected. The revised proposal comprises 324,000 hectares of private land, of which 66,000 hectares have not been previously protected. In 1999 some 4,500 hectares of these lands were claimed under the Nature Conservation Act. The conservation of Natura areas can be implemented in various ways depending on the need for protection in the case of each biotope and species. The final decision on the Natura 2000 network will be made by the European Commission.

The sufficiency and coverage of the areas proposed by Finland and Sweden for the Natura 2000 network on the basis of the habitats directive were audited for the first time in April 1999. For the purposes of the audit the European Union is divided into six physical types so that most of Finland belongs to the boreal zone and the fells of Lapland to the Alpine zone. In May 1999, Finland was requested by the EU Commission to complement its Natura 2000 proposal with a further 15 biotopes and the habitats of 17 species. The process requires full consultation procedures as well as a decision by the Council of State. Finland will be submitting its proposals for the new areas by autumn 2000. Phase II audits of the Finnish and Swedish proposals should be arranged during the course of 2000: these will involve final assessments of the significance of each area proposed for inclusion in the network to the achievement of a favourable level of pro-

15. Natura barometer in the EU countries, 20 March 2000

	Proposal for programme	Number of reserves	Total area (km²)	Per cent of land area
Denmark	Final	194	10 259	23.8
Greece	Final	234	26 522	20.1
Spain	Final	867	88 076	17.4
The Netherlands	Final	76	7 078	17.0
Italy	Final	2 507	49 364	16.4
Finland	**Final**	**1 381**	**47 154**	**13.9**
Luxembourg	Final	38	352	13.6
Portugal	Final	65	12 150	13.2
Austria	Final	113	9 450	11.3
Sweden	Final	1 919	46 300	11.3
United Kingdom	Partly completed	343	17 660	7.3
France	Partly completed	1 029	31 440	5.7
Ireland	Partly completed	259	3 007	4.3
Belgium	Partly completed	102	913	3.0
Germany	Partly completed	1 126	10 956	3.0
Total		**10 250**	**360 681**	**11.4**

Figure 13. Forests and forest conservation in selected European countries (per cent of land area)



tection of biotopes and species throughout the EU territory.

The LIFE fund that was set up by the European Union in 1992 subsidises nature conservation and environment projects that support the development of community environmental policy and legislation. The budget for phase three of the programme in 2000-2004 is expected to be around EUR 640 million, 47 per cent of which will go towards nature conservation (LIFE Nature) and around 47 per cent to innovative environmental technology projects (LIFE Environment). LIFE Nature is designed for the protection of the species and biotopes listed under the EU habitats directive and in particular for the implementation of the Natura 2000 network.

In 1999 the Commission allocated around FIM 400 million to LIFE Nature projects. Seven Finnish projects received a total of over FIM 27 million. Between 1995 and 1999 Finland received a total of FIM 180 million for 25 LIFE Nature projects. LIFE Environment funding to Finland in 1995-99 totalled FIM 59.5 million, granted to 27 different projects.

16. Nature conservation funding plan 1996-2007 (FIM million)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Funds allocated	106	149	175	185	185	185	185	185	185	185	185
Interest	0	9	12	15	12	10	10	10	10	6	3
Land exchanged	180	110	120	100	60	60	60	60	60	–	–
Income from sale of land	50	100	90	40	–	–	–	–	–	–	–

- = not in use.

4 Industry

Control over environmental protection

In the 1990s an increasing proportion of Finland's GDP was accounted for by industrial production; the corresponding shares of the service sector, construction and agriculture were all on the decline. Growth has been fastest in the electronics industry, which showed a seven-fold increase in production in the wake of soaring sales. In 1999 the metal and electronics industry accounted for 42.5 per cent of total industrial output, the forest industry for 20.9 per cent and the chemical industry for 10.5 per cent. Electronics accounted for 34 per cent of turnover in the metal and electronics sector in 1999. Over half or 53 per cent of the value of Finnish exports in 1999 was generated by the metallurgical industry, 29 per cent by the forest industry and just under 10 per cent by the chemical industry.

The industrial sector in Finland has invested increased efforts in environmental protection in recent years, and the emphasis has now shifted to the introduction of environmental management systems. EU Member States were required to implement a combined directive on the prevention and control of emissions by the end of October 1999. The directive underlined the responsibility of companies for using the best available technology (BAT) in their processes and other functions. In Finland the BAT requirement has been included in the new Environmental Protection Act and in legistlation on waste disposal and the protection of sea areas. The new Act contains the main body of national anti-pollution legislation, creating much greater uniformity in this field. According to the new Environmental Protection Act and the related decree, any business or operation involving a risk of environmental damage requires an environmental permit. At the same time, the charges for these permits were raised to reflect the amount of work involved in processing the corresponding permit.

17. Environmental charges as from 1 March 2000 (FIM)

Pulp mill	200 000
Fertiliser plant	180 000
Metal works	180 000
Airport	130 000
Iron, steel and iron alloy factory	130 000
Nuclear power plant or similar	130 000
Mining and quarrying	100 000
Paper and board mill	100 000
Pier, loading or unloading bridge	70 000
Fish farming	20 000
Small hydroelectric power plant	10 000
Jetty for over 50 boats	5 000
Bridge or conveying device	3 500

The development of environment protection

Industrial investment in environmental protection accounted for seven per cent of all industrial investments in 1997. In 1992 and 1993, the corresponding figure was around ten per cent, in 1994 less than six and in 1995 and 1996 less than seven per cent. In 1998 36 per cent of environmental investments was spent on air pollution control,

18. Expenditure by industry on environmental protection (FIM million)

	1992	1993	1994	1995	1996	1997	1998
Energy and water supply	819	939	418	276	406	601	235
Forest industry	990	940	932	1 371	1 311	998	1 168
Chemical and mineral industry	497	642	428	602	670	764	598
Metallurgical ndustry	530	332	449	564	723	565	731
Other industries	360	274	285	300	309	399	440
Total	**3 196**	**3 124**	**2 512**	**3 113**	**3 418**	**3 327**	**3 172**
of which							
Investments	*1 841*	*1 614*	*1 022*	*1 538*	*1 714*	*1 397*	*1 115*
Operating costs	*1 355*	*1 510*	*1 491*	*1 575*	*1 704*	*1 930*	*2 057*

NB The principles for producing the statistics have changed, and the 1998 data by industry are not directly comparable with earlier data.

19. Environmental management systems applied in Europe, 1 Feb 2000

	EMAS	ISO 14001
Germany	2 400	1 900
Austria	240	223
Sweden	173	956
Denmark	116	350
United Kingdom	73	1 014
Norway	63	119
Spain	47	463
France	35	443
Finland	**30**	**330**
The Netherlands	26	582
Italy	25	346
Belgium	9	130
Ireland	7	96
Portugal	2	15
Luxembourg	1	6
Greece	1	10
Iceland	0	1
Liechtenstein	0	5
Total	**3 247**	**6 987**

40 per cent on water protection and 22 per cent on waste disposal and on soil and groundwater protection.

The water protection programme adopted in 1998 and extending to 2005 and the plan of action approved in March 2000 oblige the industrial sector to considerably reduce its emissions. The obligations primarily concern the forest industry. By 2005, the aim is to reduce phosphorus and nitrogen emissions by 50 per cent compared to 1995, the target for biochemical oxygen demand is a reduction of 45 per cent. The targets of a 55-90 per cent reduction in chromium, oil, nickel, copper and zinc emissions will require increased efficiency of waste water management in the chemical and metallurgical industries. In 1999 phosphorus emissions from industry were 25 per cent, the biochemical oxygen demand 20 per cent and nitrogen emissions 5 per cent lower than in 1995. Zinc emissions had already dropped to the 2005 target level, oil emissions were down by 40 per cent compared to the target of a 55 per cent reduction.

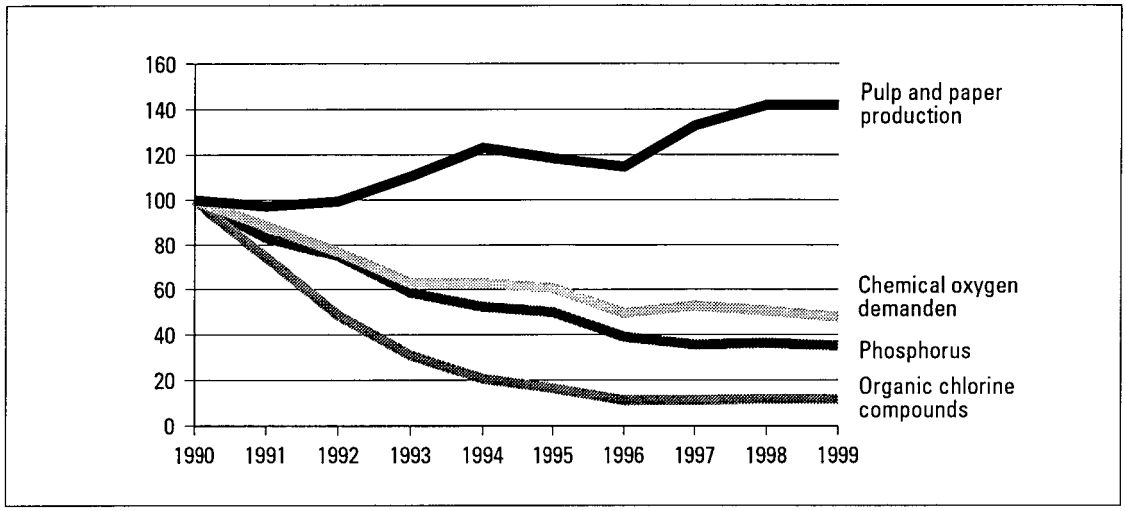
The industrial sector has moved increasingly towards voluntary environmental management systems in the 1990s, a trend that has clearly been boosted by the growing importance of customer and interest group relations. Companies have had a possibility to adopt the global ISO 14001 environment system since autumn 1995. Another option is the EMAS, a voluntary environmental management and audit system for industrial plants operating within the EU, which the first companies joined in spring 1996. The EMAS system is being revised during 2000, ahead of which an experimental EMAS registration scheme has been launched that allows not only industrial but also other business units to join the system. ISO environmental certificates have to date been awarded to 350, EMAS certificates to 30 and EMAS trial registrations to 2 Finnish industrial plants.

Forest industry

Finland accounts for five per cent of the world forest industry production and for ten per cent of its exports. Ninety per cent of the 12.9 million tonnes of paper and board produced in Finland in 1999 was exported. Indeed the forest industry has in the past few years been producing record quantities of paper and other wood products. In 1999 production in the Finnish forest industry increased by 2.5 per cent on 1998. Capacity utilisation in the paper industry in 1998 averaged 93 per cent, in March 1999 rising demand pushed the figure up to 99 per cent. Nonetheless the environmental impacts of the forest industry remained well under control in 1999, indeed the figures for several emissions were reduced.

Environmental management has very much become an everyday concern for forestry companies during the 1990s. Virtually all companies now have an environmental management system in place and they publish progress reports in connection with their annual reports. Although the turnover of Finnish forestry companies tripled during the 1990s, paper production was up by 45 per cent, pulp production by 35 per cent and sawngoods production by 45 per cent, emissions of organic chlorine compounds were

Figure 14. Pulp and paper industry production and load on the rivers and lakes (1990 =100)



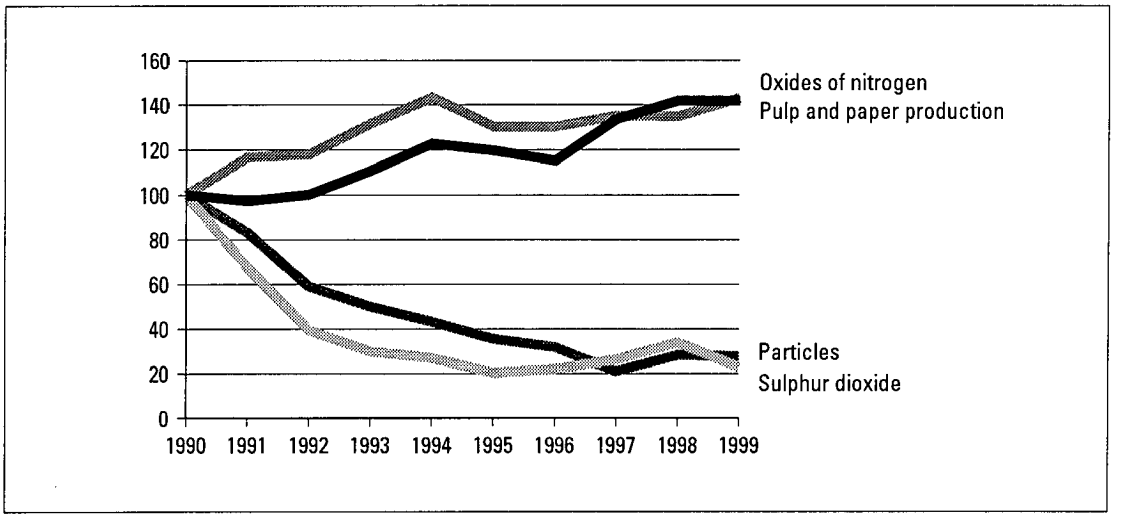
down at the same time by 90 per cent, biological oxygen demand by 80 and suspended solids emissions, chemical oxygen demand and phosphorus emissions by 50 per cent. Sulphur emissions dropped by 85 per cent in the 1990s and emissions of reduced sulphur compounds causing odour problems by 80 per cent. By contrast nitrogen oxide emissions remained unchanged throughout the 1990s.

Continued efforts to raise the standards of environmental protection in the forest industry call for good control of the entire production process. The key concern in the development of production processes in the pulp and paper industry is to minimise raw material consumption: wood, water, chemicals and pigments. In 1999, the forest industry used a total of 68 million solid cubic metres of wood: 72 per cent of this came from private forests, 6 per cent from state forests and 4 per cent from the companies' own forests and 18 per cent from imported sources. The Finnish forest industry refuses to use timber imported from disputed areas, and indeed virtually all imported timber is ISO certified.

In 1999 the forest industry used a total of 26.1 terawatt hours of electricity, representing 62 per cent of industrial electricity consumption and 34 per cent of the whole country's consumption. The industry generated 11.4 TWh and some 14.7 TWh was imported. Fuel consumption in the forest industry amounted to 267 petajoule, or 64 per cent of total industrial fuel consumption. The most important fuel is wood, which is used in the form of bark, wood chips and black liquor in the pulp industry. Wood accounts for over 70 per cent of total fuel consumption by forest industry power plants.

Environmental investments by the pulp and paper industry in 1999 amounted to nine per cent of their total investments, slightly down on the figure recorded one year previously. Most of the environmental investments in 1999 went towards air pollution control: the main priority was the treatment of malodorous gases. Measures were also taken at a number of plants to intensify energy use. In the area of water protection one of the top environmental concerns was the reduction of water consumption by means of improved water recycling and improved control of water use. In addition, steps were taken to intensify pulp washing and to develop the oxygen-based bleaching process. In waste management the accent has been on reducing landfill waste and on intensifying recycling and waste sorting.

Figure 15. Pulp and paper industry production and emissions into the atmosphere (1990=100)



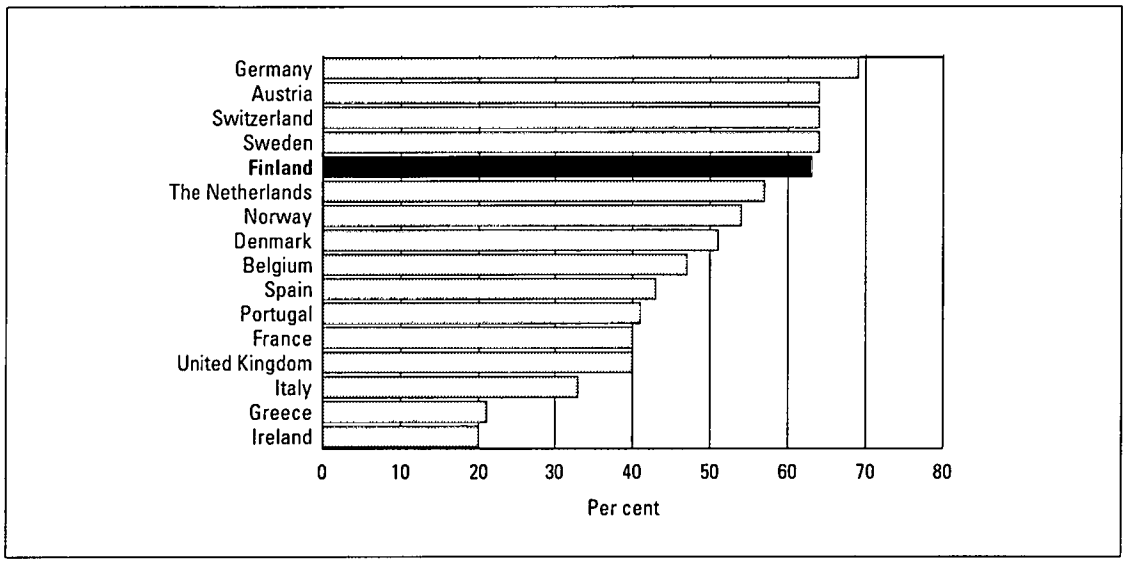
Recycled paper and board are important raw materials for the paper industry. The use of recycled materials has increased very rapidly all over the world, and it is expected that by 2010 recycled fibre will account for around half of the raw materials used in paper production. Under a decision in principle made by the Government in 1998, the recovery and utilisation of recycled paper shall be intensified so that in 2000, at least 70 per cent of the volume of paper products sold in Finland will be re-used primarily as recycled material, with the target for 2005 set at a minimum of 75 per cent. In 1999, a total of 717,000 tonnes of recycled paper was recovered, representing 63 per cent of the total end consumption of paper and board in Finland. In the whole world the recovery rate is 40 per cent. Some waste paper was imported for the production of recycled fibre. This was used primarily in the production of newsprint, different types of board and tissue.

Chemical industry

Chemicals are an important branch of industrial production in Finland in terms of both end products intended for consumers and, particularly, intermediate products supplied to other branches. However, even small quantities of many of the hazardous substances used and processed in the chemical industry may have serious environmental impacts, which underlines the need for reliable and comprehensive environmental protection. The bulk of the investments by the chemical industry in environmental protection still consists of conventional external measures aimed at purifying emissions, whereas investments in process technology remains at a low level. Nonetheless the industry has succeeded in reducing some of its emissions into water and the air, and the volume of waste has been declining since 1994.

The chemical industry has taken voluntary steps to raise the standards of its environmental protection and industrial safety in the context of the international Responsible Care programme. By May 1999 a total 118 Finnish companies had committed themselves to the programme, accounting together for more than 80 per cent of the total production of chemicals. The number of companies involved at the time that the results for 1998 were computed was 105. Over two-thirds or 69 per cent of the companies possessed an ISO environmental or quality certificate and 12 companies were constructing an ISO system. Four have an EMAS and a fifth is working on such a system.

Figure 16. Recovery of waste paper in certain European countries in 1998 (per cent)



20. Emissions from oil refining and the petrochemical industry (tonnes)

	1995	1997	1999
Volatile hydrocarbons	..	4 745	4 873
Nitrogen oxides	2 287	2 985	2793
Sulphur dioxide	4 536	3 069	2 848
Oil spills	7	5	4

.. = data not available.

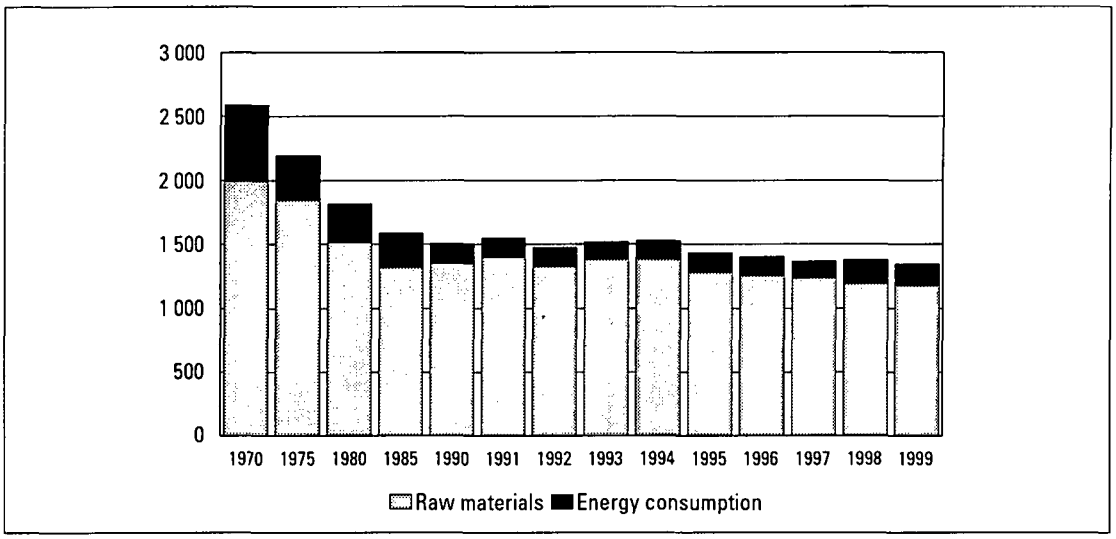
During the past ten years the companies involved in the programme have managed to reduce their emissions into water and the atmosphere relative to production volumes. Sulphate emissions into lakes and rivers have fallen by 62 per cent since 1988, phosphorus emissions by 16 per cent, nitrogen emissions by 45 per cent, mercury emissions by 85 per cent, cadmium emissions by 61 per cent and lead emissions by 98 per cent.

Metallurgical industry

The volume of production in the smelting industry has increased steadily since the early 1990s, whereas that in the electronics and electrical industry has increased almost five-fold. In 1998 the electronics and electrical industry accounted for 43 per cent of the gross value of output by the metal and electronics industry, the machinery and metal products industry for 41 per cent and the smelting industry for 15 per cent. The bulk of the adverse environmental impacts caused by the metallurgical industry originates in the smelting industry converting natural resources for use by other industries.

Finland is self-sufficient in just two metallic minerals, i.e. chromium and zinc, but other known ore deposits are becoming rapidly depleted. However, experts say there is still considerable potential for the discovery of new deposits in the Finnish bedrock. Since the metallurgical industry in Finland is modern and highly competitive, there is every reason to believe that the processing of metals will continue in the country for quite some while, even though it will largely have to rely on imported raw materials and recycling. The rate of utilisation of scrap iron and steel in Finland is around 90 per cent, including the circulation of scrap within the industry itself. The efforts invested by the Finnish smelting industry in upgrading its production processes have made it one of the

Figure 17. Carbon dioxide characteristic emissions from metal production (kilograms of carbon dioxide of metal produced)



most successful in the world both in terms of the efficiency of raw material and energy use and in terms of emissions reductions.

Extensive recycling of metals reduces the need for extracting virgin ores, as metals are almost entirely recyclable. Measured in terms of volume the most recycled material in the world is steel: each year the volume of recycled steel exceeds the figure for all other materials put together. In 1997 some 360 million tonnes of scrap were used to produce 799 million tonnes of steel in the world, i.e. almost half of it was made from recycled material. It has also been shown that, as a rule, steel production based on recycling is environmentally friendlier than production based on virgin natural resources. For instance, the manufacture of steel from scrap iron requires some 58 per cent less energy per unit than does the use of virgin raw materials. Recycling also helps to reduce energy consumption in the production of aluminium, which loses none of its properties in recycling. The smelting of recycled aluminium only takes five per cent of the energy that is needed to produce the same amount of aluminium from bauxite.

Since the manufacture of metals requires a large amount of energy, atmospheric emissions are the main source of pollution in this sector. The Finnish smelting industry has worked on improving its production processes and in this way significantly raised the efficiency of its raw materials and energy use and reduced its emissions. Half of the world's copper is produced by the Finnish flash smelting method which has a low external energy demand and which effectively

21. Emissions from metal production

	1990	1995	1996	1997	1998	1999
Production volume	**100.0**	**129.1**	**136.6**	**144.1**	**151.9**	**157.9**
Emissions into the atmosphere (thousand tonnes)						
Sulphur dioxide	21.8	8.1	8.1	7.5	7.6	7.9
Nitrogen oxides	3.7	3.2	3.1	3.5	3.5	4.0
Emissions into water (tonnes)						
Nitrogen	684.8	420.6	449.3	421.6	526.0	493.4
Chromium	1.9	3.5	2.3	3.9	4.2	5.8
Nickel	20.2	11.4	6.0	10.3	6.8	9.3
Copper	6.5	8.2	8.7	8.9	6.8	8.7
Zinc	17.1	10.7	9.9	9.4	6.9	7.6

recovers sulphurous gases. Investments in environmentally acceptable process technology in the metalworking industry exceeded the costs arising from the purchase of traditional emission purification technologies for the first time in 1996. The majority of the investments aimed at combating air pollution in the industry concern the recovery of emitted particles and dust. Water protection investments involve reducing waste water loads by developing production processes and purification methods. The aim of waste water management investments has been to reduce the amount of waste and increase recycling. In the smelting industry the development of environmental protection has focused on the introduction of environmental management systems and related life-cycle analyses. The electrical and electronics industry has aimed at reducing the use of CFC compounds and at improving the recovery and utilisation of scrap.

Waste management

Each year Finland produces some 65-70 million tonnes of waste; this includes all waste from primary production with the exception of harvesting waste left in the forests.

About 95 per cent of all waste is generated in production, chiefly in industry, agriculture and construction. Industrial waste consists of production, mining, energy and water supply waste. The volume of construction waste is magnified particularly by the large volumes of earth moved during construction. Agricultural waste consists entirely of manure, 90 per cent of which is recycled.

Industrial waste in 1997 amounted to 16 million tonnes, compared to 15.4 million tonnes in 1992. These figures include not only solid waste but also waste waters, emulsions and sludge. The biggest producers of waste are the pulp and paper industry, the mechanical forest industry and the metal and chemical industries. More than one-third of industrial waste consists of waste wood and bark from the pulp and paper industry, although this is nowadays increasingly utilised in manufacturing processes and in energy production. In 1997 4.5 million tonnes of industrial waste were re-used as material form, 5.4 million tonnes in energy and 4.1 million tonnes of industrial waste were taken to landfill sites.

In an attempt to improve and intensify waste recycling, Finland has adopted the principle of producer responsibility which says that the manufacturer is to take an active part in the disposal of the waste that will eventually be incurred. The principle has already been applied to used car tyres, waste paper and packaging materials. During Finland's Presidency EU Member States reached agreement on the application of the producer responsibility principle to the disposal of scrap vehicles. The directive proposal was endorsed by the EU Parliament and Council of Ministers in July 2000. According to the new directive car manufacturers will be required to cover all or a substantial part of the costs incurred from the recovery of scrap vehicles so that as from the beginning of 2001, manufacturers will be responsible for new vehicles sold from that date onwards. As from the beginning of 2007, manufacturers will also have responsibility for vehicles that came onto the market before 2001.

22. Finland's waste accumulation in 1997 (thousand tonnes)

	Accumulation	Recycled
Municipal solid waste	2 510	36 %
Household waste	1 000	..
Sewage sludge	136	61 %
Hazardous waste	470	..
Industrial waste	16 000	62 %
Energy and water supply waste	1 332	66 %
Mineral excavation waste	21 000	..
Agricultural waste	21 500	90 %
Building and demolition waste	1 100	..

.. = data not available.

5 Energy supplies

Energy generation

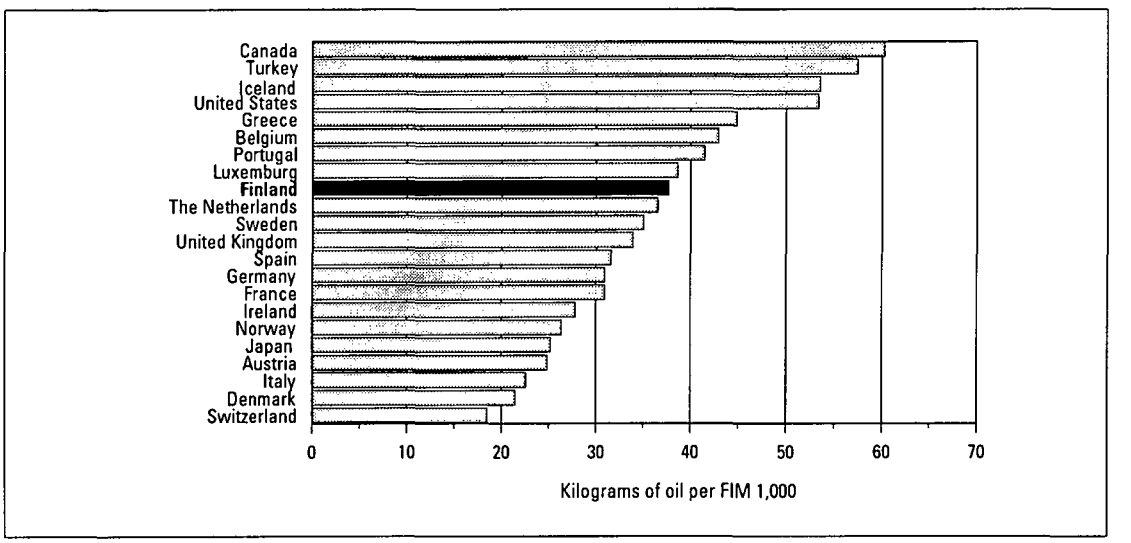
Finland's energy consumption in 1999 totalled 31.3 Mtoe. Oil accounted for 28 per cent of energy consumption, wood-based sources for 20 per cent, coal for 11, natural gas for 11, nuclear power for 18 and peat for 5 per cent. Domestic sources accounted for 29 per cent. Finland has a high level of per capita energy consumption, which is due to its northern location and continuous need for heating in the winter, the dominant role of heavy industry in its economic structure and long distances in what is a sparsely populated country. Finland's energy consumption in proportion to GDP peaked in 1993; since then the economy has steadily become less energy intensive. The Finnish electricity markets were opened to competition for small consumers in 1998. As a result the price of electricity including tax has dropped by 2-6 per cent and forced suppliers to look into ways in which they can streamline operations, reduce their costs and increase their efficiency through ownership rearrangements.

Electricity consumption amounted to 77.9 TWh in 1999, up by 1.6 per cent on the figure one year previously. Nuclear power was used to generate 22 TWh of electricity (28 per cent of total electricity consumption), hydroelectric power accounted for 12.6 TWh (16.2 per cent). Close on one-third or 32 per cent of the electricity was generated in combined heat and power production. Net imports of electricity amounted to 14.6 per cent or 11.4 TWh. Industry accounted for 54.6 per cent of the electricity demand or 42.5 TWh, households and agriculture for 24.7 per cent and services and the public sector for 17.2 per cent. In 1997 and 1998 the growth in electricity demand exceeded forecasts.

23. Total energy consumption 1999

	PJ	%
Industry	503	50
Heating	225	22
Transport	166	16
Others	124	12
Total	**1 019**	**100**

Figure 18. Total energy consumption in selected countries per GDP unit in 1997



The Finnish Energy Industries Federation Finergy has estimated that in 2015, total electricity consumption in Finland will amount to 97 TWh, 25 per cent up on the current figure. The Ministry of Trade and Industry's basic scenario arrives at roughly the same figure. According to the energy strategy currently in force in Finland, energy consumption in 2015 will be around 92 TWh. To bridge this gap so that the consumption figures indicated in the basic scenario can be reduced to this level, it will be necessary to introduce stringent savings and steering mechanisms, including tax increases and stricter norms. The Finergy forecast is based on the premise that increasing industrial production leads to increased consumption, as does the declining average size of families and the increased ownership of electronic equipment in households. In particular, it is expected that the energy-intensive forest industry will increase its consumption.

Use of fossil fuels

Much of the environmental damage caused by energy production is due to the use of fossil fuels. The adverse environmental impacts resulting from the accelerating use of fossil fuels are considerable, and in many places they are by now seriously jeopardising the renewal and tolerance of the natural environment. In the light of what we know today there is no threat of fossil energy resources being depleted over the next few decades. Given the known fossil fuel reserves, it is estimated that the world's oil resources will last for the next 40 years, those of natural gas for 55 years and those of coal for 200 years.

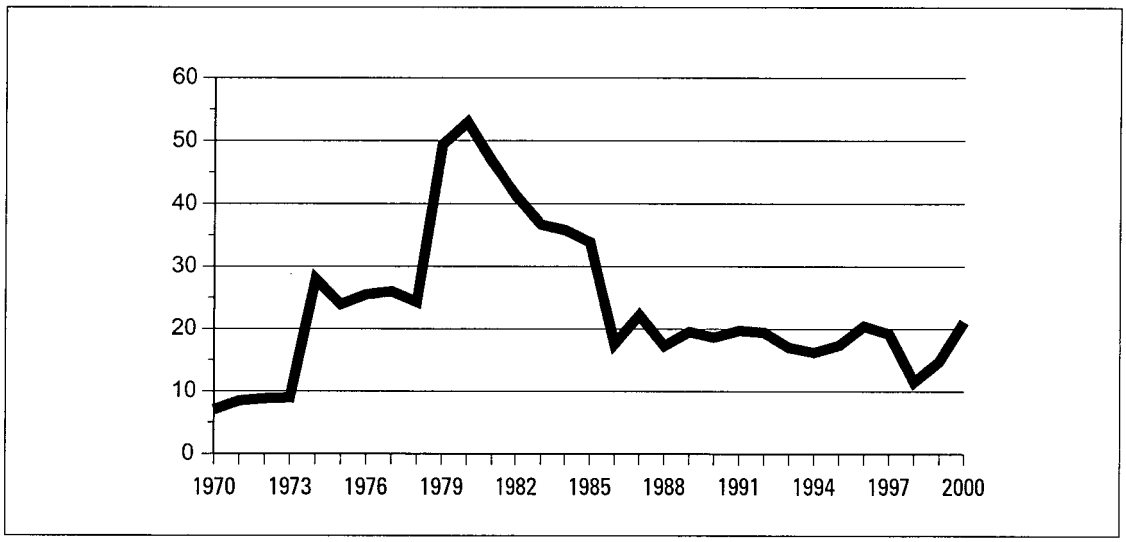
In recent years the world market prices have been rising as a result of a declining supply

24. Total consumption of oil, coal and natural gas in Finland

	Oil million tonnes	Coal million tonnes	Natural gas 1000 million cubic metres
1973	12.3	4.0	–
1980	11.0	6.7	0.9
1985	9.2	6.4	0.9
1990	9.0	6.2	2.5
1995	8.2	6.1	3.3
1996	8.5	7.6	3.4
1997	8.4	7.0	3.4
1998	8.7	5.7	3.9
1999*)	8.7	5.6	3.9

– = not in use. *) = preliminary data.

Figure 19. Trend in real world price of oil (USD per barrel)



and rising demand. In March 2000, the price of crude oil peaked at over USD 32 a barrel. In the late 1990s the supply still greatly exceeded demand and in 1998 the real price of crude oil fell below USD 10 a barrel at the 1996 price of the US dollar. The last time the price was this low was in 1973 ahead of the first oil crisis. In 1999 world production of oil totalled 3.45 billion tonnes.

Oil consumption in Finland peaked in the 1970s at between 10 and 12 million tonnes a year. Consumption figures declined sharply in the 1980s and during the 1990s annual consumption of oil dropped to less than nine million tonnes. The consumption of petrol and lubricants continued to fall in 1999, whereas the use of other oil products increased.

Greenhouse gases

One of the most serious environmental problems caused by fossil fuel use is the development of so-called greenhouse gases and the warming of the atmosphere. An agreement on reducing greenhouse gas emissions was reached in Kyoto, Japan, in December 1997, while the EU Member States' Environment Ministers reached agreement on an internal division of burdens in Luxembourg in June 1998. At the Luxembourg meeting Finland committed itself to reducing its greenhouse gas emissions to the 1990 level by 2008-2012. The Kyoto Protocol identifies emission target levels for six gases: carbon dioxide, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbon (HFC), perfluorocarbon (PFC) and sulphur hexafluoride (SF_6). At unit level the greenhouse effects resulting from other gases are much greater than those from carbon dioxide: for instance, the effects of methane are 20 times greater, those of nitrous oxide over 300 times greater and those of the three other gases 1,000 times greater.

In 1999 the carbon dioxide emissions from Finland's energy production totalled 56 million tonnes, or 1,4 million tonnes less than one year previously. Nonetheless carbon dioxide emissions in 1999 exceeded the baseline figures of 1990 by 2.1 per cent. Preliminary estimates suggest that Finland's greenhouse gas emissions will increase from around 75 million equivalent tonnes of carbon dioxide at baseline in 1990 by 20 per cent or to some 90 million tonnes in 2010 unless additional steps are taken to curb emissions. The biggest challenge is repre-

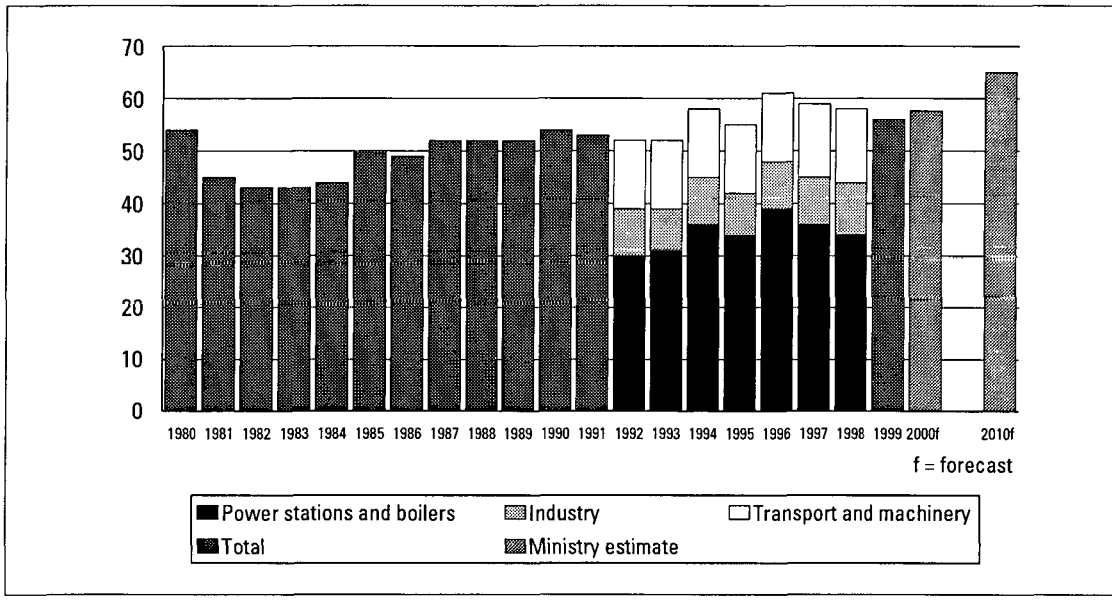
25. Greenhouse gas emissions in the EU countries (million equivalent tonnes of carbon dioxide) and division of burdens by 2008-2012

	Emissions 1998 million tonnes	Change in 1990-1998	Target for division of burdens 2008-2012
Luxembourg	6	-59 %	-28.0 %
Germany	1 022	-16 %	-21.0 %
Denmark	76	9 %	-21.0 %
Austria	80	6 %	-13.0 %
United Kingdom	663	-10 %	-12.5 %
Belgium	145	7 %	-7.5 %
Italy	540	5 %	-6.5 %
The Netherlands	230	8 %	-6.0 %
France	551	1 %	0.0 %
Finland	**76**	**1 %**	**0.0 %**
Sweden	71	2 %	4.0 %
Ireland	64	19 %	13.0 %
Spain	370	20 %	15.0 %
Greece	120	14 %	25.0 %
Portugal	74	18 %	27.0 %
Total	**4 046**	**-2 %**	**-8.0 %**

26. Greenhouse gas emissions in Finland (million equivalent tonnes of carbon dioxide)

	1990	1995	1996	1997	1998	1999
Carbon dioxide (CO_2)	60.8	62.2	68.4	66.2	64.0	64.0
Methane (CH_4)	6.1	4.7	4.5	4.4	4.2	4.4
Nitrous oxide (N_2O)	8.3	7.8	7.9	8	7.9	7.7
Others (SF_6, HFC, PFC)	0.1	0.1	0.1	0.2	0.3	0.8
Total	**75.2**	**74.7**	**81.0**	**78.7**	**76.3**	**76.9**

Figure 20. Carbon dioxide emissions from fossil fuels and peat (million tonnes)



sented by the growth of electricity consumption and road traffic. Work is currently under way in the national climate programme to look into different strategies for reducing greenhouse gas emissions.

Air pollution and acid deposition

Acidification affects the soil and water in those areas of Finland that are the most sensitive and that receive the biggest load. The major sources of acid deposition are emissions of sulphur dioxide and oxides of nitrogen, largely from energy production. In 1998 Finland's sulphur dioxide emissions totalled 89,600 tonnes, 85 per cent less than in 1980. This reduction is the result of changes in the structure of energy production, a decrease in the use of heavy fuel oil, a fall in the sulphur content of fuel as well as improvements in process technology. Finland's sulphur dioxide emissions in proportion to GDP are about one-third smaller than is the average figure for the European OECD countries. Electricity and heat generation account for 28 per cent of the emissions, industry for 37 per cent. Some 12 per cent of the sulphur dioxide deposition occurring in Finland comes from domestic sources, while 68 per cent of its own emissions are deposited outside the country's borders. Finland reached the targets laid down for 2000 in the second sulphur protocol signed in Oslo as early as 1994.

In 1998 Finland's total emissions of oxides of nitrogen were around 252,000 tonnes, or almost 15 per cent less than in 1980. Close on two-thirds or 64 per cent of these emis-

27. Origin of acid deposition in Finland 1997 (per cent)

	Sulphur	Nitrogen
Finland	**12**	**10**
Western Europe	10	36
Russia	26	6
Baltic states	5	3
Other Eastern Europe	7	6
Others (background deposition)	40	29
Total	**100**	**100**

28. Long-range transportation of Finnish emissions in 1997 (per cent)

	Rikki	Typpi
Finland	**22**	**12**
Western Europe	7	8
Russia	18	24
Baltic states	3	3
Other Eastern Europe	3	4
Others (background deposition and seas)	47	49
Total	**100**	**100**

sions were caused by traffic, energy generation accounted for 29 per cent. Measured against the country's GDP, these emissions are comparatively high in Finland, about 70 per cent higher than in European OECD countries on average. About 16 per cent of the deposition of oxides of nitrogen comes from domestic sources, while 81 per cent of Finnish emissions drift across the borders and are deposited in other countries. Finland has achieved the targets set out in the Sofia Protocol according to which emissions were to be halted at the 1987 level by 1994. The European Union adopted a directive on the reduction of emissions from large-scale combustion plants in June 2000. The directive takes account of the BAT requirements and imposes new threshold values for new gas turbines.

Acid deposition has caused damage to a number of fish populations in Finland, and evidence of damage has been observed in some 2000 lakes in southern and central Finland. There have, however, been some signs of recovery during the past few years as a result of reduced airborne loads. The sulphate concentrations in the lakes of southern and central Finland are on the decrease and these lakes' resistance to acidification has improved significantly during the past ten years. In spite of these favourable trends critical loads are still being exceeded in certain parts of Finland in 2000. Improvements have also been recorded elsewhere in Europe, where acid deposition has decreased by 30-40 per cent since the 1980s. The recovery process in North America has been

Figure 21. Finland's sulphur emissions and reduction targets (thousand tonnes of sulphur dioxide)

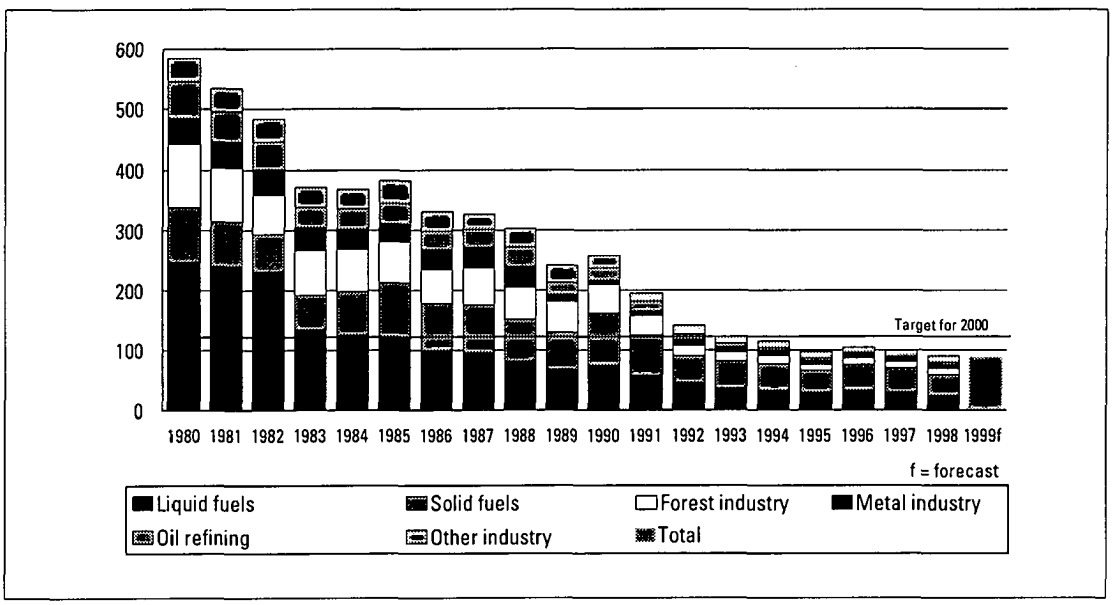
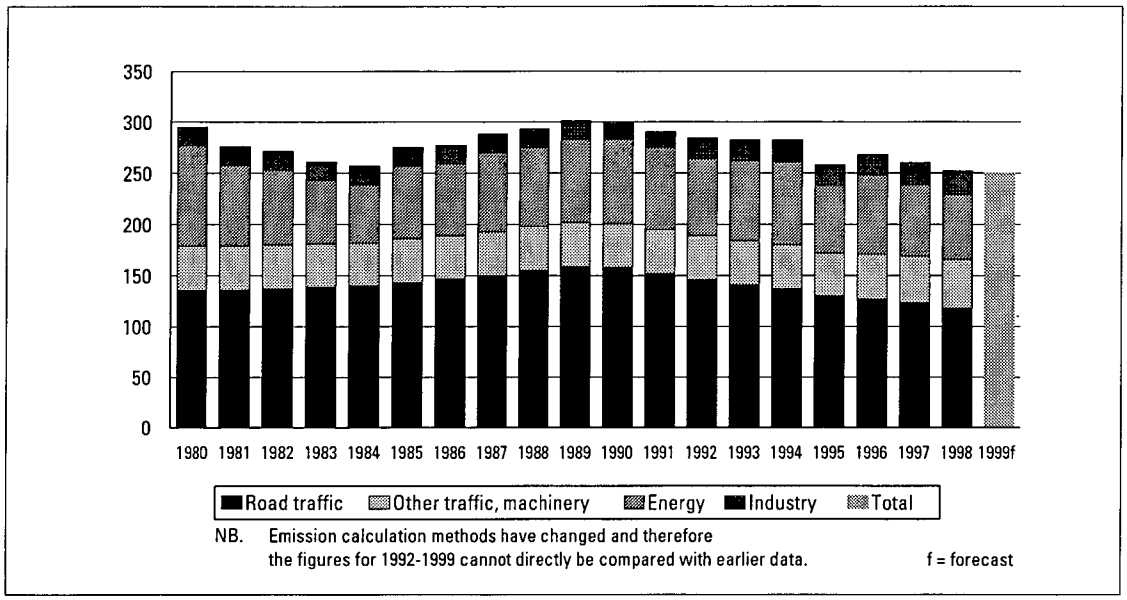


Figure 22. Finland's nitrogen oxides emissions (thousand tonnes)



slower, and the situation there is similar to that experienced in Scandinavia in the 1980s.

In the 1970s and 1980s groundwater pH values showed a slight tendency to decrease in many places around Finland. At the same time the buffer capacity of well water has been reduced. At least in the near future groundwater acidification cannot be expected to pose any major threat to the

29. EU countries' sulphur dioxide, nitrogen oxide and ammonia emissions in 1996 and emission ceilings reported by each country for 2010 (thousand tonnes)

	Sulphur dioxide (SO_2)		Nitrogen oxide NO_2-na		Ammonia(NH_3)	
	Emissions	Emission ceiling	Emissions	Emission ceiling	Emissions	Emission ceiling
Spain	1 685	746	1 203	847	381	353
United Kingdom	2 025	585	2 018	1 167	319	297
Germany	1 543	520	1 887	1 051	649	550
Italy*)	1 322	475	1 768	990	461	419
France	947	375	1 695	810	668	780
Greece	543	523	374	344	107	73
Belgium	242	99	330	176	97	74
Portugal*)	373	160	407	250	97	90
Ireland	147	42	121	65	128	116
Denmark	181	55	291	127	99	69
The Netherlands	135	50	486	260	146	128
Finland	**105**	**110**	**267**	**170**	**35**	**31**
Sweden	78	67	301	148	61	57
Austria	52	39	161	103	76	66
Luxembourg	8	4	22	11	7	7
EU-15	9 386	3 842	11 332	6 519	3 331	3 110

*) = Emission data for 1995.

well-being of the country's forests. The situation may well change in the long term unless deposition levels can be reduced below the critical loads in the whole country.

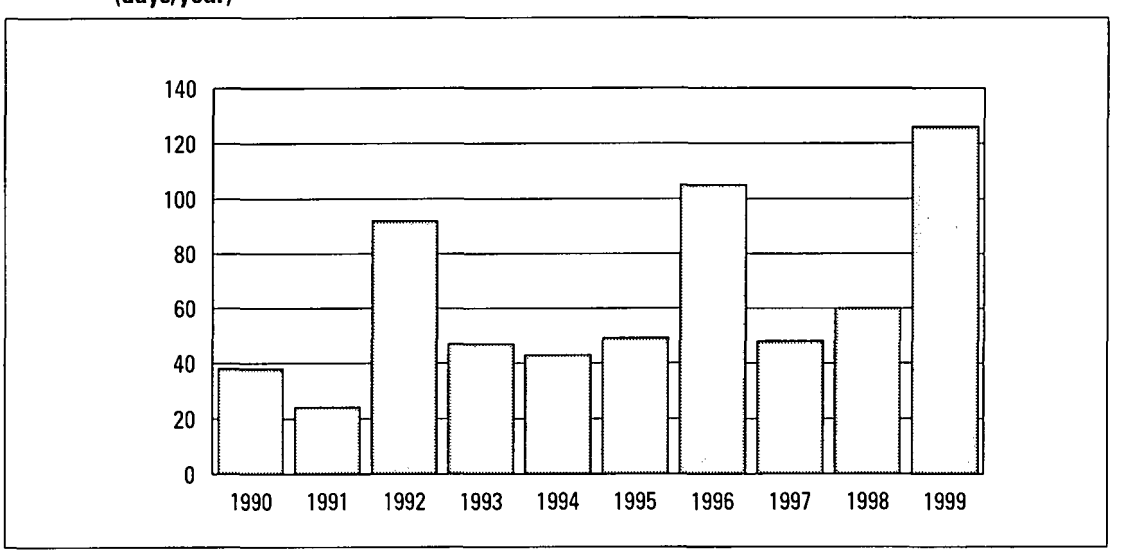
Atmospheric ozone

Along with climate change and acidification, one of the main global threats to the environment is presented by ozone depletion in the upper atmosphere and the formation of ozone in the lower atmosphere. Causing increased ultraviolet radiation that is detrimental to humans as well as to flora and fauna, ozone depletion in the upper atmosphere is expected to gain momentum during the early years of the new millennium, especially over northern regions. In spring 2000 the situation in the northern polar region was much worse than during the two previous years. According to measurements by the Meteorological Institute ozone depletion above Finland reached 35 per cent and locally as much as 60 per cent in March 2000. This, according to the Meteorological Institute, was due to the cold conditions in the stratosphere which favour the same kind of ozone depletion chemistry seen over Antarctica.

Finland currently has stricter legislation than many other EU countries to restrict the use of substances that contribute to ozone depletion. In 1998 the EU Council of Environment Ministers took a decision to further tighten restrictions on the manufacture and use of ozone-depleting substances. For instance, additional restrictions were imposed on methyl bromide and HCFC compounds. The use of methyl bromide will be phased out in the European Union by 2005, and the production of HCFC compounds will be frozen at the current level by 2008 and discontinued by the end of 2025. As a result of this decision the EU exceeds almost all the requirements set out in the Montreal Protocol.

The high ozone concentrations in the lower atmosphere have adverse effects on vegetation and human health. Ozone is formed in the reaction of certain emissions from transport and industry, such as nitrogen oxides and carbon monoxide, with particles in the atmosphere. Experts believe that nitrogen oxide and volatile hydrocarbon emissions from road traffic are the main culprits behind ozone build-up in Western Europe today. In Finland the volume of nitrogen oxides in

Figure 23. Excessive ozone content recorded in the lower atmosphere at certain observation stations (days/year)



particular is crucially important to ozone formation. The formation of ozone is by nature a non-linear process and largely depends on the meteorological conditions and background concentrations in the northern hemisphere. For this reason it is not always easy to establish clear links of causation between emissions and concentrations.

It is estimated that during the crop growing season, critical ozone exposure times are exceeded almost every year in Finland. Critical exposure levels for forests are exceeded in southern and central Finland, especially during hot, sunny summers. The health threshold identified in the EU ozone directive is repeatedly exceeded every year over large areas of Finland. The only way that ozone concentrations in the lower atmosphere can be significantly reduced is through a marked reduction in emissions of nitrogen oxides and volatile hydrocarbons throughout the northern hemisphere.

Sustainable energy supply

The promotion of renewable energy sources and increased efficiency in energy use are key conditions for sustainable development.

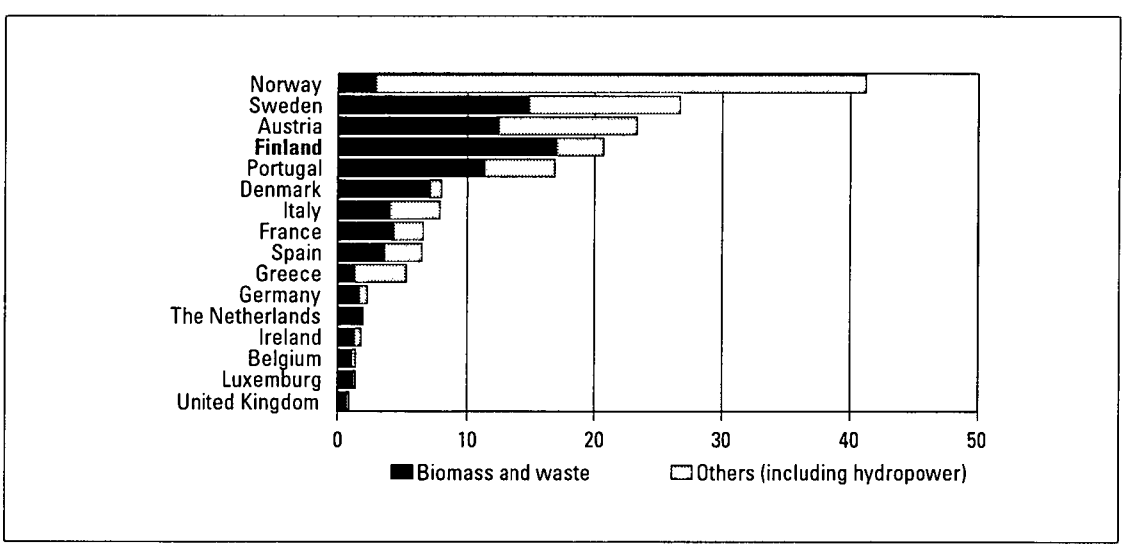
The European Union promotes the use of renewable energy sources, solar energy, wind power, biomass and waste, geothermal energy and small-scale hydroelectric schemes and related trade in equipment and technology through the ALTENER III research programme. The EU's SAVE programmes are aimed at promoting the conservation of energy. ALTENER III was

30. Annual increase in world wind and nuclear energy capacity in 1990-2004*) (MW)

	Wind energy	Nuclear power
1990	200	2 421
1991	240	2 246
1992	338	3 092
1993	480	5 035
1994	730	1 300
1995	1 290	0
1996	1 292	1 406
1997	1 566	4 380
1998	2 597	3 697
1999	3 922	..
2000**)	4 885	..
2001**)	5 825	..
2002**)	6 095	..
2003**)	7 600	..
2004**)	9 175	..

*) = construction under way .. = data not available.
**) = estimated start of construction.

Figure 24. Renewable energy sources as a proportion of total energy consumption in 1997 (per cent)



launched in January 2000 as part of a framework energy programme. The budget for ALTENER research programmes in 1998-2002 totals EUR 77 million. According to a proposal made by the EU Commission in May 2000, the Union's aim is to increase the proportion of renewable energy sources from the current level of 6 per cent to 12 per cent by 2010.

Between 1998 and 2010, the EU will also be working to promote the introduction of renewable energy sources by a major campaign to boost investments in which the aim is to build one million solar panel systems capable of generating 1KWh of electricity, 10,000 MW of wind power capacity, 10,000 MW of biomass capacity and 100 model communities relying exclusively on renewable energy. All in all it is estimated that the achievement of the target of 12 per cent by 2010 will require investments totalling around ECU 165 billion.

The commercial utilisation of wind and solar energy began in the 1980s and has since then expanded very rapidly. The costs of generating wind energy have dropped by as much as 30-40 per cent since the early 1990s, and the joint body for research centres working on renewable energy under the auspices of the EU expects production costs to fall to the same level as in condensing power plants by 2005. The technology that is needed for the large-scale exploitation of solar energy is already available, although some of it is still at the laboratory stage.

According to a report published by the Technical Research Centre in May 1999, an increase of 50 per cent in the use of renewable energy sources by 2010 would be possible in Finland at a relatively low cost. The majority or 90 per cent of the increase would come from bioenergy, three per cent from wind energy, three per cent from hydropower, four per cent from heat pumps and less than 0.5 per cent from solar energy. The target would imply an increase of 3-4 percentage points in the use of renewable energy sources as a proportion of total energy consumption compared to 1995. Biofuels emit less harmful greenhouse gases and sulphur into the air than fossil fuels. The net greenhouse gas emissions of bioenergy are close to nil when biofuels with a low degree of refinement are used.

Finland has both the know-how and the wind conditions to be able to achieve a rapid increase in the use of wind energy over the next few years. Indeed the country's wind energy capacity has been increasing very rapidly: in 1998 it stood at 17 MW, by 1999 the figure had climbed to 38 MW. In 1999 Finland produced 41.6 GWh of energy by wind power. The country also has a high standard of know-how in the field of solar energy. Current applications of solar energy are mainly in the provision of electricity for summer cottages and remote regions. A total of some 35,000 solar panel units have been sold to generate electricity for summer cottages, solar energy is used to light 1,500 shipping beacons and four experimental solar power stations have been connected to the electricity network. Electricity companies are also offering clients the option of purchasing 'green electricity' generated by means of old hydropower, wind and solar energy.

Although Finland's energy supply system relies largely on conventional forms of energy, it is nevertheless highly efficient, particularly on account of the co-generation of heat and energy. One-third or 33 per cent of all electricity in the country is generated in combination with heat. In 1998 industry accounted for 12 TWh of this, community district heating for 13 TWh. These co-generating plants generated a total of 23 TWh of district heating. All in all the consumption of district heating in 1999 amounted to 26.9 TWh. Some 44 per cent of the population live in housing connected to a district heating system: in Helsinki the figure is 93 per cent of the population, in Tampere 71, in Lahti 90 and in Oulu 81 per cent. The mean price of district heating in 1998 was FIM 0.192 per kWh.

Energy taxes

As well as levying taxes on transport fuel, the Finnish energy taxation system focuses heavily on the end product, i.e. electricity. Electricity tax is divided into a lower and higher bracket. The lower applies to industry and market gardeners using hothouses, the higher tax is applied to households, the service sector, agriculture and the public sector. In contrast to the situation in electricity generation, the tax on fuels used to produce heat is levied according to its carbon content. The tax is FIM 102 per tonne of carbon dioxide tonne.

The electricity surtax payable by industrial companies and private consumers was increased by an additional 24 per cent from the beginning of September 1998. This rise was offset by reducing the basic tax on transport fuels so that the overall tax burden remained unchanged. Higher taxes were also levied on coal, peat and natural gas for the production of heating energy. The principle behind the increase in electricity tax has been to encourage the use of renewable energy sources. Indeed the tax refund on electricity generated by wind was increased from two to four pennies per KWh.

In January 2000 the Ministry of Finance appointed a working group to identify and resolve problems in the existing energy taxation system and to draft the necessary changes in legislation and guidelines. The working group is due to submit its report in May 2001.

31. Finland's energy tax revenue 1999 excluding natural gas (FIM million)

	Basic tax	Surtax	Maintenance support fee	Total
Petrol				
– unleaded	7 546	592	99	8 237
– leaded	0	0	0	0
Diesel	3 153	559	44	3 756
Light fuel oil	303	750	59	1 112
Heavy fuel oil	–	315	20	335
Coal	–	281	8	289
Peat	–	88	0	88
Total	**11 002**	**2 585**	**210**	**13 797**

– = not in use.

32. Development of energy taxes in Finland

	1.1.1997	1.1.1998	1.9.1998
Petrol (p/litre)	308.3	328.3	328.3
Diesel (p/l)	63.5	178.5	178.5
Light fuel oil (p/l)	29.0	32.7	37.9
Heavy fuel oil (p/l)	22.1	25.8	32.1
Coal (FIM/tonne)	169.0	198.6	246.0
Peat (FIM//MWh)	4.2	4.9	9.0
Natural gas p/m^3	7.1	8.3	10.3
Electricity, tax bracket I (p/kWh)	3.1	3.3	4.1
Electricity, tax bracket II (p/kWh)	1.675	2.02	2.5

6 Transport

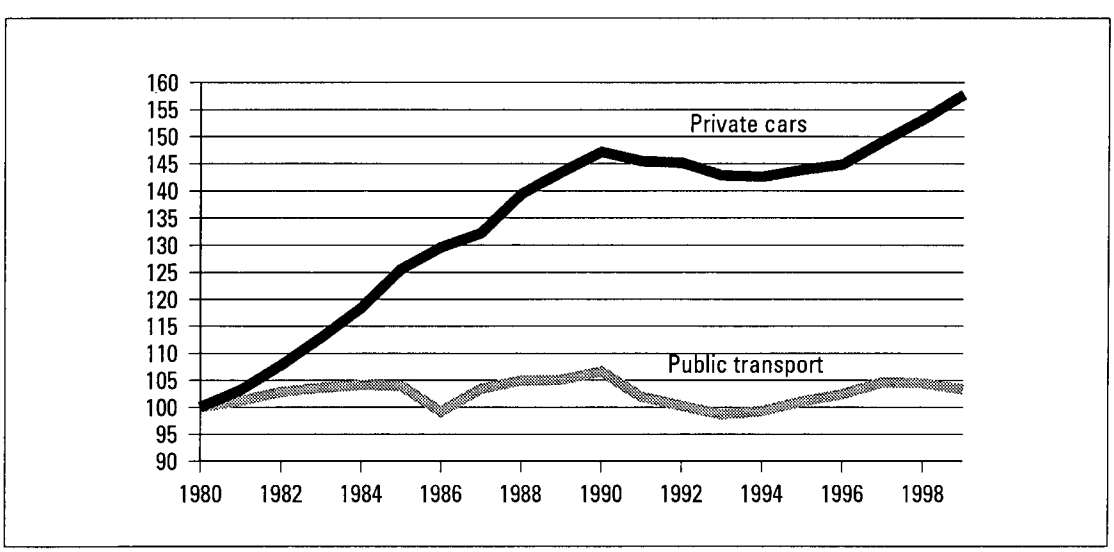
Trends in traffic volumes

The annual distance travelled per head of population in Finland is one of the highest in the European Union: on average Finnish people travel 14,500 km a year, while the average for the EU countries is around 13,000 km. In 1989-1999 the daily distance travelled in Finland was around 45 km compared to no more than 10 km in 1980. The number of trips has remained unchanged since the 1970s: every day people make around three trips within Finland. The volume of goods transport in Finland is also higher than in the rest of Europe: the total number of tonne kilometres is some 70 per cent higher than the average for the EU countries. The reasons for these high mobility figures include the country's high level of economic activity and its decentralised regional and community structure.

The growth of transport is seen most clearly in road traffic, which has increased by more than 30 per cent at the same time as the figures for other forms of transport have declined. In 1998 private cars accounted for 81 per cent of domestic per capita passenger traffic; the corresponding figure for buses and coaches was 12 per cent, railways 5 per cent, air transport 2 per cent and water transport 0.2 per cent. It is predicted that by 2010, passenger traffic will increase by 15 per cent and freight transport by 27 per cent.

The efficiency of the transport system has increased during the 1990s and costs have decreased by almost 10 per cent. Most exports and imports are conveyed by sea. The proportion of the total internal freight transport per capita that takes place by road has remained almost unchanged at 65 per cent throughout the 1990s. Railways account for one-quarter of all internal goods transport. This is a far greater proportion than in Central European countries where no more than 14 per cent of internal freight is carried by rail. Nonetheless freight costs in Finland are 2-3 times higher than in most competing countries in Europe.

Figure 25. Trends in the use of public transport and private cars (1980=100)



Environmental impact

- Transport has the following environmental effects:
- greenhouse gas emissions,
- other exhaust gas emissions detrimental to the environment or human health: oxides of nitrogen, sulphur dioxide, hydrocarbons, carbon monoxide and particles,
- noise,
- impacts on waterways, the soil, natural resources and biodiversity,
- impacts on the social environment.

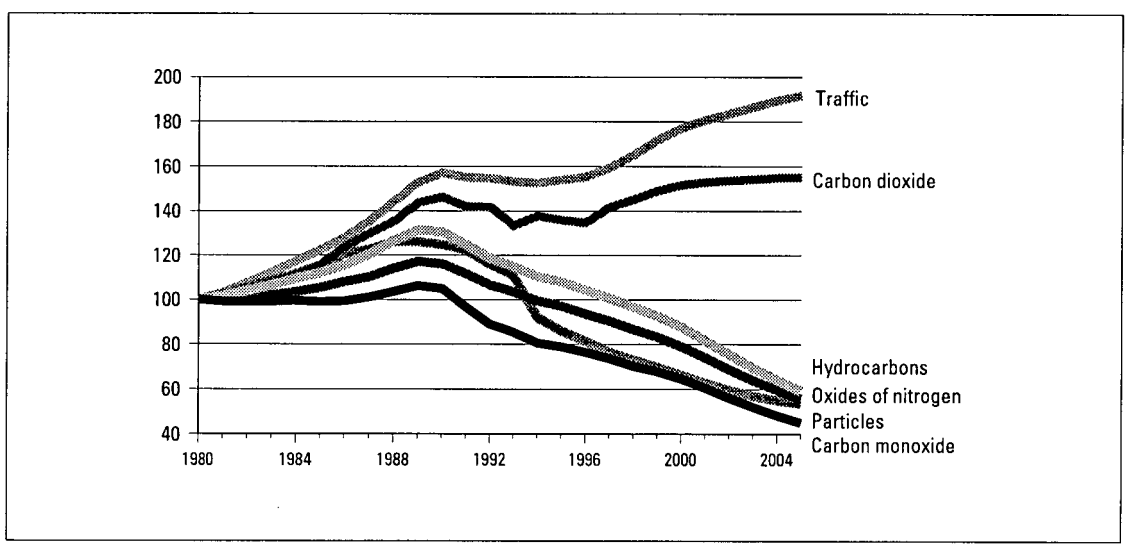
Considerable efforts have been invested in reducing the adverse environmental impacts of transport. The Government's transport-related sustainable development obligations are defined in the Ministry of Transport and Communications environment programme published in September 1999. This programme lays the foundation for the environment system within the Ministry's administrative sector. The programme's follow-up report will be out in June 2000, providing evidence for the first time on target attainment in the light of selected environment indicators. The system closely integrates environmental issues with the planning, development, implementation and follow-up of the transport sector's operations. Institutes and corporations under the Ministry of Transport and Communications will complement this umbrella programme with their own programmes and environment systems.

The environmental policy pursued in the traffic sector has already had some success in reducing transboundary pollution and emissions of certain heavy metals, for instance. Road vehicle emission limits were tightened quite considerably in the 1990s, which led to the introduction of new, cleaner fuel qualities as well as vehicles equipped with catalytic converters or improved engines. New, stricter EU fuel quality requirements will be phased in during 2000 and 2005. Indeed lead emissions from petrol en-

33. Traffic emissions as a percentage of total emissions in Finland

Type of emission	% attributable to traffic
Carbon dioxide	20
Oxides of nitrogen	60
Hydrocarbons	60
Carbon monoxide	75
Sulphur dioxide	20

Figure 26. Trends in emissions from road traffic (1980=100)



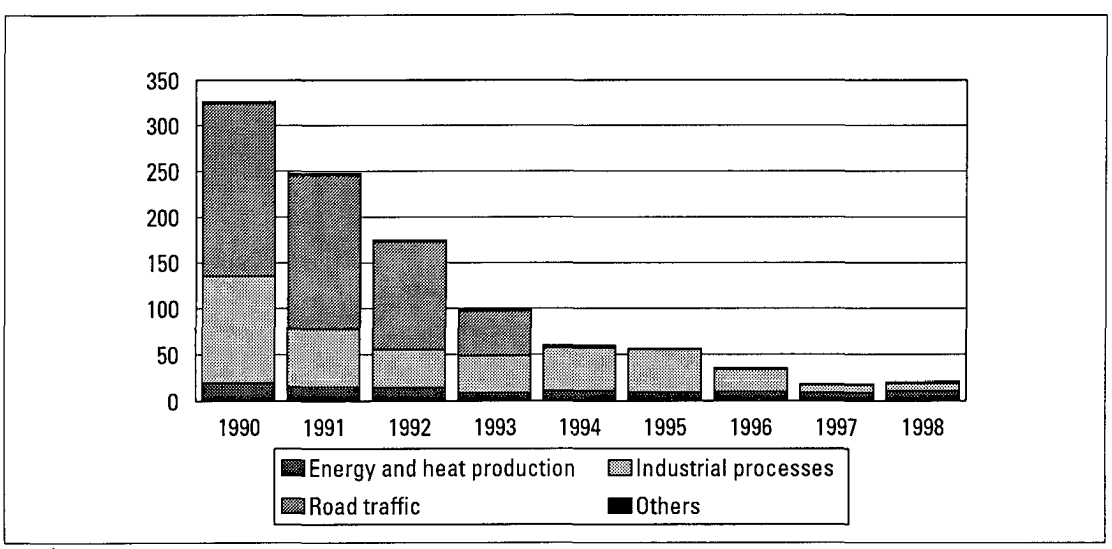
gines and sulphur emissions from diesel engines have been almost entirely eliminated through fuel changes. The introduction of catalytic converters has in turn reduced emissions of nitrogen oxides, hydrocarbons, carbon monoxide and particles. Vehicles equipped with catalytic converters now account for well over half of total passenger traffic. It is expected that all petrol cars will be fitted with catalytic converters by 2010.

Emission limits will be further tightened over the next few years. In summer 2000 Finland will be adopting a revised emission directive concerning heavy vehicles which will bring a 30 per cent reduction in exhaust gas emissions from heavy goods vehicles and buses and coaches in 2001. In 2006 emissions from new cars will be further reduced by 30 per cent and particle emissions by 80 per cent. A 40 per cent reduction in oxides of nitrogen emissions will enter into force in 2009. Earlier decisions will see stricter emission limits brought in for passenger cars and light commercial vehicles in 2001 and 2006.

However, not all the environmental problems caused by transport can be resolved by means of technology alone. For instance, the reduction of carbon dioxide emissions, noise and problems related to land use are broader and more complex issues that are harder to resolve than the more 'traditional' environmental problems: a major challenge indeed for transport policy in the 21st century. In the future special attention should be paid to air quality and noise abatement in urban areas. Improvements in fuel quality and engine technologies mean that air quality norms are nowadays exceeded less often, but the limits for particles and oxides of nitrogen are still sometimes exceeded. Another major problem with regard to air quality in urban areas is ozone, which is produced in the reaction of traffic and industrial emissions (particularly oxides of nitrogen) with particles in the atmosphere. Ozone has adverse effects on both the flora and human health. However, most of the ozone in the lower atmosphere originates from other countries. The problems of noise pollution caused by traffic will continue to increase with the ever-increasing number of people and vehicles in cities. The noise problem has so far been tackled primarily by technical innovations and noise barriers, but in the future it is clear that urban and community planning will need to play a more prominent role.

The de-icing salt that is used on Finnish roads in the winter, amounting to some

Figure 27. Trend in total emissions of lead in Finland (tonnes)



119,682 tonnes in 1997 and 102,130 tonnes in 1998, also has major environmental impacts. About half of the country's important groundwater areas have roads that are de-iced in the winter. An extensive research programme was launched in 1992 to explore the long-term adverse effects of road salt on groundwater reserves. The results showed that the chloride content of water at 25 per cent of the 250 groundwater supply plants exceeded the norm. Work is currently under way to study the feasibility of alternative de-icing substances in Finland. Airports received instructions on alternative de-icing methods in 1996.

Emissions from air traffic are continuing to increase. Air traffic within Europe increased by 40 per cent between 1993 and 1997, air travel to destinations outside the EU area by almost the same amount. It is predicted that over the next few years air traffic in Europe will continue to increase by 6-8 per cent a year, which, according to an EU survey, will lead to a 3-4 per cent annual increase in carbon dioxide emissions. The growth of air traffic is effectively cancelling out the reductions in emissions achieved through the improved fuel efficiency of modern aircraft engines. A communication by the EU Commission in December 1999 aims to encourage greater environmental efforts in the air traffic sector. The concrete measures that will take effect during 2000 will be aimed at boosting the environmental efforts within the International Civil Aviation Organization (ICAO) and to establish uniform and comprehensive procedures for the treatment of environmental issues related to air traffic in the Member States.

34. Material flows in road maintenance (thousand tonnes)

	1997	1998
Construction		
Aggregates from outside	6 051	7 703
Surfacing materials	1 082	722
Maintenance		
Salt	120	102
Grit	646	611
Waste collected	11	13

35. Emissions from water transport in Finland 1998 (thousand tonnes)

	Carbon monoxide	Hydro-carbons	Nitroen dioxide	Sulphur dioxide	Carbon dioxide
Passenger vessels	1.4	0.5	18.5	2.6	845.8
Freighters	1.9	1.0	41.0	15.2	1 546.5
Pleasure craft	2.1	0.8	1.3	0.1	164.4
Fishing and work vessels	0.4	0.1	3.0	0.1	138.7
Ice-breakers	0.1	0.0	1.6	0.2	55.2
Total	**25.9**	**2.4**	**65.4**	**18.2**	**2 750.6**

On the railways, work is continuing to reduce the environmental impact of rail traffic by means of electrification. Railway noise is being reduced by polishing tracks. Shipping is becoming responsible for an increasing proportion of total emissions: for instance, over 90 per cent of all sulphur emissions in the transport sector can be traced to this source. In international shipping the sulphur content of fuels must not exceed 4.5 per cent, the limit set for the Baltic Sea is 1.5 per cent.

The issue of combating climate change gained increased prominence in the late 1990s with the adoption of the Kyoto Protocol. Carbon dioxide emissions are increasing all over the world in spite of all the technological advances that are being made. Using IPCC's criteria, transport currently accounts for around 20 per cent of Finland's carbon dioxide emissions, and road traffic is responsible for 96 per cent of total transport emissions. It is predicted that these emissions will increase by as much as 24 per cent by 2010 in spite of the improving energy efficiency of new vehicles. In 1999 a special working group was set up to discuss ways of reducing carbon dioxide emissions in the transport sector. In its report the working group introduced eight clusters of measures that could help to reduce carbon dioxide emissions from road traffic: these were the

taxation of road traffic (traffic pricing), the promotion of economic driving, the development of bicycle and pedestrian traffic, the development of public transport, the intensification of good transport, the development and proliferation of information technology, the integration of the community structure and other measures. The transport sector will be preparing its own programme as part of the national climate programme during 2000.

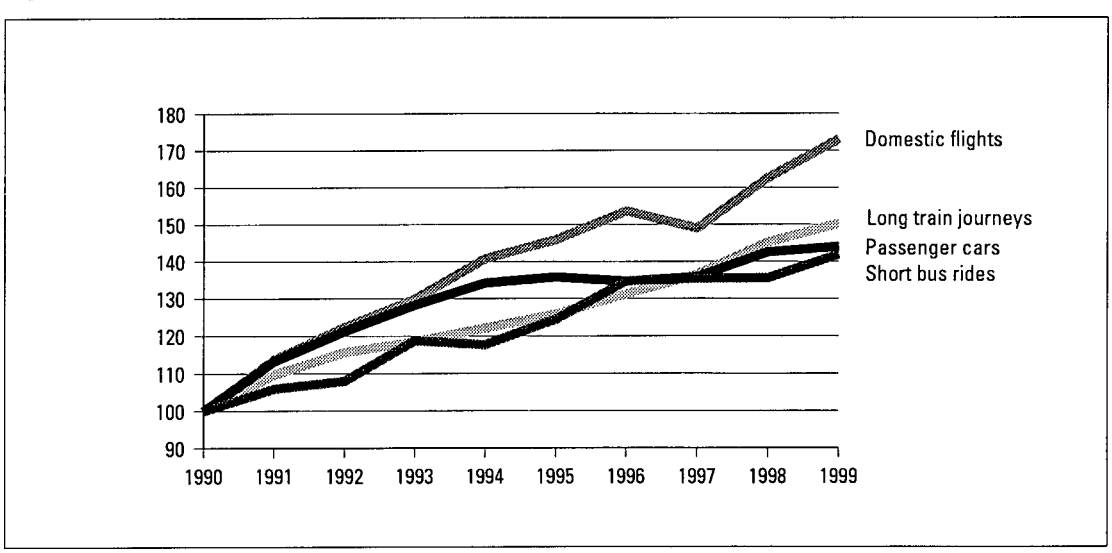
At EU level a strategy has been developed for the reduction of carbon dioxide emissions from private cars. To this end the European Union has signed voluntary agreements with the automotive industry. It has been agreed with European manufacturers that average carbon dioxide emissions from new vehicles will be reduced to 140 g/km by 2008; with Asian manufacturers the target shall be reached by 2009. In 2003 and 2004 there will be further discussions to see whether the targets can be further reduced to 120 g/km by 2012. The EU strategy is backed up by a system for monitoring carbon dioxide emissions and rules concerning the information to be provided to consumers on the fuel economy of new cars.

Efforts will be continued to support the transport sector's environmental policy through various research programmes. Examples include the LYYLI research project in which the aim is to define a community structure and transport system that is favourable to the environment, the technology-oriented Mobile 2 and Promoter programmes, the URBAN research programme, the environmental cluster programme, a programme called LINKKI in which the focus is on energy conservation, FIGARE and CLIMTECH which are concerned with combating climate change, the FIBRE programme which is exploring issues of biodiversity, and finally SYTTY where the chief concern is with environmental health.

Transport costs and taxation

The pricing of traffic through various kinds of taxes and fees is an important means of steering consumption in an environmentally friendlier direction. In Finland environmental taxes and fees are applied to road traffic, rail transport and in part to water transport. There are basically three types of road traffic tax, i.e. taxes are levied on acquisition, ownership and use. One way to increase the pop-

Figure 28. Trends in prices of different forms of transport (1990=100)



36. Special taxes levied on road traffic (FIM million)

	1995	1996	1997	1998	1999	2000	2001
	A	A	A	A	A	B	BP
Vehicle licence tax	1 046	1 110	1 129	1 198	1 125	1 270	1 345
Diesel engine vehicle tax	668	929	980	1 042	1 101	1 090	1 190
Excise duty/VAT on motor vehicle tax	590	792	924	1 157	1 345	1 408	1 474
Motor vehicle tax	2 685	3 611	4 210	5 259	6 115	6 400	6 700
Excise duty/VAT on fuel tax	2 188	2 425	2 527	2 536	2 643	2 642	2 662
Fuel tax	9 946	11 021	11 487	11 528	12 014	12 010	12 100
Total	**17 123**	**19 888**	**21 257**	**22 720**	**24 343**	**24 820**	**25 471**

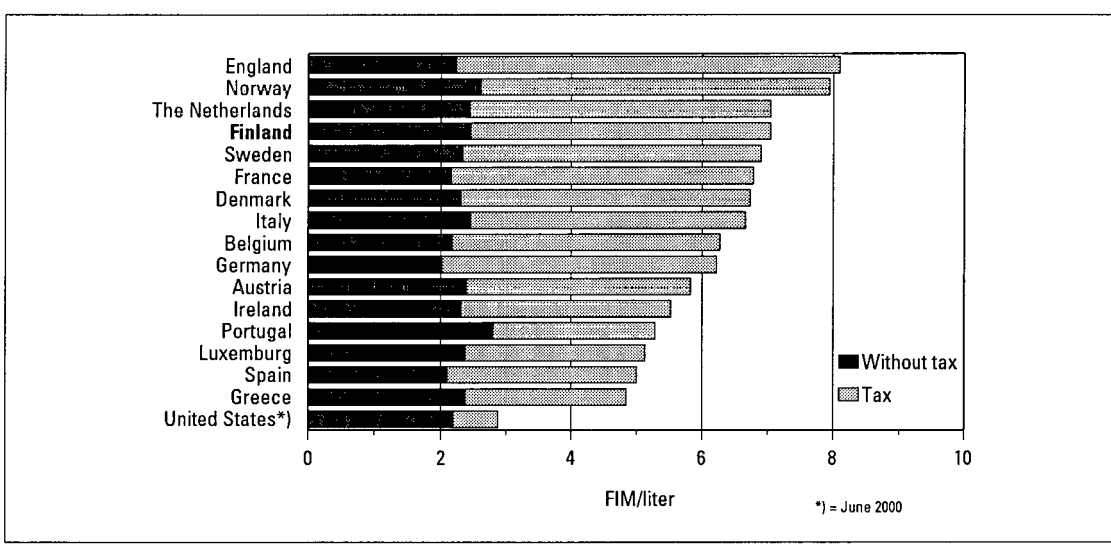
A = Final accounts. B = Budget. BP = Budget proposal.

ularity of new cars with a low fuel consumption might be to introduce tax incentives that would encourage consumers to buy certain types of vehicles. In 1998 more than FIM 12.2 billion was spent on the maintenance of transport routes: FIM 4.1 billion on roads, FIM 3.1 billion on streets, FIM 2.5 billion on railway tracks, FIM 0.6 billion on waterways, FIM 1.2 billion on air traffic and airports and FIM 0.8 billion on harbours.

The tax on fuel is the main source of revenue from the special taxes levied on road traffic: taxes currently make up around 70 per cent of the price of unleaded petrol in Finland. This is the fourth highest proportion in the EU countries after England, Norway and the Netherlands. The tax on diesel is slightly lower than the average for EU countries. Fuel taxes are graded on environmental grounds. As a result reformulated, oxygenated petrol and sulphur-free diesel have in practice taken over from older fuel qualities.

In its White Paper on fair payment for infrastructure use in summer 1998, the EU Commission calls for the harmonisation of charging mechanisms in different modes of transport with a view to creating an equitable pricing system leading to economic efficiency. The marginal social cost charging

Figure 29. Retail prices of motor fuel (95E) on 15 July 2000 (FIM per liter)



principle is considered to meet these criteria. According to the Commission the taxes and fees imposed on different modes of transport should also cover external costs, i.e. costs arising from emissions, noise, congestion and accidents that are not met directly by those causing them. Since the publication of the White paper a number of projects have been launched that are aimed at harmonising principles of calculating marginal social costs and at exploring the practical impacts of the proposed measures in the Member States. According to the valuation principles currently in use, road traffic in Finland covers the average incidental costs it causes.

The adverse environmental impacts of traffic can be reduced not only by economic instruments but also by changing the relative proportions of different modes of transport and by improved planning of community structures. The total value of civil engineering in Finland in 1998 was FIM 19.5 billion. Attempts are now being made to prevent the environmental problems caused by land use for transport purposes by developing a system for advance assessment of the environmental impacts. More than half the environmental impact assessments completed or in preparation are concerned with transport projects.

7 Towards sustainable development

An active policy of environmental protection during the past two decades has helped considerably to reduce the extent of environmental damage caused in Finland. Even though the economy has been booming and production volumes increasing, the environmental load has remained at the low level achieved or even declined. The biggest future challenges are to contain the growth of greenhouse gas emissions, to reduce the volume of waste through increased eco-efficiency and to halt the decline in biodiversity. However, in spite of the continuing decrease in the environmental load, the existing pollution and waste load in the environment still presents a major burden. New pressure on the environment will be created by the predicted increase in the use of natural resources, traffic and total energy consumption. Indeed there is a very real threat that strong economic growth will lead to an increase in environmental damage – unless we have in place a far-sighted, preventive environmental policy.

During Finland's Presidency of the European Union in the latter half of 1999, agreement was reached, among other things, on the recycling of scrap vehicles, the expansion of environmental impact assessment to certain plans and programmes and on a recommendation concerning the minimum requirements of environmental audits. In addition, the European Council meeting in Helsinki requested the EU Commission to start drafting a proposal for the European Union's sixth Environment Action Plan. This plan is due to be completed by the end of 2000. The Commission is also working on a proposal for a long-term strategy of sustainable development that would closely integrate economic, social and ecological policies. Scheduled for 2001, this strategy will tie in closely with the Union's sectoral policies. At the same time the strategy represents the Community's contribution to the ten-year follow-up of the Rio process in 2002. Furthermore it is the Union's aim that the Kyoto Protocol shall be ratified and that it shall take effect in 2002. This will require considerable efforts by all countries participating in the sixth Conference of the Parties in The Hague in autumn 2000.

In certain areas the success of the European Union's environmental policy has been less than satisfactory. The first strategies for the integration of the environmental dimension into sectoral policies were introduced to the European Council in Helsinki. The new and revised sectoral reports will be brought to the Gothenburg meeting of the European Council in 2001. The sixth Environment Action Plan and the strategy for sustainable development will also be discussed at the same meeting. Indeed the state of the environment remains a major concern within the European Union. In general many of the trends in development in environmental matters today are contradictory and it is extremely difficult to form a full and reliable picture of the true state of the environment. It is for this purpose that different kinds of environmental indicators have been developed.

One of the most important tasks that lies ahead in the near future, both in Finland and internationally, is to draw an overall picture of the state of the environment and the threats on the horizon. The follow-up meeting to the Rio Environment and Development Conference in 2002 will be aiming to draw such a picture of the results achieved within the framework of sustainable development and the state of the environment. Work is currently under way to develop the tools and methods needed for this analysis. The UN Commission on Sustainable Development started its work to develop indicators of sustainable development in 1995. UN Member States were asked to test a preliminary battery of 134 indicators. The aim of the UN CSD is to reach agreement on the

available indicators of sustainable development by 2001. Finland was involved in testing these indicators in 1996-1999. In addition, the UN, the World Bank, the OECD and Eurostat, the EU's statistical agency, will be publishing revised guidelines for the calculation of an environmentally adjusted, green GDP in summer 2001.

Principal agreements on the conservation of natural resources and the environment to which Finland is committed

Agreement	Objectives	Implementation
Climate change Kyoto Protocol on Climate Change, 1998.1998.	To stabilise greenhouse gas concentrations in the atmosphere at a safe level. The aim is to reduce greenhouse gas emissions by at least 5 per cent from the 1990 level by 2008-2012. The target varies from country to country. For the EU countries the aim is a reduction of 8 per cent. Finland is to stabilise its emissions at the 1990 level.	The Protocol has not yet entered into force. The signatories will implement their emission reductions through a policy and measures adjusted to their national conditions. The Protocol also allows for emissions trading, the rules of which were agreed upon in Buenos Aires in1998.
Substances depleting the ozone layer in the upper atmosphere Montreal Protocol, 1987.	To arrest the depletion of the ozone layer and to restore it to a level which is safe from the point of view of human health and the environment. To restrict and eventually stop the manufacture and consumption of substances that affect the ozone layer.	Substances causing depletion of the ozone layer are no longer manufactured in Finland, and the import of CFC substances and halogenated hydrocarbons has decreased by over 95 per cent since 1990. The use of such substances has been restricted by decision of the Council of State. The most recent restrictions concern HCFC and HBFC compounds and methyl bromide.
General agreement on long-distance transport of air pollution across national boundaries: ECE		
International Protocol on the Control of Volatile Organic Compound Emissions and their Transboundary Fluxes, 1991.	To cut down emissions of volatile hydrocarbons by 30 per cent from the 1988 level by 1999.	The Protocol took effect on 29.9.1997.
Protocol on heavy metals.	To restrict emissions of mercury, cadmium and lead into the atmosphere.	Finland signed the Protocol in June 1998.
Protocol on non-degradable organic compounds (POP).	To restrict or discontinue the use of non-degradable organic compounds.	Finland signed the Protocol in June 1998.
Sulphur Reduction Protocol, 1994.	To ensure in the long run that sulphur deposition does not exceed the critical load for each area. The first step will be to reduce the excess by 60 per cent by 2000. To this end Finland is committed to cutting down its sulphur emissions by 80 per cent from the 1980 level by 2000.	The Protocol took effect in August 1998. Finland's emissions in 1998 were already 85 per cent lower than in 1980. However, further steps will be needed to keep emissions at this level.

Agreement	Objectives	Implementation
Protocol on the Control of Nitrogen Oxide Emissions and their Transboundary Fluxes, 1988. Declaration on the reduction of nitrogen oxide emissions, 1988.	Finland committed itself to freezing its emissions of oxides of nitrogen to the 1987 level by the end of 1994. In the declaration Finland announced its intention to reduce emissions by 30 per cent from the 1980 level by 1988.	In 1998 oxides of nitrogen emissions were 13 per cent below the 1987 level.
Gothenburg Protocol to abate acidification, eutrophication and ground-level ozone, 1999.	To cut emissions of sulphur dioxide, nitrogen oxides and volatile organic compounds (VOC) and ammonia for 2010. Finland's emission ceilings as from 2009 are 116,000 tonnes of sulphur, 170,000 tonnes of nitrogen oxide, 130,000 tonnes of VOC and 31,000 tonnes of ammonia.	Finland signed the protocol in December 1999.
Biological diversity		
Agreement on Biological Diversity, 1992.	To protect the diversity of global ecosystems, animal and plant species and their genes, to establish a pattern for their sustainable use and to achieve an equitable division of the benefits gained from the use of biological natural resources.	A national action programme on biological diversity for 1997-2002 was completed in 1997. Finland's country report assessing the state of biodiversity was submitted in 1998. The follow-up group submitted its first report in spring 2000. The Academy of Finland biodiversity research programme (FIBRE) will be carried out in 1997-2002.
Biosafety Protocol, 2000.	To make sure that the import of genetically modified organisms is safe in terms of both biological diversity and human health.	The Protocol was signed in spring 2000.
Protection of the Baltic Sea Helsinki Convention, 1974. Helcom Recommendations 1980 –. Ministerial statements 1988, 1998. Baltic Environmental Programme 1992. Baltic Protection Programme 1992.	To reduce emissions of nutrients, heavy metals and non-degradable or toxic substances into the Baltic Sea by 50 per cent, to eliminate hazardous substances within one generation and to protect the marine environment.	The targets will be pursue by integrating them into national legislation and programmes and into decisions of the Water Court in individual cases, and by economic incentives and the dissemination of information.
Hazardous waste Basel Agreement on the Transboundary Transport of Hazardous Waste and Supervision of its Handling, 1989. Protocol on liability and compensation for damage, 1999.	To reduce the production of hazardous waster and its transportation from one country to another and to prevent its conveyance to countries that lack the facilities for handling it properly.	Finland has a sufficient number of facilities for the final processing of hazardous waste, so that only an extremely small proportion of such waste has had to be processed overseas. Most of the waste exported, a total of 30,000-50,000 tonnes a year, was sent to Western European countries. Exports of hazardous waste to non-OECD countries is prohibited by law.

Statistical appendix

1. World's carbon dioxide emissions from fossil fuels 1900-1999 (millions of tonnes)

	Total	Industrial-ised countries	Developing countries	Former East Bloc countries
1900	1 942	..	..	..
1901	1 999	..	..	..
1902	2 046	..	..	..
1903	2 244	..	..	..
1904	2 270	..	..	..
1905	2 392	..	..	..
1906	2 575	..	..	..
1907	2 853	..	..	..
1908	2 725	..	..	..
1909	2 845	..	..	..
1910	2 978	..	..	..
1911	3 041	..	..	..
1912	3 205	..	..	..
1913	3 437	..	..	..
1914	3 102	..	..	..
1915	3 074	..	..	..
1916	3 311	..	..	..
1917	3 498	..	..	..
1918	3 448	..	..	..
1919	3 067	..	..	..
1920	3 548	..	..	..
1921	3 064	..	..	..
1922	3 295	..	..	..
1923	3 720	..	..	..
1924	3 694	..	..	..
1925	3 724	..	..	..
1926	3 722	..	..	..
1927	4 061	..	..	..
1928	4 033	..	..	..
1929	4 336	..	..	..
1930	3 987	..	..	..
1931	3 582	..	..	..
1932	3 233	..	..	..
1933	3 400	..	..	..
1934	3 687	..	..	..
1935	3 817	..	..	..
1936	4 242	..	..	..
1937	4 537	..	..	..
1938	4 297	..	..	..
1939	4 562	..	..	..
1940	4 811	..	..	..
1941	4 947	..	..	..
1942	4 937	..	..	..
1943	5 047	..	..	..
1944	5 003	..	..	..
1945	4 453	..	..	..
1946	4 701	..	..	..
1947	5 260	..	..	..
1948	5 615	..	..	..
1949	5 438	..	..	..
1950	5 953	4 344	522	1 088
1951	6457	4 621	599	1 236
1952	6 553	4 573	655	1 325
1953	6 708	4 658	670	1 380
1954	6 778	4 621	747	1 410
1955	7 433	5 002	851	1 580
1956	7 929	5 276	925	1 728
1957	8 251	5 295	1 006	1 950
1958	8 458	5 150	1 302	2 005
1959	8 924	5 269	1 547	2 109
1960	9 324	5 532	1 661	2 131
1961	9 368	5 654	1 476	2 239
1962	9 738	5 913	1 432	2 394
1963	10 268	6 275	1 480	2 512
1964	10 848	6 545	1 565	2 738
1965	11 352	6 767	1 709	2 875
1966	11 921	7 030	1 835	3 056
1967	12 336	7 289	1 835	3 212
1968	12 954	7 681	2 002	3 271
1969	13 746	8 140	2 239	3 367
1970	14 748	8 384	2 531	3 833
1971	15 329	8 495	2 797	4 037
1972	15 932	8 839	2 938	4 155
1973	16 791	9 276	3 164	4 351
1974	16 817	9 006	3 256	4 555
1975	16 717	8 662	3 445	4 610
1976	17 675	9 195	3 715	4 766
1977	18 167	9 176	4 000	4 991
1978	18 315	9 343	4 285	4 688
1979	19 347	9 590	4 481	5 276
1980	19 088	9 331	4 433	5 324
1981	18 441	9 054	4 447	4 940
1982	18 304	8 673	4 669	4 962
1983	18 252	8 610	4 832	4 810
1984	18 863	8 839	5 054	4 969
1985	19 503	8 973	5 376	5 154
1986	20 176	9 017	5 624	5 535
1987	20 628	9 143	5 894	5 591
1988	21 419	9 431	6 238	5 750
1989	21 800	9 587	6 479	5 735
1990	22 000	9 542	6 704	5 754
1991	22 278	9 472	7 485	5 321
1992	21 934	9 483	7 374	5 076
1993	21 815	9 557	7 674	4 584
1994	22 326	9 694	8 192	4 440
1995	22 984	9 824	8 614	4 547
1996	23 369	10 201	8 980	4 188
1997	23 658	10 305	9 339	4 015
1998	23 610	10 316	9 350	3 944
1999	23 589	..	..	..

.. = Data not available.

Source: Worldwatch Institute.

2. Trends in real GDP and consumption of energy and materials

	GDP at 1995 prices, FIM billion	Consumption of materials, millions of tonnes	Total consumption of energy, (Mtoe 1,000)
1980	430.1	165.9	22 606
1981	439.3	160.9	22 404
1982	453.0	166.5	22 005
1983	465.5	181.3	22 463
1984	481.4	183.6	23 369
1985	496.3	190.9	24 946
1986	508.7	186.9	24 748
1987	530.1	194.2	26 218
1988	555.2	194.3	26 517
1989	583.8	203.1	26 679
1990	584.0	196.6	27 220
1991	547.4	176.3	26 775
1992	529.2	173.5	26 436
1993	523.2	167.2	27 149
1994	543.8	180.1	29 014
1995	564.6	178.2	28 478
1996	587.2	176.6	29 766
1997	624.1	185.8	30 590
1998	658.3	193.5	31 043
1999	684.8	199.2	31 277

Source: Statistics Finland, National Accounts and Studies 229; Ministry of Trade and Industry: Energy Review.

3. Trends in real GDP and atmospheric emissions

	GDP at 1995 prices, FIM billion	Carbon dioxide emissions, millions of tonnes	Sulphur dioxide emissions, thousands of tonnes	Emissions of oxides of nitrogen, thousands of tonnes
1980	430.1	54	584	295
1981	439.3	45	534	276
1982	453.0	43	484	271
1983	465.5	43	372	262
1984	481.4	44	368	258
1985	496.5	50	383	275
1986	508.7	49	331	278
1987	530.1	52	327	288
1988	555.2	52	303	293
1989	583.8	52	242	301
1990	584.0	54	258	300
1991	547.4	53	195	290
1992	529.2	52	141	284
1993	523.2	52	122	282
1994	543.8	58	115	282
1995	564.6	55	97	258
1996	587.2	61	105	268
1997	624.1	59	100	260
1998	658.3	57	96	252
1999	684.8	56	87	250

Source: Statistics Finland.

4. Incidence of melanoma 1963-1997 (per 100,000 population)

1963–67	5.2
1968–72	6.4
1973–77	8.3
1978–82	10.8
1983–87	13.3
1988–92	14.1
1993	14.2
1994	14.1
1995	13.6
1996	15.3
1997	14.8

Source: Cancer Register.

5. Trends in the world market prices of certain metals (1995=100)

	Pig iron	Copper	Lead	Zinc
1965	100.0	100.0	100.0	100.0
1975	103.3	112.5	134.5	157.0
1985	77.4	96.8	82.9	118.2
1995	76.9	94.9	75.7	113.6
2000	60.9	68.5	47.1	89.0

Source: United Nations, United Nations Conference on Trade and Development - UNCTAD, Monthly Commodity Price Bulletins.

6. Mining of ores and industrial minerals and quarrying of limestone 1980-1999 (millions of tonnes)

	Ores	Limestone	Industrial minerals
1980	10.5	3.1	3.1
1981	9.9	5.0	3.5
1982	9.7	5.5	5.1
1983	9.0	6.0	6.0
1984	9.5	5.6	7.1
1985	8.4	5.8	7.2
1986	6.9	5.0	7.2
1987	6.1	5.0	7.9
1988	6.1	5.4	8.3
1989	5.5	5.5	8.6
1990	5.5	5.7	8.3
1991	5.5	5.3	7.2
1992	4.7	4.4	8.0
1993	4.9	4.1	8.7
1994	4.6	3.9	9.2
1995	3.2	3.4	9.3
1996	3.4	3.4	9.3
1997	3.5	3.7	9.9
1998	3.2	4.0	10.0
1999	3.1	3.9	10.4

Source: Mining Industry Association.

7. Forest increment and total drain (million solid cubic metres)

	Increment	Total drain
1980	72.0	58.8
1981	72.0	56.1
1982	72.0	52.9
1983	72.0	50.6
1984	72.0	52.6
1985	75.6	55.0
1986	75.6	49.6
1987	75.6	54.1
1988	75.6	57.1
1989	75.6	58.7
1990	75.3	55.0
1991	75.3	44.6
1992	75.3	50.8
1993	75.3	53.7
1994	75.3	61.5
1995	75.7	63.6
1996	75.7	56.9
1997	75.7	64.1
1998	75.7	68.2
1999*)	75.8	69.4

*) = preliminary data.

Source: Finnish Forest Research Institute, Inventory of the Finnish Forests.

8. Use of fertilisers in agriculture (kilogrammes per arable hectare)

Year of fertilisation 1 July – 30 June	Nitrogen	Phosphorus
1979/80	83.3	27.9
1980/81	82.4	27.8
1981/82	78.7	26.8
1982/83	91.4	29.9
1983/84	90.7	30.9
1984/85	88.9	30.8
1985/86	90.0	30.2
1986/87	94.4	31.0
1987/88	98.2	32.0
1988/89	100.3	29.7
1989/90	111.5	30.7
1991/91	109.4	26.3
1991/92	92.8	19.9
1992/93	94.3	19.4
1993/94	94.1	19.0
1994/95	101.6	20.0
1995/96	92.3	16.1
1996/97	86.0	11.8
1997/98	85.9	12.3
1998/99	86.5	11.6

Source: Kemira Agro.

9. Use of pesticides in agriculture (thousands of kilogrammes of active ingredient)

	Weed killers	Others	Total
1980	2 099.1	345.0	2 444.1
1990	1 580.1	413.8	1 993.9
1991	1 375.4	312.3	1 687.7
1992	1 006.7	332.8	1 339.5
1993	842.8	364.8	1 207.6
1994	929.2	342.5	1 271.7
1995	91.4	244.2	1 035.6
1996	677.3	234.8	912.1
1997	773.9	264.5	1 038.4
1998	843.9	320.3	1 164.2
1999	790.2	349.9	1 140.1

Source: Plant Production Inspection Centre.

10. Sources of water loading 1998 (tonnes)

	Phosphorus	Nitrogen
Agriculture	2 370	41 330
Households	672	15 341
Industry	262	4 132
Deposition from air	410	12 160
Others	473	5 728
Natural runoff	2 700	70 000
Total	**6 887**	**148 691**

Source: Finnish Environment Institute.

11. Phosphorus loading from industry, households and fish farming (tonnes)

	Industry	Fish farming	Households
1985	836	134	518
1986	751	145	511
1987	840	170	479
1988	885	210	454
1989	832	250	436
1990	699	250	458
1991	578	245	296
1992	501	219	279
1993	414	188	242
1994	379	167	274
1995	357	154	245
1996	297	153	247
1997	266	140	234
1998	262	128	262
1999	260	123*)	259

*) = preliminary data.

Source: Finnish Environment Institute, Pollution Prevention Unit.

12. Implementation rates of nature conservation programmes, 1.1. 2000 (hectares of land area)

	Target	Implemented	%	Unimplemented	%
National parks and nature reserves	850 030	844 530	99.4	5 500	0.6
Protection programme for ancient forests	345 750	340 590	98.5	5 160	1.5
Mire protection programme	608 26	552 960	90.9	55 300	9.1
Herb-rich woodland protection programme	6 230	4 040	90.9	2 190	35.2
Shore protection programme	143 240	90 840	63.4	52 400	36.6
Natura 2000, new areas	88 800	47 600	53.6	41 200	46.4
Bird sanctuary protection programme	66 490	11 940	18.0	54 550	82.0

Implemented = area is already protected or area has been acquired to state ownership but no actual protection decision has been made as yet.
Unimplemented = programme covers private land not yet acquired to state ownership.

Source: Ministry of the Environment, Department of Areal Use.

13. Forests and their protection in certain European countries

	Forest area	Proportion of forest of total land area	Strictly protected forests	Strictly protected forests	All protected forests	All protected forests
	(1,000 ha)	(%)	(ha)	(% of forest area)	(ha)	(% of forest area)
Finland	**23 000**	**76**	**1 530 000**	**6.60**	**2 440 000**	**10.6**
Sweden	28 000	69	576 163	2.50	832 370	3.7
Albania	1 048	38	14 500	1.38	164 111	15.7
Norway	11 950	37	148 000	1.23	199 500	1.7
Denmark	445	11	6 085	1.14	92 000	20.7
Russia (Eur.)	132 341	39	1 726 000	1.30	3 995 600	3.0
Belgium	665	41	1 260	1.00	5 000	3.7
Bulgaria	3 357	30	..	1.00	335 000	10.0
Ireland	570	8	5 736	1.00	5 736	1.0
Greece	6 513	49	142 000	1.00	951 700	14.6
Czech Republic	2 637	33	25 000	0.95	175 000	6.6
Slovenia	1 110	54	10 420	0.93	71 000	6.4
The Netherlands	334	10	3 028	0.90	18 500	5.5
Slovakia	1 920	42	15 428	0.80	270 000	14.0
Italy	8 675	29	62 053	0.72	560 409	6.7
United Kingdom	2 305	10	10 000	0.40	128 700	5.1
Romania	6 370	27	..	0.35	527 000	8.3
Spain	12 511	25	32 644	0.26	3 000 000	24.0
Germany	10 700	30	24 976	0.24	400 000	4.0
Austria	3 924	47	8 062	0.20	49 000	1.2
Hungary	1 748	19	3 665	0.20	370 422	21.2
Bosnia	2 589	51	3 125	0.12	25 506	1.0
Croatia	2 485	44	2 856	0.11	181 405	7.3
France	15 156	28	14 000	0.09	180 000	1.2
Portugal	3 306	37	2 827	0.08	560 409	6.3
Switzerland	1 186	29	1 018	0.08	13 529	1.1
Poland	8 726	28	3 687	0.04	183 246	2.1

.. = not available.

Source: Parviainen, J. – Kassioumis, K. – Bucking, W – Hochbichler, Päivinen, R. – Little, D. (2000), EU/COST E 4: Forest Reserve Research Network Project, Final Report.

14. Production in the pulp and paper industry and loading of rivers and lakes (tonnes per year)

	Paper and board production	Pulp production	Chemical oxygen demand	Organic chlorine compounds	Phosphorus
1990	8 958 000	5 093 000	430 000	9 700	0.641
1991	8 777 000	4 894 000	380 000	7 200	0.532
1992	9 145 000	4 913 000	330 000	4 700	0.480
1993	9 953 000	5 589 000	270 000	3 000	0.375
1994	10 909 000	6 331 000	270 000	2 000	0.335
1995	11 012 000	5 797 000	260 000	1 600	0.320
1996	10 442 000	5 739 000	213 000	1 100	0.250
1997	12 149 000	6 620 000	227 000	1 300	0.228
1998	12 704 000	6 718 000	217 000	1 144	0.233
1999	12 947 000	6 977 000	205 267	1 127	0.225

Source: Forest Industry Association, Yearbooks on Environmental Protection.

15. Production in the pulp and paper industry and emissions to the atmosphere (tonnes per year)

	Paper and board production	Pulp production	Sulphur dioxide	Oxides of nitrogen	Particles
1990	8 958 000	5 093 000	24 100	16 200	22 000
1991	8 777 000	4 894 000	16 300	18 900	18 300
1992	9 145 000	4 913 000	9 500	19 100	13 000
1993	9 953 000	5 589 000	7 200	21 300	11 000
1994	10 909 000	6 331 000	6 500	23 000	9 500
1995	11 012 000	5 797 000	4 900	21 100	7 800
1996	10 442 000	5 739 000	5 300	21 100	7 000
1997	12 149 000	6 620 000	6 315	21 878	4 609
1998	12 702 000	6 718 000	5 435	21 834	6 219
1999	12 947 000	6 977 000	5 521	23 169	6 109

Source: Forest Industry Association, Yearbooks on Environmental Protection.

16. Recovery of waste paper in certain European countries 1998 (per cent)

Germany	69
Austria	64
Switzerland	64
Sweden	64
Finland	**63**
The Netherlands	57
Norway	54
Denmark	51
Belgium	47
Spain	43
Portugal	41
France	40
United Kingdom	40
Italy	33
Greece	21
Ireland	20

Source: Pulp and Paper International and Forest Industry Association.

17. Specific emissions of carbon dioxide from metal refining (kilogrammes of carbon dioxide per tonne metal produced)

	Raw materials	Energy use
1970	1 992	595
1975	1 848	347
1980	1 513	308
1985	1 319	268
1990	1 351	156
1991	1 399	149
1992	1 322	154
1993	1 383	136
1994	1 383	145
1995	1 281	155
1996	1 255	150
1997	1 235	132
1998	1 190	192
1999	1 176	169

Source: Federation of Finnish Metal, Engineering and Electrotechnical Industries.

18. Total energy consumption in certain European countries relative to GDP in 1997

	Total energy consumption, kilogrammes of oil/FIM 1,000
Canada	60.2
Turkey	57.5
Iceland	53.5
United States	53.4
Greece	44.9
Belgium	42.9
Portugal	41.4
Luxembourg	38.6
Finland	**37.7**
The Netherlands	36.5
Sweden	35.0
United Kingdom	33.9
Spain	31.6
Germany	30.9
France	30.9
Ireland	27.8
Norway	26.4
Japan	25.2
Austria	24.9
Italy	22.6
Denmark	21.4
Switzerland	18.5

Source: IEA/OECD, Energy Balances of OECD Countries 1996-1997.

19. Trends in oil prices in real terms on the global market (USD per barrel)

	Current prices	Real (1996) prices
1970	2.1	7.0
1971	2.6	8.4
1972	2.8	8.8
1973	3.1	8.9
1974	11.2	27.9
1975	10.6	23.9
1976	11.8	25.5
1977	12.8	26.0
1978	12.9	24.3
1979	29.2	49.4
1980	35.5	52.9
1981	34.1	46.6
1982	31.4	41.2
1983	28.4	36.7
1984	28.3	35.8
1985	27.0	33.8
1986	13.8	17.5
1987	17.8	22.2
1988	14.2	17.3
1989	16.9	19.5
1990	17.6	19.6
1991	18.3	19.7
1992	18.2	19.4
1993	16.1	17.0
1994	15.5	16.2
1995	16.9	17.4
1996	20.4	20.4
1997	19.2	19.2
1998	13.1	11.5
1999	18.1	14.7
2000*)	25.9	21.1

*) = I-IV/2000.

Source: United Nations, United Nations Conference on Trade and Development – UNCTAD, Monthly Commodity Price Bulletins.
NB. Concerns Crude Petroleum/Dubai, UK Brent and Alaska Average/W. Texas Average, spot, FOB.

20. Carbon dioxide emissions from fossil fuels and peat in Finland (millions of tonnes)

	Total	Power stations	Industry	Traffic
1980	54.0	..	..	..
1981	44.7	..	..	..
1982	42.8	..	..	..
1983	42.4	..	..	..
1984	43.4	..	..	..
1985	49.5	..	..	..
1986	48.1	..	..	..
1987	51.9	..	..	..
1988	51.6	..	..	..
1989	51.9	..	..	..
1990	53.9	..	..	..
1991	53.2	..	..	..
1992	51.4	29.5	8.5	13.4
1993	52.0	31.0	8.2	12.8
1994	58.3	36.6	8.6	13.1
1995	55.2	34.3	8.1	12.8
1996	61.6	39.3	9.3	13.0
1997	59.8	36.4	9.8	13.6
1998	57.4	33.7	10.1	13.7
1999e	56.0	..	..	..
2000	57.7*)	..	..	..
2010	65.0*)	..	..	..

e =preliminary data. *) = Ministry of Trade and Industry forecast. .. = data not available.

Source: Statistics Finland and Ministry of Trade and Industry.

21. Sulphur emissions in Finland (thousands of tonnes of sulphur dioxide)

	Liquid fuels	Solid fuels	Forest industry	Metal industry	Oil refining	Other industries	Total
1980	248	91	104	42	61	38	584
1981	241	74	89	42	50	38	534
1982	232	62	65	42	45	38	484
1983	135	57	75	38	34	33	372
1984	125	73	71	33	34	32	368
1985	122	91	68	30	34	38	383
1986	100	79	56	33	31	32	331
1987	96	80	62	34	30	25	327
1988	82	70	53	35	32	31	303
1989	68	62	52	11	20	29	242
1990	75	87	48	7	20	21	258
1991	58	67	33	7	17	13	195
1992	46	45	17	10	9	14	141
1993	36	46	15	9	5	11	122
1994	33	45	13	9	4	11	115
1995	30	37	9	7	4	10	97
1996	33	43	11	6	3	9	105
1997	30	41	10	6	3	9	99
1998	25	34	10	7	4	10	90
1999*)	..	..	..	..	..	..	87

.. = data not available. *) = forecast.

Source: Ministry of the Environment, Department of Environmental Protection and Statistics Finland.

22. Emissions of oxides of nitrogen in Finland (thousands of tonnes)

	Road traffic	Other traffic	Energy	Industry	Total
1980	136	43	98	18	295
1981	136	43	79	18	276
1982	137	43	73	18	271
1983	139	43	62	18	262
1984	140	43	57	18	258
1985	143	43	71	18	275
1986	147	43	70	18	278
1987	150	43	77	18	288
1988	155	43	77	18	293
1989	159	43	81	18	301
1990	158	43	82	17	300
1991	152	43	80	15	290
1992	146	43	75	20	284
1993	141	43	78	20	282
1994	137	43	81	21	282
1995	130	42	66	20	258
1996	127	44	77	20	268
1997	123	46	70	21	260
1998	118	48	63	23	252
1999*)	..	..	..	..	250

.. = data not available. *) = preliminary data.

Source: Ministry of the Environment, Department of Environmental Protection and Statistics Finland.

23. Excesses of ozone in the lower atmosphere at certain observation stations (days per year)

	Utö	Virolahti	Ähtäri	Oulanka	Total
1990	9	8	11	10	38
1991	17	5	1	1	24
1992	29	21	27	15	92
1993	7	12	17	11	47
1994	14	10	13	6	43
1995	26	6	14	3	49
1996	29	44	19	13	105
1997	20	11	13	4	48
1998	19	13	19	9	60
1999	43	47	29	7	126

Source: Finnish Environment Institute.

24. Renewable sources of energy as a percentage of total energy consumption in 1997 (per cent)

	Total	Biomass, waste	Others (incl. hydropower)
Norway	41.2	2.9	38.3
Sweden	26.7	14.9	11.8
Austria	23.3	12.4	10.9
Finland	**20.7**	**17.0**	**3.7**
Portugal	16.9	11.3	5.6
Denmark	8.0	7.1	0.9
Italy	7.9	4.0	3.9
France	6.6	4.3	2.3
Spain	6.5	3.6	2.9
Greece	5.3	1.3	4.0
Germany	2.3	1.7	0.6
The Netherlands	2.0	1.9	0.1
Ireland	1.8	1.3	0.5
Belgium	1.4	1.1	0.3
Luxembourg	1.4	1.2	0.2
United Kingdom	0.9	0.7	0.2

Source: EEA and Eurostat; Environmental Signals 2000. EEA. Environmental assessment report No. 6, p. 20.

25. Trends in the use of public transport and private cars (millions of passenger kilometres)

	Total	Private cars	Motor-cycles	Public transport
1980	48 051	34 800	800	12 451
1981	49 300	35 900	800	12 600
1982	51 100	37 500	800	12 800
1983	53 000	39 300	800	12 900
1984	54 960	41 200	800	12 960
1985	57 445	43 700	800	12 945
1986	58 245	45 100	800	12 345
1987	59 669	46 000	800	12 869
1988	62 364	48 500	800	13 064
1989	63 779	49 900	800	13 079
1990	65 273	51 200	800	13 273
1991	64 196	50 600	900	12 696
1992	63 884	50 500	900	12 484
1993	62 882	49 700	900	12 282
1994	62 855	49 600	900	12 355
1995	63 540	50 060	900	12 580
1996	63 890	50 400	900	12 590
1997	65 820	51 900	900	13 020
1998	66 833	53 830	900	13 002
1999	68 662	54 900	900	12 862

Sources: Finnish National Road Administration, VR-Group Ltd., Finnish Maritime Administration, Civil Aviation Administration, Helsinki City Transport.

26. Trends in emissions from road traffic (thousands of tonnes)

	Carbon dioxide	Hydrocarbons	Oxides of nitrogen	Particles	Carbon monoxide
1980	7 645.4	47.0	135.7	9.3	386.2
1981	7 747.9	47.7	135.7	9.5	382.9
1982	7 930.4	48.8	137.3	9.8	382.7
1983	8 203.1	50.0	138.5	10.1	382.6
1984	8 453.6	51.4	140.4	10.4	384.3
1985	8 851.8	52.6	143.0	10.7	382.3
1986	9 459.7	54.3	146.6	11.2	383.7
1987	9 929.8	56.6	149.6	11.4	390.3
1988	10 334.6	59.5	154.7	11.7	400.0
1989	10 985.1	61.7	159.1	11.7	410.2
1990	11 179.0	61.4	157.6	11.6	405.4
1991	10 858.6	58.7	151.5	11.4	373.3
1992	10 834.7	55.8	144.6	10.8	343.6
1993	10 196.5	54.0	140.4	10.3	329.8
1994	10 535.9	51.9	135.0	8.5	311.4
1995	10 391.7	50.7	131.8	8.0	304.9
1996	10 300.8	49.0	127.0	7.6	295.5
1997	10 837.9	47.3	122.6	7.1	284.4
1998*)	11 102.2	45.4	117.6	6.8	271.2
1999*)	11 399.4	43.6	113.0	6.5	262.0
2000*)	11 598.8	41.2	107.2	6.2	249.4
2001*)	11 695.1	38.4	100.6	5.8	234.0
2002*)	11 752.2	35.5	93.4	5.5	216.7
2003*)	11 795.2	32.7	86.9	5.3	201.5
2004*)	11 846.4	30.2	81.0	5.1	186.6
2005*)	11 870.3	27.8	75.9	5.0	173.9

*) = forecast. Source: Technical Research Centre of Finland; LIISA Calculation Model.

27. Trends in total lead emissions in Finland (tonnes)

	Energy and heat production	Industrial processes	Road traffic	Others
1990	20.2	115.2	189.0	1.8
1991	15.6	62.3	168.0	1.5
1992	15.0	40.3	118.0	1.4
1993	9.1	39.7	49.0	1.9
1994	11.5	45.7	1.0	1.9
1995	9.7	45.6	0	1.0
1996	10.1	23.8	0	1.0
1997	9.3	8.2	0	1.0
1998	11.3	7.9	0	1.1

Source: Finnish Environment Institute.

28. Trends in the prices of different modes of transport (1995=100)

	Running costs of a private car	Bus, local journeys	Long-distance train journeys	Domestic flights
1990	80.3	73.6	79.4	68.5
1991	85.1	83.4	87.2	77.9
1992	86.8	89.3	91.9	83.9
1993	95.5	94.5	94.2	89.1
1994	94.6	98.8	97.0	96.5
1995	100.0	100.0	100.0	100.0
1996	108.2	99.2	104.3	105.3
1997	108.8	100.0	108.4	102.1
1998	108.9	105.0	115.3	111.5
1999	114.0	106.1	119.4	118.7

Source: Ministry of Transport and Communications.

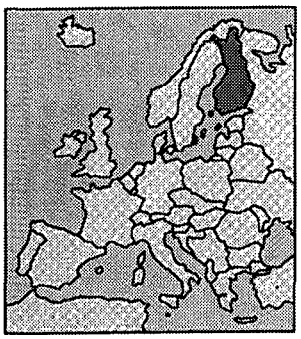
29. Retail prices of motor fuel (95E) on 15 July 2000 (FIM per litre)

	Ex-refinery price	Pump price	Taxes	Proportion of taxes (per cent)
England	2.23	8.09	5.86	72.4
Norway	2.60	7.94	5.34	67.3
The Netherlands	2.44	7.04	4.60	65.3
Finland	**2.45**	**7.04**	**4.59**	**65.2**
Sweden	2.33	6.89	4.56	66.2
France	2.30	6.73	4.43	65.8
France	2.16	6.78	4.62	68.1
Italy	2.45	6.66	4.21	63.2
Belgium	2.17	6.27	4.10	65.4
Germany	2.02	6.22	4.20	67.5
Austria	2.39	5.82	3.43	58.9
Ireland	2.31	5.52	3.21	58.2
Portugal	2.79	5.28	2.49	47.2
Luxembourg	2.37	5.13	2.76	53.8
Spain	2.10	5.00	2.90	58.0
Greece	2.37	4.84	2.47	51.0
United States*)	2.19	2.87	0.68	23.6

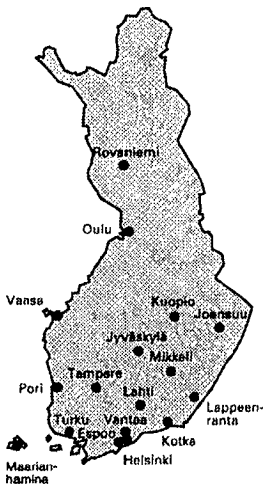
*) = June 2000 price of regular unleaded fuel.

Source: EU/Oil Petrolier and the Finnish Petroleum Federation; USA: International Energy Agency, Monthly Oil Market Report, 11 July 2000.

Finland in Figures



Suomi
Finland



Population : *5.2 million, with average density of only 17 persons per square kilometre; annual growth 0.2 per cent. Average household size is 2.2 persons. 77 per cent urban dwellers, with 0.9 million living in the capital city of Helsinki and its surrounds. 93 per cent speak Finnish and six per cent Swedish. 85 per cent are Evangelic-Lutheran and one per cent Greek Orthodox. 58 per cent have completed post-comprehensive education and 10 per cent have university degree or equivalent. 121 Internet connections per thousand inhabitants and 67 mobile phones for every 100 inhabitants.*

Area : *Situated in northern Europe with an area of 338,145 square kilometres of which 304,530 square kilometres land area. Land boundary with Sweden 586 kilometres, Norway 727 kilometres and Russia 1,269 kilometres. Coastline approximately 1,100 kilometres. The greatest length is 1,157 kilometres, from Hanko to Utsjoki, and the highest point, Halti, 1,328 metres above sea level. Of the total area 10 per cent is covered by water. There are 188,000 fresh water lakes in Finland. Forests, mainly pine and spruce, cover 68 per cent of the country while 6 per cent of the land area is under cultivation, with barley and oats as the main crops.*

Government : *Finland has been a sovereign parliamentary republic since 1917. The head of the state is the president, elected every six years. The post has been held by Ms. Tarja Halonen since 1 March 2000. The Parliament comprises 200 members, elected for a four-year term. The country is divided into 5 provinces and the Autonomous Territory of the Åland Islands. Member of the European Union since January 1995.*

Economy : *GDP in 1999 totalled FIM 724 billion (USD 129.7 billion), i.e. FIM 140,100 (USD 25,113) per capita. One of the highest standards of living in the world. Of the total labour force 21 per cent are employed in industry, 32 in services, 16 in trade, 12 in financial services, 7 in transport and communications, 6 in agriculture and forestry and 6 in construction. Unemployment rate, calculated according to EU standards, was 10.3 per cent in June 1999.*

Foreign trade : *Main trading partners are Germany, Sweden, United Kingdom, USA and Russia. The value of imports totalled FIM 176 billion (USD 32 billion) and that of exports FIM 233 billion (USD 42 billion) in 1999. Of the imports 40.9 per cent were raw materials and 24.3 per cent consumer goods. Main exports are electrical equipment, pulp and paper products, machinery, and metal and chemical products.*

The catchment area of the Baltic Sea

Finland's Natural Resources and the Environment 2000

Finland's Natural Resources and the Environment 2000 is a review of the state of Finland's natural resources and the environment. It presents the main principles of interaction between the national economy and the environment and describes the extent to which the objectives of sustainable development have been realised in Finland. It also reviews trends in the main sectors of the economy as they affect the environment. These sectors include industry, energy, transport, natural resources and environmental protection. Finally, the publication contains a presentation of the principal agreements on the conservation of natural resources and the environment to which Finland is committed.

Tilastokeskus, myyntipalvelu
PL 4V
00022 TILASTOKESKUS
puh. (09) 1734 2011
faksi (09) 1734 2500
myynti.tilastokeskus@tilastokeskus.fi
www.tilastokeskus.fi

Statistikcentralen, försäljningstjänsten
PB 4V
00022 STATISTIKCENTRALEN
tfn (09) 1734 2011
fax (09) 1734 2500
myynti.tilastokeskus@stat.fi
www.stat.fi

Statistics Finland, Sales Services
P.O.Box 4V
FIN-00022 STATISTICS FINLAND
Tel. +358 9 1734 2011
Fax +358 9 1734 2500
myynti.tilastokeskus@stat.fi
www.stat.fi

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