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Climate change darkening the horizon

The environment is today in a better state in Finland than 10–20 years ago in many respects, but climate change threatens to overshadow these achievements.

The state of the environment is not an instant snapshot, but a combination of inter-related trends and factors. Whether we interpret this combination as favourable or unfavourable depends at least partly on our personal values and viewpoints.

With the help of the indicators chosen for assessment in this review, everyone can assess the state of the environment from their own perspectives. The review spotlights encouraging trends such as declining emissions into the air and water, but also notes worrying developments such as increasing natural resource use and the loss of biodiversity.

The greatest of these worries concerns climate change. As recently as the 1990s, global warming was still seen as a distant challenge rather than a problem requiring urgent action. But this perception has changed since the turn of the millennium, as reports and research findings have produced more detailed forecasts of the consequences of global warming.

The report on the economic impacts of climate change published by Nicholas Stern in autumn 2006 particularly gained widespread publicity, with its estimate that global gross national product would decline by 5–20% if no effective action were taken to combat climate change. Determined action should already be taken over the next 10–20 years.

In recent years one clear symbol of the onset of climate change has been the melting of the Arctic ice-cap. In summer 2007 ice cover on the Arctic Ocean reached a record low extent, 39% less than its average extent over the period 1979–2000. In summer 2008 the ice cover was only slightly more extensive, making some scientists predict that permanent ice cover could vanish within a decade. Less dramatic forecasts suggest that summer ice cover will disappear from the Arctic Ocean by approximately 2040.

The impacts of climate change are already becoming visible in ecosystems in Finland, too. Many arctic species are declining, while southerly species are spreading northwards.

Climate change will not only affect the environment in Finland through changes in temperatures and precipitation. It will also mean that pressures related to the utilisation of the country’s forests, water resources and landscapes will intensify, due to the need to combat climate change.

Measures such as the construction of more hydropower facilities and the exploitation of more biomass from the forests to produce bioenergy will also inevitably affect the prospects for threatened species in Finland’s forests and inland waters.

In environmental protection it is hard to make decisions that do not hurt anyone, but history shows that even costly actions are often clearly worthwhile in the longer term. Research findings can help us to find the best possible solutions. But implementing these solutions often requires determined action from individual citizens in their everyday lives, and from society as a whole.

Online data updates

Finland’s environmental administration works to keep citizens up to date by providing the latest information on vital environmental issues such as pollution, its impacts and actions to address environmental problems, in line with national obligations set out in the EU Environmental Information Directive. This is primarily done through the website www.environment.fi, which is also closely linked to the websites of several other Finnish authorities who provide online information about environmental issues.

This review of the State of the Environment in Finland in 2008 summarises the information available online, compiling data on the most important and topical issues in an accessible form. In many sections of the report website addresses are provided for readers who want to find more extensive or up-to-date information on the issues featured.

Although the causal factors behind many environmental problems are global, the consequences are evident at local level. Thirteen separate reports examining the state of the environment in various regions of Finland have been produced at the same time as this national report, focusing on issues of particular importance for each region. These regional reports have been published only in Finnish.

This national State of the Environment in Finland review for 2008 has been produced by the Finnish Environment Institute (SYKE), using information provided by experts from Finland’s environmental administration and from other Finnish authorities and research institutes.

www.environment.fi/stateofenvironment
High natural resource use levels

Half of Finland’s natural resource use is related to the manufacture of goods for export

The total material requirement of the Finnish economy amounts to more than 100 tonnes per inhabitant. About four-fifths of these resources are non-renewable or very slowly renewable resources such as oil, coal, metals, gravel and peat. Renewable resources such as wood and other biomass account for around a fifth of all natural resource use.

Approximately half of the natural resources used by industry and consumers in Finland originate abroad. But in fact more than half of these materials are utilised in the manufacture of goods destined for export. Both imports and exports of materials have grown rapidly in recent decades. As recently as 1970 just a quarter of the materials used in Finland came from abroad, and just under a third of natural resource use was related to exported goods.

Finland’s total material requirement increased by about 50% over the period 1970–2006. This rising trend in resource use was only reversed significantly during the oil crisis of the mid 1970s and a serious recession that affected the Finnish economy in the early 1990s. There were also slight reductions in 2004 and 2005, due to factors including declining imports of coal.

Total material requirement is estimated by summing the flows of different material goods expressed in tonnes. These calculations also include “hidden flows”, i.e. the amounts of natural materials moved or altered in connection with construction and the extraction of other natural resources. The hidden flows behind imported goods are likewise calculated. Such hidden flows account for more than half of all natural resource use.

An ecological footprint of 5.2 hectares for every Finn

The concept of the ecological footprint has become a well-known measure of natural resource use. It describes the amounts of renewable natural resources used by people in proportion to nature’s capacity to regenerate, and also our carbon dioxide emissions in relation to the carbon sequestration capacity of the natural environment. Ecological footprints are expressed in hectares, based on estimates of how much biologically productive land is needed to meet our levels of consumption and cope with our wastes.

Ecological footprints can be calculated for individual citizens or for the whole of humanity. It has been estimated that the total ecological footprint of the world’s current population exceeds our planet’s biocapacity to produce renewable natural resources by about 30%. The WWF’s Living Planet 2008 report estimates that Finnish citizens have an average ecological footprint of around 5.2 hectares. Because of Finland’s low population density and extensive areas of forest the country’s overall biocapacity per inhabitant is approximately 11.7 hectares, but on a global scale productive land only amounts to just 2.1 hectares per person.

Ecological footprints can be calculated in many ways, and methodologies are continuously being developed. The results obtained from different calculation models cannot be directly compared. In a list published by the WWF in 2008, for instance, Finland’s ranking in the list of countries consuming the most natural resources per person had improved to sixteenth from third two years previously. This change was partly due to a change in the calculations that meant that nuclear power was no longer counted as a form of energy production responsible for carbon dioxide emissions.
Temperatures in Finland on the rise

Alternative scenarios for the future

Global warming is an undisputable fact, according to the fourth assessment report of the UN Intergovernmental Panel on Climate Change (IPCC), published in 2007. Over the last century, average global temperatures have risen by 0.74 degrees Celsius. Sea levels have also risen, while ice and snow cover have decreased.

The IPCC report states that the main reason for this warming is emissions of greenhouse gases generated by human activities. On a global scale, the most significant sources of these emissions are the burning of fossil fuels and deforestation.

The IPCC has defined a set of scenarios for future climatic trends based on different forecasts for trends including population growth, economic growth and technological development. By feeding the figures for predicted emission levels under each of these scenarios into climatic models, climatologists can predict the consequent levels of precipitation, temperature and other parameters for each case.

According to the gloomiest of these scenarios, A1F1, average global temperatures would rise by 4.0 degrees by 2100 compared to the average level over the period 1980–1999. Under the most optimistic scenario, B1, global warming would be limited to two degrees. These figures are the best estimates produced by different climate models, representing the midpoints of the wider temperature ranges predicted by the models, which may be of several degrees in magnitude.

Fewer frosty winters ahead for Southern Finland

Models indicate that the expected climatic warming will be particularly dramatic in Finland and other northerly regions. An overall temperature rise of 3–7 degrees is predicted by the scenarios for Finland by 2100. Precipitation is expected to increase by 13–26%.

This warming will be more pronounced during the winter, when precipitation will also increase most steeply. The forecast for Southern Finland is for longer snow-free periods and more rain.

Measures to mitigate climate change already overdue

It is impossible to completely halt climate change, since many of the greenhouse gas emissions already released by human activity will remain in the Earth’s atmosphere for centuries and keep on warming the climate even if we could stop all new emissions immediately.

The EU aims to limit global warming to two degrees Celsius, to avoid the worst pre-
dicted impacts. This is a challenging target, since during the 2000s global greenhouse gas emissions have risen even more rapidly than in the 1990s, in spite of efforts to rein them in.

Finland’s emissions well over target levels

Finland has promised to reduce its annual greenhouse gas emissions to below their level in the benchmark year of 1990 over the next few years. This target will be difficult to reach, as emissions have risen considerably since 1990. In 2007 the country’s total greenhouse gas emissions exceeded the 1990 target level of 70.9 million tonnes by 7.6 million tonnes. The recent economic recession has reduced emissions at least temporarily.

If domestic emissions cannot be curbed, Finland will have to compensate for its excess emissions. The international climate agreement defines ways that countries can obtain the right to exceed their emission targets, through the “Kyoto mechanisms”. Finland intends to gain emission credits amounting to about 10 million tonnes over the period 2008–2012 by realising emission-reducing projects in developing countries.

The EU also runs an emissions trading scheme that enables industrial facilities to trade in emission credits. This market allows Finnish companies to buy more emission credits in addition to their free allocation. The scheme also entitles any facilities able to reduce their emissions to sell their surplus emission credits.

www.environment.fi/climate
Energy consumption up five-fold over the last 50 years

Finland’s total energy consumption multiplied more than five-fold between 1950 and 2007. This upward trend has only been reversed temporarily during serious economic recessions. A brief downturn in 2005 was due to an exceptionally mild winter and major stoppages in the forest industry sector. Production rates in Finland’s energy-intensive industries and structural changes in industry will also shape the future demand for energy. Where energy use in buildings is concerned, renovations targeting energy efficiency will help, but the spread of new building developments will increase overall consumption.

Household energy consumption has risen due to increases in both the number of households and the amount of living space per person. The proliferation of domestic appliances has also raised electricity consumption. Computers and other home electronics have become major energy users alongside Finland’s many electric saunas. Improvements in the design and maintenance of such appliances could reduce the related energy consumption considerably.

Energy consumption levels in holiday homes are also growing as more summer cottages are fitted out and heated to serve as year-round second homes.

It is important to reduce energy consumption, since every source of energy is associated with harmful impacts. Most forms of energy production result in harmful emissions and wastes. The extraction and transportation of fuels pollutes and fragments natural areas, and power plants of all kinds blemish landscapes and water courses.

Many of the most harmful impacts, such as emissions of acidifying substances and greenhouse gases, are particularly linked to the use of fossil fuels, which account for about half of all the energy consumed in Finland today. Related emissions of airborne particles and heavy metals are also significant environmental problems.

Total energy consumption includes the consumption of all the energy produced from energy sources in Finland or imported into the country. The figures for final energy consumption omit losses related to the transformation and transmission of energy, which in 2007 amounted to about 25% of total energy consumption. Source: Statistics Finland. 2008.

Per capita energy consumption rates in Finland are extremely high, due to a high material standard of living, the importance of the energy-intensive paper and metallurgical industries, the country’s northerly location, and the long distances between settlements. Source: Eurostat.

A new national long-term Climate and Energy Strategy was approved by the Finnish government in November 2008. The strategy aims to reverse the persistent rising trend in energy consumption during the 2010s. By 2020 it is hoped that annual final energy consumption will be approximately 310 Terawatt-hours (1,116 PJ), similar to today’s level. This figure should then be reduced by at least a third by 2050.

The strategy also aims to greatly increase the exploitation of renewable energy sources. By 2020 as much as 38% of the energy used in Finland should come from renewable sources. The largest share of this renewable energy will come from wood-based biofuels, but there should also be increases in the use of waste derived fuels, heat pumps, biogas and wind power.

Finland also aims to increase its energy self-sufficiency and ensure the availability of energy supply in all possible conditions.
Renewable sources provide about a quarter of Finland’s energy

Finland is one of the world’s leading users of bioenergy. Biofuels are particularly obtained from the by-products of the pulp and paper industry, and the use of these wood-based fuels has so far largely depended on production levels in the forest industries. Hydropower is also a significant source of renewable energy, but other forms of renewable energy have not yet been exploited widely in Finland. In all, about a quarter of the country’s energy is derived from renewable sources.

Finland’s forests are also considered to hold the main potential for increasing the use of bioenergy. The potential for further exploitation of hydropower is limited, although the productivity of many older hydropower facilities could be boosted. The use of solar energy and wind power could be increased considerably.

The exploitation of renewable energy sources also results in problems, such as nutrient emissions, impacts on biodiversity, noise and fluctuations in the availability of energy. It is vital to find forms of energy production that can reduce greenhouse gas emissions while also resulting in economic and environmental benefits. One such solution involves using agricultural and organic wastes to produce biogas.

In 2007 wind power accounted for just 0.2% of the electricity consumed in Finland. In 2008 Finland had 113 large-scale wind power facilities, but the new national climate and energy strategy aims to increase wind power production to more than 20 times its present level. Source: VTT Technical Research Centre of Finland. 2008.

Heat pumps can particularly help to reduce the energy consumption of homes with electric central heating systems. Air source heat pumps can produce up to 3-5 times more heat energy than they need electrical energy. In 2007 ground source heat pumps and exhaust air heat pumps around Finland produced 2,815 GWh and 100 GWh of energy, respectively. Source: Finnish heat pump association. 2009.
Waste still increasing

Finns generate around 500 kilos of household waste a year on average

During 2006 about 70 million tonnes of waste was generated in Finland – about four million tonnes more than in 2005. Of this waste almost 71% consisted of mineral wastes and about 19% was wood-derived wastes. These figures do not include manure spread on farmland or logging residues left in the forest. About 40% of wastes were used in some way as materials or to produce energy. The rest ended up in landfills or was otherwise processed. Hazardous wastes amounting to about 2.4 million tonnes were generated in Finland in 2006, mostly in the mining and industrial sectors.

Municipal waste accounts for less than 4% of all wastes. The total annual amounts of municipal waste varied between 2.4 and 2.6 million tonnes during the years 2000–2007. About two-thirds of this waste is generated by households. In 2007 Finns produced an average of 505 kilos of household waste per person – 12 kilos more than in 2006. Finland now aims to stabilize the total amount of municipal waste at its level from the turn of the millennium (approximately 2.4 million tonnes), and then to start reducing the amounts of waste by 2016.

More wastes recovered

Slightly more municipal waste was recovered in 2007 for use of its material content than in previous years. Energy recovery has also improved slightly. About 12% of municipal waste was combusted.

The quantities of municipal waste ending up at landfills declined by about 10% between 2000 and 2007, but more than half of all municipal waste still goes to landfill. By 2016 it is intended that this figure should be reduced to just a fifth.

Waste recovery in 2006 (million tonnes)

<table>
<thead>
<tr>
<th></th>
<th>Municipal wastes</th>
<th>Construction wastes</th>
<th>Mining wastes</th>
<th>Industrial wastes</th>
<th>Energy industry wastes</th>
<th>Agricultural and forestry wastes</th>
<th>Other wastes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy recovered</td>
<td>0.22</td>
<td>0.523</td>
<td>0</td>
<td>7.4</td>
<td>0.004</td>
<td>1.89</td>
<td>0</td>
</tr>
<tr>
<td>Material recovered</td>
<td>0.87</td>
<td>7.752</td>
<td>3.38</td>
<td>5.518</td>
<td>0.623</td>
<td>0.133</td>
<td>0.33</td>
</tr>
<tr>
<td>Other management and disposal</td>
<td>1.53</td>
<td>14.87</td>
<td>18.14</td>
<td>5.057</td>
<td>1.01</td>
<td>0.015</td>
<td>0</td>
</tr>
</tbody>
</table>


Producer’s responsibility for waste management

Manufacturers and importers are obliged to take responsibility for the management of certain kinds of wastes, and meet the related costs. Such goods include vehicles, tyres, electronic and electrical appliances, batteries, newspapers and magazines, office paper and packaging. Where packaging is concerned, responsibility lies with packers and the importers of packaged goods.

The idea behind producer’s responsibility is to encourage the reuse and recycling of materials. Targets have particularly been well reached for drinks packages. In 2007, some 97% of all returnable bottles covered by refundable deposits were returned. For drinks cans the figure was almost 90%.

Electrical and electronic appliances were first covered by producer’s responsibility in 2005. In 2006, the total weight of recovered domestic appliances amounted to about 7 kilos per capita – an average figure by European standards.


Recovery rates for electrical and electronic appliances in 2006

Source: Pirkanmaa Regional Environment Centre. 2008.

www.environment.fi/wastes
Urban sprawl spreading

The spatial structure of most of Finland’s urban areas is becoming more dispersed. Even where the populations of urban areas are stable or declining, new built-up areas are gradually spreading around their fringes. Such developments often increase the distances between homes, workplaces and services. Since the late 1980s some services have been relocating away from urban centres, following the dispersal of homes and workplaces. This trend is clearest for major new retail outlets.

The spatial structure of urban areas is much more dispersed in Finland than in other parts of Europe, partly because urbanization only occurred comparatively recently here. Planners have only succeeded in promoting in-fill developments to make central areas more compact within the Helsinki Metropolitan Area, in satellite towns along the main rail route northwards from Helsinki, and in a few other urban growth centres such as Tampere, Oulu, Turku and Jyväskylä. But even around these centres peripheral areas are affected by urban sprawl due to low-density suburban developments. In 2005 about 31% of the built-up area of Helsinki consisted of low-density housing areas with detached homes.

International research projects have defined a minimum population density level for effective public transportation of around 20 inhabitants per hectare. With regard to this figure, the potential for effective public transportation systems has been declining continuously in Finland’s larger areas, with the exceptions of Helsinki and Kuopio, where prospects are still favourable. In Jyväskylä and Tampere the proportion of the population living in such areas has remained quite stable over the last decade. In many urban areas it may be hard to wean residents off dependency on their cars in future, once the opportunity to develop areas that can be effectively served by public transport has been missed.

Percentages of the inhabitants of Finnish cities living in areas with population densities favourable to public transport (> 20 inhab./ha) 1980–2005

Urban sprawl means:
- Longer journeys to work, shops and services
- Higher costs for building and maintaining infrastructure
- High mobility costs
- Wastage of natural resources and unnecessary emissions

Compact urban developments create advantages:
- More effective public transportation
- More accessible services
- Natural resources and green areas can be saved.
- Reduced emissions

Source: Monitoring system of urban structure (YKR) / SYKE and Statistics Finland. 2008.
Commuters travelling twice as far as 20 years ago

The average distance travelled by Finns commuting to work is today almost twice as long as a couple of decades ago. In 2005 the average journey to work was 13 kilometres each way. This means that fewer people can walk or cycle to work. Some commuters can use public transport, but more and more people are going to work by car.

Average commuting distances vary considerably between different parts of urban areas. In the Helsinki metropolitan area, for instance, average journeys to work are long. But for people living in the core of the metropolitan area, within 20 kilometres of the centre of Helsinki, average commuting distances are shorter than for the whole country. People living around the edge of the metropolitan area commute long distances. The journeys to work of people living more than 30 km from the centre of the capital are almost everywhere more than 20 km. It is in these localities where commuting distances have lengthened most over the last ten years. A small group of long-distance car commuters is responsible for a large share of the total commuting distance – and the related greenhouse gas emissions.

There are also great differences between different towns and cities when it comes to commuting distances and their current trends. The average length of journeys to work is not generally dependent on the size of the urban area, though commuting distances do tend to be longer in larger cities. The longest average journeys to work are for commuters from the towns of Hyvinkää, Porvoo and Lohja, which all lie about 50-60 km from Helsinki. Commuters in the west coast towns of Vaasa, Pietarsaari and Raase have the shortest daily journeys.

Increases in average commuting distance 1995–2005

Source: Environmental Information System (HERTTA), Monitoring system of urban structure (YKR), SYKE and Statistics Finland. 2008.

Average commuting distances in different towns and cities in 1995 and 2005


Increases in average commuting distance 1995–2005 at different distances from the centre of Helsinki


Average lengths of journeys to work in Finland 1980–2005

Residents’ everyday movements are affected by the availability of services. Retail services are gradually shifting away from urban centres to locations near ring roads and radial routes more easily accessible by car. Two-thirds of all Finns still live less than a kilometre from the nearest grocery store as the crow flies, however. This situation has not changed significantly during the 2000s, but people are increasingly using larger supermarkets located further away from their homes, attracted by wider ranges of goods and lower prices. Specialised stores have at the same time been relocating from central areas to retail clusters on the edges of urban areas.

According to a national survey of personal mobility journeys to shops and services have increased most rapidly after commuting journeys. Car journeys account for 86% of the total length of such trips in kilometres. In many areas highways originally built to link separate urban centres are now also part of local district road networks. Many retail outlets are located right on these main roads, and often this leaves customers little choice other than to use their own cars to reach them.

In autumn 2008 the Ministry of the Environment conducted a survey of major planned retail developments. Many of these developments have been planned in peripheral locations on the edges of built-up and residential areas, forcing their customers to travel long distances. Few customers live within a radius of a couple of kilometres, so these businesses must attract sufficient clients from a wider catchment area. Many of the projected developments are very large in relation to the numbers of local residents. Of today’s major shopping centres only one has more square metres of retail space than inhabitants within a radius of 10 kilometres. Dozens of the planned developments meet this criterion, though in some cases these are specialist stores that require large amounts of space.

National land use guidelines
Finland’s national land use objectives, which are applied to help control spatial development, were revised in November 2008. Some of the most significant changes concerned the need to make communities more spatially compact, the demand for more housing in the Helsinki area, a desire to assess transport and land use together, and the need to examine energy issues related to land use. Another revised objective relates to the need to locate workplaces and services so as to minimise the need for people to use their cars.

Changes in the locations of workplaces in the retail sector in the Turku area by sq km 1985–2005

The numbers of retail jobs have declined in urban centres and risen in suburban areas beside major roads. Source: YKR/SYKE and Statistics Finland. 2008.

Local stores still conveniently near
People use cars for 86% of shopping trips and errands
At the end of 2007 a total of almost three million road vehicles were registered in Finland, including about 2.6 million cars. The numbers of vehicles have grown steeply ever since the late 1940s, except during the recession of the early 1990s.

Road traffic has risen correspondingly. During 2006 Finns drove private cars in a total distance of more than 62 billion kilometres. This means that every Finn drove or was driven for an average of about 12,000 kilometres.

In spite of these increases, many traffic-related emissions have declined considerably during the 1990s and 2000s. Emissions of carbon monoxide, nitrogen oxides, hydrocarbons and particles have been roughly halved since 1990.

Traffic-related carbon dioxide emissions have contrastingly increased by about 16% since 1990. Traffic today accounts for about a quarter of all of Finland’s carbon dioxide emissions.

Improvements in vehicle technologies and biofuels could also lead to a downturn in traffic-related carbon dioxide emissions in the near future. But even if this happens, car use cannot go on increasing at the same rate. The capacity of Finland’s road network is already under pressure, especially in and around Helsinki, and it is also hard to create enough parking spaces for today’s vehicles in central urban districts.

Car use could be reduced by encouraging the use of public transport, for instance. But trends so far have been in the opposite direction. The share of all journeys being made on public transport has declined quite steadily, even though people have been moving from rural areas into urban areas where it should be easier to organise effective public transport. Today more than 90% of all journeys in Finland are made by private car, and less than 20% by public transport.

One car for roughly every two Finns
Many emissions have declined in spite of increasing road traffic
Traffic noise affects 15% of the Finnish population

Measures particularly needed in noisy residential areas

Road traffic is by far the most serious source of noise pollution in Finland, where about 800,000 people are exposed to traffic noise levels exceeding 55 decibels. In spite of efforts to abate noise, the total numbers of people exposed have not changed much in recent decades.

Exposure to noise pollution can be reduced by planning roads, railways, airports and other sources of noise in locations that will result in the least harm. Noise barriers can be built to protect people in the worst affected areas. Noise can additionally be prevented by reducing traffic and by lowering speed limits.

Technological developments may also reduce such problems significantly. Traffic noise can be curbed by enhancing vehicles’ motors, tyres and aerodynamics, and by using different road surfaces.

Noise abatement measures should be prioritised in residential areas exposed to average daytime noise levels exceeding 65 decibels, and in areas where very many people are exposed to noise. In addition to reducing noise pollution it is also essential to continue to combat harmful noise levels in workplaces.

Noise levels related to leisure pursuits are at the same time becoming more problematic due to the increasing popularity of noisy activities and entertainment electronics. Comprehensive data on exposure to such noise is not yet available, however.

Even in nature reserves like these marshes Luutasuo in Loppi, it is impossible to get away from the sounds of traffic and other noise caused by human activity. This is particularly true in densely populated parts of Southern Finland. Preserving areas unspoilt by noise is vital both for our own well-being and for biodiversity.

Oil tanker traffic intensifying in the Gulf of Finland

In 2007 almost 150 million tonnes of oil was shipped through the Gulf of Finland. This figure amounts to about a quarter of Russia’s total oil production. Oil shipping has increased rapidly, tripling since 2000. By 2015 it is estimated that this figure will have grown further to more than 260 million tonnes.

It is feared that this increase makes accidental oil spills more likely. Steps have been taken to reduce risks. The systems for monitoring and controlling the movements of ships have been enhanced, and investments have been made in new pollution prevention equipment. Measures have also been adopted to intensify cooperation between the Baltic coastal states on oil spill prevention. Other kinds of shipping have also increased recently in the Baltic, especially in the Gulf of Finland.

www.environment.fi/oil

In 2007 oil tankers shipped about 145 million tonnes of oil through the Gulf of Finland. Source: SYKE and VTT Technical Research Centre of Finland. 2008.
Almost all forms of air pollution in Finland and neighbouring countries have declined clearly since their peak levels in the 1980s. Emissions have most notably been reduced thanks to the spread of desulphurization applications, electrostatic precipitators, cleaner fuels and enhanced combustion techniques.

Emissions of sulphur dioxide, which in the 1980s and 1990s threatened to acidify Finland’s lakes and forests, have been most significantly reduced. Sulphur emissions throughout the EU declined by 71% over the period 1990–2006. In recent years Finland’s sulphur dioxide emissions have been about 60–70% lower than in 1990. Finland’s emissions vary greatly from year to year, depending on factors including the availability of emission-free hydropower, and the demand for energy for heating.

Nitrogen oxides today have a more pronounced acidifying impact than sulphur dioxide. EU emissions of nitrogen oxides declined by 37% over the period 1990–2006. Finland’s nitrogen oxide emissions have in recent years been about 25–35% lower than in 1990.

Particle emissions have been assessed in Finland since the year 2000. An increase over this period is largely due to changes in energy production levels.

Most air pollution in Finland originated from energy production and traffic, but the breakdown of sources varies for different kinds of emissions. The most significant source of ammonia, for instance, is agricultural manure.
Thanks to lower emissions of impurities, air quality in Finland has also generally improved over the last twenty years. The greatest improvements have been in the surroundings of industrial and power plants. But at the same time, rapidly increasing traffic has slowed progress on air quality in cities and other areas with busy traffic.

Improved air quality overall is reflected in a decline in the deposition of airborne pollutants on the ground. Between 1990 and 2006 it has been estimated that deposition rates for sulphur and nitrogen compounds decreased by 70% and 30%, respectively.

Following such improvements, the worst airborne pollutants today are tiny inhalable particles, less than 10 micrometres in diameter, which can get into our lungs when we breathe. Harmful substances like heavy metals or hydrocarbons may also be bound up with such particles.

In Finland as a whole, most airborne particles are derived from energy production, but in built-up areas road traffic is the most significant source. Vehicle exhaust gases contain such particles, and their wheels also create particles when they wear down road surfaces. The consequent dust worsens air quality in cities, especially in the spring when grit still remains on the roads after the winter.

The tiniest particles of all can be borne long distance. Particles originating from forest fires can even be blown in from neighbouring countries.

The authorities are obliged to instigate actions to reduce the concentrations of pollutants. In Finland the most commonly exceeded limits are annual levels for nitrogen dioxide and daily levels for inhalable particles. Annual average concentrations of nitrogen dioxide must not exceed 40 µg/m³ at any measuring station. The 24-hour limit value for particle concentrations is 50 µg/m³, which may not be exceeded on more than 35 days a year.

Particle emissions from fireplaces are a significant health risk, since low chimneys can leave dense clouds of such particles floating in the vicinity of their source. The numbers of people exposed to such risks are increasing as wood-fired heating becomes more popular and more people move to such areas. The ageing of the Finnish population and the increasing prevalence of respiratory illnesses and asthma also compound the consequent health risk.

The European Union has set limit values for air quality. If these thresholds are exceeded, the authorities are obliged to instigate actions to reduce the concentrations of pollutants. In Finland the most commonly exceeded limits are annual levels for nitrogen dioxide and daily levels for inhalable particles. Annual average concentrations of nitrogen dioxide must not exceed 40 µg/m³ at any measuring station. The 24-hour limit value for particle concentrations is 50 µg/m³, which may not be exceeded on more than 35 days a year.

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The authorities are obliged to instigate actions to reduce the concentrations of pollutants. In Finland the most commonly exceeded limits are annual levels for nitrogen dioxide and daily levels for inhalable particles. Annual average concentrations of nitrogen dioxide must not exceed 40 µg/m³ at any measuring station. The 24-hour limit value for particle concentrations is 50 µg/m³, which may not be exceeded on more than 35 days a year.

Particle emissions from fireplaces are a significant health risk, since low chimneys can leave dense clouds of such particles floating in the vicinity of their source. The numbers of people exposed to such risks are increasing as wood-fired heating becomes more popular and more people move to such areas. The ageing of the Finnish population and the increasing prevalence of respiratory illnesses and asthma also compound the consequent health risk.

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Industrial phosphorus emissions down to a fraction of levels in the 1980s

Agriculture is today the main source of nutrient pollution in water bodies

Industrial facilities, municipal wastewater treatment plants and fish farms have had the most success in reducing their emissions into water bodies. It has been much more difficult to curb emissions from agriculture, forestry and scattered settlements not connected to sewerage systems.

The agricultural sector today accounts for about 60% of anthropogenic phosphorus loads in water bodies and about 50% of nitrogen loads. Farmers have received considerable agri-environmental subsidies, aiming to encourage changes in farming practices that favour water protection. But these measures have so far been insufficient, partly because it has not yet been possible to target EU subsidies to encourage actions specifically where they would best promote water protection.

Other sectors, notably industry and municipalities, have managed to reduce their emissions much faster than agriculture.

Pollution loads from commercially managed forests have declined in recent decades particularly thanks to a decline in forest drainage schemes and water protection measures taken in forestry. Our understanding of recent trends in loads is incomplete, however, since the impacts of measures often only become evident after a long time lag.

Industrial phosphorus and nitrogen loads clearly started to decline in the late 1980s, largely due to improvements in industrial processes and wastewater treatment. Between 1985 and 1995, industrial phosphorus and nitrogen loads declined by 37% and 34%, respectively. Over the period 1995–2005, loads decreased further: by 46% for phosphorus and 22% for nitrogen. In the 2000s industrial nutrient loads have no longer been declining significantly.

One in five Finns live in areas unconnected to sewerage systems

Since the mid 1980s, wastewater from almost every urban centre in Finland has been piped to treatment plants. Modern treatment plants can remove more than 95% of organic substances and phosphorus from wastewater, and an average of 54% of nitrogen.

Around a million Finns live in homes in rural areas that are not connected to sewerage systems. Additionally almost half a million holiday homes around Finland treat their own wastewater independently.

The phosphorus loads entering water bodies from unconnected rural areas and holiday homes were estimated to amount to some 350 tonnes a year during the early 2000s. Recently enacted Finnish legislation on the treatment of household wastewater outside sewerage systems facilitates improvements that will reduce the local loads burdening water bodies. The legislation allows for a fairly long period before such improvements need to be made in older properties.

In addition to loads originating from agriculture, forestry, industry and settlements, water bodies may also be polluted by fish farming, peat extraction and mining operations. These activities’ overall share of the phosphorus and nutrient loads entering water bodies in Finland is very low, but on the regional and local scale their impacts on the state of water bodies may be significant.
Water bodies mainly in good ecological condition

Persistent problems in rivers and coastal waters

Finland’s surface waters are largely in an excellent or good ecological state. Waters with lower ecological status than “good” include almost a third of the lakes whose state has been assessed, half of the stretches of rivers, and more than half of the total extent of coastal waters of the Baltic Sea.

The ecological statuses of assessed surface waters are classified as excellent, good, satisfactory, passable or poor, according to how much their condition has deteriorated due to human activities. Evaluations are made for lakes, rivers and coastal waters according to different sets of biological criteria including the occurrence of algae, fish, bottom fauna and aquatic plants.

This classification is carried out to meet the obligations under the EU Water Framework Directive and related national legislation. A target has been set that all surface waters should have a good or excellent ecological status by 2015, and conditions in waters already classed as good or excellent should not deteriorate.

About 34% of Finland’s inland water bodies have been preliminarily assessed. Almost all large inland waterways and coastal waters have been classified. The coverage of classification should become complete by the end of 2009.

The amount of work needed to achieve the goal of a good ecological status is great.

Blue-green algae

The Gulf of Finland and lakes in coastal regions of Southern and Southwestern Finland have suffered most from algal blooms. The abundance of algal blooms is affected by summer weather conditions as well as the availability of nutrients, so annual variations can be great. In comparison with long-term averages the situation concerning algal blooms in summer 2008 was not acute.

www.environment.fi/algalsituation

The categories illustrated on the map have been classified in relation to the lengths of rivers and the total extents of lakes and coastal waters. The data is from the end of 2008. Waters shown in grey have not yet been classified. Waters shown in brown include artificial reservoirs and radically altered water courses.


The blue-green algae species Anabaena (spirals) and Aphanizomenon (linear cluster) regularly form blooms in Finland’s lakes and the Baltic Sea.
**Meadows and pastures among the most threatened biotopes**

Modern forestry practices behind the decline of many species

About half of Finland’s natural biotopes have been classed as threatened. Their share of the country’s total area is much smaller than this, since many of the threatened biotopes are small in extent. Only a fifth of all biotopes were classed as being “of least concern”. The proportion of threatened biotopes found in Southern Finland is considerably larger than in Northern Finland.

The most common factor behind increasing threats facing biotopes is commercial forest management practices, which particularly affect the quality of biotopes in forests, mires and small water features. Further factors of note include drainage schemes, hydrological engineering, and the clearing of fields long ago. The eutrophication of soils and water bodies has increased the threats facing sandy shores, nutrient-poor forests and meadows, and aquatic ecosystems.

Climate change is clearly a crucial threat factor for the future, even though not all of its impacts on different biotopes are yet understood. Climate change most imminently threatens nature in arctic fell habitats, especially biotopes dependent on snow or permafrost.

The first assessment of the statuses of Finland’s biotopes was completed in 2008, examining almost 400 biotopes and how they have been changed by human impacts. These biotopes were grouped into seven main categories: inland waters and shores, mires, forests, rocky habitats, traditional agricultural biotopes, arctic fells and the Baltic Sea and its coasts.

Climate and improvement of natural mire ecosystems still cannot be guaranteed. Their hydrological conditions are easily altered by the impacts of human land use also in their surroundings. No new mire drainage schemes for forestry purposes are planned. But improvements to existing drainage schemes can still dry out undrained mire habitats in the same hydrological systems.

Peat harvested sites cover a total area of around 1,000 sq km. To avoid further harmful impacts, any new peat extraction schemes should be located in peatlands where natural mire habitats have already been lost. Hydrological engineering, the use of groundwater, logging and forestry work in undrained mires, the construction of roads and the increasing use of off-road vehicles may still harm natural mires.

Climatic warming will at a very early stage start to threaten various kinds of arctic mires that form where permafrost persists.
Mud worms invade the Baltic Sea

Changes in marine ecosystems due to human activity and alien species accidentally introduced in ships’ ballast water have greatly altered the flora and fauna of the Baltic Sea. In many areas soft sea floors are now dominated by invasive species including the shellfish *Macoma baltica* and polychaete worms (*Marenzelleria* sp.), in place of the native Baltic amphipod *Moppoporia affinis*.

Many non-native invasive species represent a threat to Finland’s natural biodiversity. According to the Nordic Council of Ministers, the alien invaders that have managed to establish viable populations in Finland include 21 marine species, 24 aquatic species founding inland waters, and 593 terrestrial species (mainly plants).

At least one in ten of Finland’s species are under threat. Finnish legislation on nature conservation includes a list of 1,410 threatened species. The main factors behind the decline and loss of Finland’s native species are the overgrowth of traditional farmland habitats no longer grazed or mown, and changes due to modern forestry practices.

Finland is a world-leader in terms of expertise on species. Nevertheless the statuses of as many as two-thirds of the country’s species are poorly known. A wide-ranging research programme that surveyed Finland’s deficiently known and threatened forest species over the period 2003–2007 revealed well over a thousand species previously unrecorded in Finland, including many totally new to science.

In 2008 breeding white-tailed eagles occupied some 300 territories around Finland, hatching a total of 263 eaglets. The country now has an estimated population of around 1,000 white-tailed eagles. This number is much higher than in the 1970s, when the eagles almost vanished from Finland due to persecution and problems caused by the high concentrations of pollutants in their fish prey. Their recovery has been aided by the provision of uncontaminated food during the winter by volunteers, the protection of their nesting areas, and bans on the use of toxic substances.

In 2007 some 250–270 pairs of peregrine falcons bred in Finland. The falcons suffered even more from pollution than white-tailed eagles. Until the 1950s, there may have been almost 1,000 pairs around Finland. But their numbers then crashed in the 1950s and 1960s due to contamination with DDT and other toxic chemicals. By the early 1970s their Finnish population was estimated at just 30 pairs. Following bans on the use of such toxic substances the population started to recover gradually. Source: Olli, T. & Koskimies, P. 2008.

www.environment.fi/speciesprotection

Survivors: the white-tailed eagle and the peregrine falcon
Finland in numbers

Finland is a large country geographically (the 8th largest country in Europe), but has a relatively low population, as the most sparsely populated country in the EU. Most people live in the south.

Finland is generally flat with few hilly regions. The country has tens of thousands of lakes (one for every 30 inhabitants), and consequently also many islands and shores.

Geographical latitudes range from 60°N to 70°N so much of Finland lies inside the Arctic Circle. Widespread natural habitats include coniferous taiga forests and bogs, though there are also some temperate mixed forests in the south-west and mountain birch forests and open tundra-like arctic fells in the north.

Finland’s climate is warmed by the Gulf Stream, making temperatures milder than in other regions in the same latitudes. In the south, temperatures usually remain below zero for 4–5 months each winter, and snow covers the ground for about 4 months a year. In the north, snow cover and sub-zero temperatures typically persist for 6–7 months.

Vital statistics

Area

<table>
<thead>
<tr>
<th>Total area (excl. seas)</th>
<th>338,419 km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>78% forestry land</td>
<td></td>
</tr>
<tr>
<td>8% agricultural land</td>
<td></td>
</tr>
<tr>
<td>4% built land</td>
<td></td>
</tr>
<tr>
<td>10% inland waters</td>
<td></td>
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</tbody>
</table>

Population

<table>
<thead>
<tr>
<th>Total population, end 2007:</th>
<th>5,300,484</th>
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<tbody>
<tr>
<td>Average population density:</td>
<td>16 per km²</td>
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<tr>
<td>Predicted population in 2040:</td>
<td>5.5 millions</td>
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<tr>
<td></td>
<td>5.7 millions</td>
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Lakes and islands

<table>
<thead>
<tr>
<th>Lakes larger than 500 m²</th>
<th>187,888</th>
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</thead>
<tbody>
<tr>
<td>Lakes larger than 1,000 m²</td>
<td>56,000</td>
</tr>
<tr>
<td>Inland islands larger than 100 m²</td>
<td>98,000</td>
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<tr>
<td>Sea islands larger than 100 m²</td>
<td>81,000</td>
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</table>

Climate

<table>
<thead>
<tr>
<th>Average temperature in January /July in Helsinki</th>
<th>-4.2 °C / 17.2 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>in Sodankylä</td>
<td>-14.1 °C / 14.3 °C</td>
</tr>
</tbody>
</table>

Nature conservation

Protected areas

International environmental agreements

Member of the European Union since 1.1.1995

Finland is a party to more than a hundred international environmental agreements either directly or through the EU. For a complete list, see: [www.environment.fi/agreements](http://www.environment.fi/agreements)

Finland hosts the Baltic Marine Environment Protection Commission (Helsinki Commission).

See: [www.helcom.fi/Convention](http://www.helcom.fi/Convention)