State of the Environment in Denmark 2005

Illustrated summary

What condition is our environment in? This is the question that the report "State of the Environment in Denmark 2005" addresses.

The report summarises current knowledge of the main trends with regard to the state of the environment and nature in Denmark. The report describes how these developments are connected with developments in society as a whole and the impacts that can be expected with regard to our health.

This illustrated summary shows the most important trends and provides an overall picture of the issues covered by the report. The main report is in Danish only.

National Environmental Research Institue

DANISH MINISTRY OF THE ENVIRONMENT

ISBN: 978-87-7772-919-5

National Environmental Research Institute

Illustrated summary of the State of the Environment Report

State of the Environment 2005

Status and trends

State of the Environment in Denmark 2005 – Illustrated summary

Edited by:
Hanne Bach
Niels Christensen
Henrik Gudmundsson
Trine Susanne Jensen
Bo Normander
Department of Policy Analysis, NERI

Translation by:
Carey Smith
Department of Policy Analysis, NERI

Published by:
National Environmental Research Institute (Danmarks Miljøundersøgelser©)
Ministry of the Environment in Denmark
www.dmu.dk

Graphics:
Juana Jacobsen
Kathe Møgelvang
Graphics Group, NERI

Photographs:
2.maj: Sonja Iskov; CDanmark; Energi E2; Foto Folketinget; Highlight;
MIM fotoarkiv: Erling Krabbe, Jens Schering, Ole Malling;
NERI: Poul Johansen, Rune Dietz; Polfoto: Anders Brohus;
Scanpix: Berit Roald; SNS: Jan Kofoed Winter; Peter Bundgaard;
Søren Dyck; Torben Reitzel.

ISBN: 978-87-7772-919-5

Printer:
Schultz Grafisk
ISO 14001 (environment) and
ISO 9002 (quality) certified

Further copies can be obtained from:
Miljøministeriet
Frontlinien
Rentemestervej 8
2400 København NV
Tel: 70 12 02 11
frontlinien@frontlinien.dk
www.frontlinien.dk

The state of the environment report (in Danish) "Natur og Miljø 2005. Påvirkning og tilstand. Faglig rapport fra DMU nr. 550" is available as a Pdf-file on DMU's web-site: http://www2.dmu.dk/1_Viden/2_Publikationer/3_fagrapporter/rapporter/FR550.pdf

The Danish state of the environment report is published every four years, and the 2005 issue is the fourth in the series. The aim of the report is to provide an overall picture of the developments in the state of the environment and the nature, and describe the underlying reasons for these developments as well as the consequences for, amongst other things, human health.

In the mid-1980s, environmental issues were high on the political agenda and, at that time, Danes were more concerned about pollution than unemployment and foreign debt. Politicians recognised that it was necessary to increase efforts to safeguard the environment and nature. However, both a lack of knowledge and view of the overall picture meant that it was difficult for politicians to arrive at convincing solutions, which at the same time focused on larger problems before lesser problems. Environmental research and monitoring over the subsequent 20 years has provided a great deal of insight and knowledge which, in turn, can secure the scientific basis for efforts to protect the environment as well as the means to provide an overall picture, both of which were lacking 20 years ago.

The state of the environment report collects existing knowledge and presents this knowledge to provide politicians, citizens and other stakeholders with the information they require – for politicians to prioritise their policy efforts and enabling citizens and other interest groups to take part in the environmental debate.

The report provides a snapshot which, looking back, shows how the environment has developed up until the present. It is not possible to cover everything and the report, most of all, does not cover the day's breaking news items on the environmental agenda. These items are communicated in other ways. We have selected the issues which we consider to be the most important in order to be able to describe the state of the environment. Changes are occurring continuously, and it can be difficult to take everything into consideration. However, as far as possible, we have attempted to make assessments, which reflect the challenges of tomorrow. Throughout the report, many examples are provided where developments are proceeding in the right direction. Goals are being achieved, environmental impacts are decreasing – or, at least, are increasing more slowly than growth in society's activities. This is known as decoupling. However, there continue to be examples where we must note that goals are not being fulfilled, and decoupling is not taking place.

Therefore, there is every possible reason for research and monitoring to continue to develop so that society can be at the leading edge of not only today's challenges, but also of those of the future.

Henrik Sandbech
Director general
National Environmental Research Institute, Denmark

Developments in society affect environment and nature

The influence of society on the state of the environment

Developments in society affect the state of the environment and nature. This relates to changes in both the size and the age distribution of the population, changes in production as well as consumption of goods.

From an economic point of view, industry and services are the most important sectors in society, whilst agriculture, energy and transport are the areas which exercise the greatest influence on nature and the environment. Agriculture affects the environment by means of use of fertilisers and pesticides, whilst the consumption of coal, oil and natural gas for energy and transport leads to a range of associated impacts on the environment.

The intensification of agriculture

Agriculture continues to specialise and intensify. The number of farms is falling; farms are becoming larger and the number of livestock on the individual farm is rising. The crop yield now is approximately the same as it was 15 years ago, but comes from a smaller area under cultivation. The agricultural sector's own estimates forecast that this trend will continue, with the area of land under cultivation falling by around 6.5% and the disappearance of 22,000 farming units (around 50% of the total) by 2015. Moreover, it is expected that more crops will be grown, not for food production, but for the production of bio-energy. Intensive farming practises result in reduced variation in landscapes and reduced wildlife in and around the fields. The continued intensification and specialisation can also lead to pollution being more concentrated in certain areas – for example, in the vicinity of larger pig production units. Intensification can, on the other hand, mean that nutrients and pesticides can be utilised better, as farming units become more efficient.

The emission of ammonia from livestock production has fallen by around 30% from 1985 to 2003, but the livestock units continue to create problems for neighbours with regard to odour as well as for sensitive natural areas. The leaching of nitrogen to water has fallen around 48% from 1989 to 2003, which is close to the goal for the National Action Plan for the Aquatic Environment.

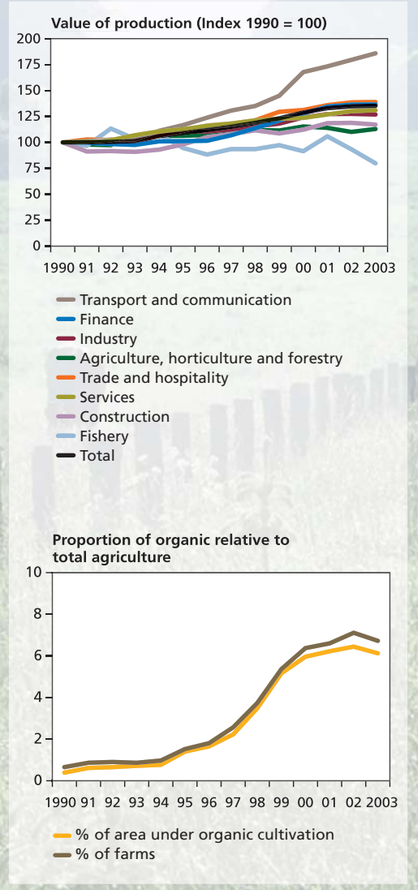
Consumption of pesticides in Denmark has decreased 58% since the beginning of the 1980s. Pesticides are mainly used in agriculture but also in horticulture and forestry, not to mention private gardens and public areas, e.g. along railway lines and roads. The authorities use application frequency as a measure for the impact on the environment. Application frequency is the number of times a field is sprayed with a pesticide in the recommended dosage. Application frequency has decreased 18% since the beginning of the 1980s and, in 2003, the frequency was 2.04. This figure varies from year to year, among other things, due to weather conditions as these affect the requirement to use pesticides. The latest Pesticides Plan (2004–2009) contains as one of the goals to reduce the application frequency to 1.7 before 2009.

Forestry is more than the production of wood

Forests are undergoing a process of change. The aim is to double Denmark's forest area over the course of 80–100 years, to change forestry towards more natural cultivation forms and to secure forests' natural values. The area of forest comprises approx. 11% of Denmark's total land area, and the forested area is rising by 2,500 hectares per year. On average, 4–5,000 hectares of forest need to be planted each year in order to achieve the goal of doubling the area. Current development trends of forestry emphasize biodiversity, groundwater protection, climate, hunting, recreation and preservation of sites of cultural heritage, rather than the production of wood alone.

Fishing encounters limits

The fishing industry is stagnating as a result of the quotas that the EU sets in order to protect declining fish populations. Especially cod is threatened by intensive fishing practices. The environmental impact of fishery also includes damage resulting from the methods used to catch the fish, e.g. bottom trawling, which destroys plant- and animal-life on the seabed. Production from aquaculture was valued at 1 billion DKK in 2003, which equates to the value of the Danish cod catch. Fish farming impacts the local water environment with nutrients from leftover food and with antibiotics used to combat disease. Aquaculture has significant potential for growth, if it is possible to reduce the impact on the environment associated with these activities.



The value of production has especially increased for transport and communication, while it has decreased for primary sectors, such as agriculture and fishery.

The number of organic farms and the area of land under organic cultivation as shares of the respective totals for farming as a whole. Demand for organic goods has risen during the 1990s but has levelled out in recent years. Around 6% of agricultural land is under organic cultivation today and 3% of the total income for agriculture as a whole is generated by organic farms.

Energy production and transport are of great significance

Energy production is made more efficient

Denmark's energy production is increasing and a significant proportion is exported. The importance of oil as a source of energy has declined from 50% in 1985 to 40% in 2004, while especially natural gas and renewable energy have been on the increase. Renewable energy stems from biomass, waste, wind, the sun and energy from heat pumps, and this energy source now accounts for over 20% of the gross energy consumption.

The environmental impact from the production of energy has, in many areas, fallen. Sulphur emissions have fallen by approx. 98% and the emission of nitrogen oxides by 50% since 1985. However, since 2000, these emissions have increased in line with rising energy production. Energy production is the most important source of greenhouse gas emissions. The emission of greenhouse gases varies from year to year due to climatic variations and the annual energy trade balance. In 2003, emissions were approx. 10% higher than in 1990.

Renewable energy is not without negative environmental impact. The incineration of waste leads to the emission of polluting substances as well as ashes and slags which are sent to landfill. Windmills impact especially on the visual environment and noise can be a problem. The effect of sea windmills on birds, fish and sea mammals continues to be a focus of research.

Industrial energy consumption is falling

Industrial production impacts on the environment in various ways. Since the 1990s, industrial energy consumption has decreased at the same time as the value of production has risen. Today, industrial wastewater is treated, as a result of the National Action Plans for the Aquatic Environment, and the heavy metal content in industrial wastewater is, typically, no higher than that in household wastewater. However, industry is still a significant contributor of heavy metals to the air, and industry uses a range of chemical substances which are damaging to health and are undesirable in the environment. The authorities are increasingly focusing on the environmental impacts of industry, by limiting the effects of the products which industry produce. With regard to waste, industrial waste accounts for 15–20% of total waste produced.

Transport is growing

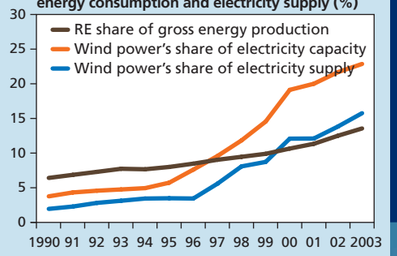
Both personal and goods transportation is growing roughly in line with the economic growth. Traffic is associated with a broad spectrum of environmental impacts. This activity is responsible for 31% of the final energy consumption, over half of the consumption of oil products, and significant shares (a quarter or more) of the emissions of substances such as nitrogen oxides, hydrocarbons, greenhouse gases and particles.

Stricter requirements with regard to engines and the use of cleaner fuels have meant that the emission of nitrogen oxides and hydrocarbons from traffic has reduced markedly. The emission of greenhouse gases from traffic has, on the other hand, increased in step with the increasing levels of traffic, as no similar requirements exist in this area. The emission of particles has fallen a great deal since 1990. However, this trend has now stopped. The primary reason for this is the rise in the number of private diesel cars as these emit more particles than cars running on petrol.

Traffic represents the most widespread source of noise. Roads create barriers which can impact on the natural environment as well as amenity values and the mobility of people and animals. Approximately 60% of Denmark's special protection areas for birds are within 5 km of an important traffic route.

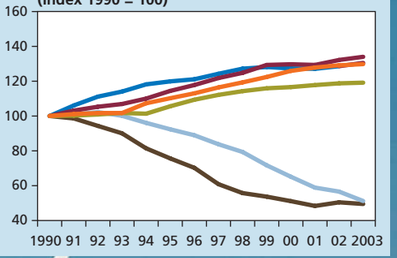
The government's strategy for sustainable development includes environmental goals for transport. For example, the rise in the emission of greenhouse gases from traffic is to be halted. Up until now, emissions have risen in line with economic growth. Further, the emission of nitrogen oxides and hydrocarbons is to be reduced by 60% from 1988 to 2010. A fall of around 50% has been achieved to date.

Renewable energy (RE) as a proportion of gross energy consumption and electricity supply (%)



Renewable energy comprises an increasing share of total energy supply, corresponding with political objectives. The goal for renewable energy to reach 20% of total electricity supply by the end of 2003 has been achieved. The extension of wind power continues and is now concentrated on sea windmills.

Private cars – selected trends (Index 1990 = 100)



Car traffic is increasing in step with economic growth. Some of the impacts from cars are falling, e.g. emissions of nitrogen oxides and particles are decreasing, while emissions of CO_2, for example, are increasing.

- Particles
- Nitrogen oxides
- CO_2
- Car traffic
- No. of private cars
- GDP

Economic growth

does not always lead to increased environmental impact

Consumption is rising

Consumption in Denmark rose 20% from 1990 to 2003 with knock-on effects in the fields of production, import, transport and waste generation. In some areas, the increase in consumption resulted in increased impact on the environment, while, in other areas, more environmentally-sound products and consumption behaviour have come into play.

Consumption has changed in step with rising standards of welfare. We use, for example, relatively less on our homes and food, but more on electronic equipment such as PCs and mobile phones. Food consumption has not changed a great deal, but demand for organic products, with lower impact than in conventional farming, has increased. Today, organic products comprise around 5% of food consumption in Denmark, a share which is among the highest in the world.

Energy consumption in households has risen by around 7% since 1990. Energy consumed for heating has fallen by around 25% since 1985, while consumption of electricity for electrical appliances, lighting, etc. has risen slightly. Appliances are becoming more efficient with regard to electricity consumption. However, the number of appliances in use has increased.

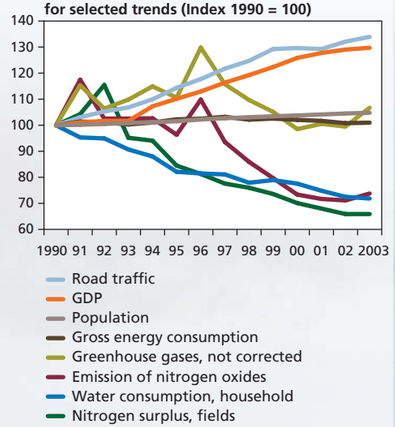
Households produce around a quarter of the total waste in Denmark. The amount produced increased for many years, but since levelled out and from 2002 to 2003, the amount of waste fell by 4%. The Danish Environmental Protection Agency estimates that the total waste amount will increase 27% from 2000 to 2020, which is a little lower than the expected rate of economic growth. The overall goal for the treatment of waste is that 65% of the waste is re-used, 26% is incinerated, with the remaining 9% being sent to landfill. This goal has been achieved.

Decoupling of growth and environmental impact

Denmark's strategy for sustainable development from 2002, "Our common future – balanced development" ("Fælles fremtid – udvikling i balance"), aims to consider both economic growth and environmental protection. Included in the strategy is that changes in behaviour and more environmentally effective technology are able to prevent economic growth necessarily leading to increased environmental impact. The phenomenon is termed "decoupling".

In a number of areas marked decoupling tendencies can be observed. For example, household water consumption has fallen despite an overall rise in household consumption. Similarly, nitrogen oxides and sulphur emission from energy production and traffic have fallen despite rising activity in these areas. In the industrial sector, production is increasing at the same time as energy consumption is falling, e.g. in the paper and in the cement industry. In a number of other areas, decoupling is less pronounced. Overall, energy consumption and the emission of greenhouse gases have risen by around 10% (without any corrections) whilst the economy has grown 30%. A fall in agricultural emissions has occurred while production has largely remained constant. In a range of other areas, e.g. greenhouse gas emissions resulting from private car use and household waste production, environmental decoupling is not evident.

Absolute and relative decoupling for selected trends (Index 1990 = 100)



Within some areas environmental impact is falling while the economy is growing. In other words, there is a decoupling of environmental impact from growth. In other areas, environmental impact is rising, but at a rate lower than economic growth, and, finally, there are areas where environmental impact is rising at the same pace or more rapidly than economic growth. Evidently, in these cases, one cannot speak of decoupling.

Human-induced climate change is a major challenge

The greenhouse effect was first recognised in Denmark as a serious problem around 1990. Human-induced climate change will have consequences for almost all the Earth's natural ecosystems, for food production, the amount and the distribution of fresh water and for human health. The changes will affect the basis for socio-economic development in many countries.

Greenhouse gas emissions

Denmark has undertaken a duty to reduce, as an average over the period 2008–2012, the emission of greenhouse gases by 21% compared with the level in 1990. The calculation of the emission in the reference year, 1990, will be finally established in 2006, but estimates according to current methods put the emission at approx. 70 million tonnes. The emission in 2003 was approx. 74 million tonnes. The target represents an emission of 55–60 million tonnes, where the interval of 5 million tonnes reflects the discussions between Denmark and the EU on the calculation method for the emissions in the reference year.

Greenhouse gas emission projections are calculated on the basis of the latest energy forecasts. Projections have shown that the Danish emission, on average, will be approximately 72 million tonnes per year in the period 2008–12. This represents an improvement of 12 million tonnes in relation to the previous prediction of the emissions from 2003. The improvement is due, among other things, to the expected fall in Danish electricity exports as a result of increased hydropower capacity in Sweden and Norway, extension of the production of renewable energy from offshore windmills and the effects of the CO_2 quota law, which is expected to lead to a fall in electricity production. Furthermore, it is expected that Denmark will offset an emission of approximately 4.5 million tonnes by purchasing CO_2 quotas and by investing in CO_2-curbing projects. Overall, this means that, according to current calculations, there will be a shortfall in relation to Denmark's target of between 8 and 13 million tonnes. The most important sources for greenhouse gas emissions are energy production (63%), transport (22%) and agriculture (15%).

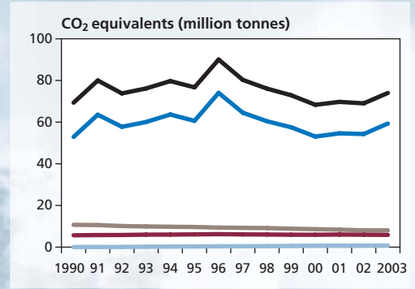
Consequences of climate change for the natural environment in Denmark

The Danish weather has become warmer. Scientists expect that climate in the future will generally become warmer still, and wetter and windier, with more storms and periods characterised by heavy rainfall. The temperature has risen, on average, by 1ºC and precipitation has risen by 110 mm since 1870. The years 1990 and 2000 were the warmest ever registered in Denmark.

The change in climate will, among other areas, have consequences for agriculture. Crops will change, farmers will achieve higher yields, but there will also potentially be a need for increased fertiliser application as higher rainfall leads to a higher nutrient loss. The increased rainfall will have implications for the ecological quality in lakes, watercourses and fjords due to the increased drainage and the leaching of nutrients from land.

It is expected that the temperature of seawater in Danish waters will rise 3–5 ºC and that sea level in Denmark will rise approx. 0.5 m before 2100. The reasons behind this are that the Arctic ice is melting and that water expands when temperature increases. Sea level rise requires better coastal protection so that these areas can withstand storms and floods.

Biodiversity will also be affected by changes in climate. Some species will become extinct or disappear from Denmark, while others will move to the north, and new species will arrive in Denmark. Ecosystems, for example the Wadden Sea, can be seriously impacted by rising sea levels. Climate change also impacts on forest ecosystems. A number of tree species, for example, the Norway Spruce, prefer a colder climate than we already have in Denmark today. More frequent storms will present a challenge to forestry, and there will be an increasing need to move towards the use of mixed forest with a range of different species, at different ages, which can withstand storms better.



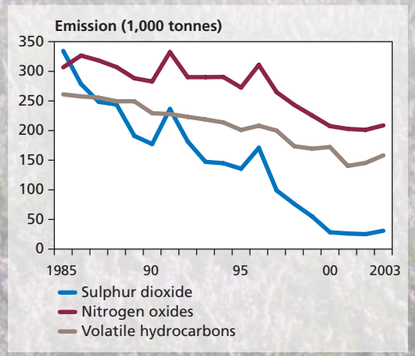
Development in Denmark's emission of greenhouse gases calculated as CO_2 equivalents for carbon dioxide, nitrous oxide, and methane as well as the three industrial gases, HFC, PFC and SF_6.

Air pollution affects sensitive habitats and human health

There is less air pollution

Efforts in Denmark directed at the reduction of air pollution go back more than 30 years. Health risk and environmental damage have been reduced over this period by limiting the emission of polluting substances such as sulphur dioxide, nitrogen oxides, hydrocarbons, lead and particles. However, all the problems with regards to air pollution have not been solved. There are still a number of direct impacts on both human health and on the natural environment.

The emission of sulphur dioxide has fallen by 93% since 1980 as a result of taxes, desulphurisation at larger power stations and the lower sulphur content in the oil products used. The emission of nitrogen oxides has fallen around 85% since 1985. This is especially due to technological developments at power stations and heat and district heating plants as well as the introduction of catalytic converters on cars. The emission of hydrocarbons has decreased by 35% mainly due to the introduction of catalytic converters on cars and the fall in emissions associated with the use of solvents.



Development in Denmark's emission of sulphur dioxide, nitrogen oxides and volatile hydrocarbons. The emission of these substances is regulated by an EU directive, which sets a ceiling for Danish emissions. This ceiling is to be adhered to from 2010. Denmark has already achieved the limit for sulphur dioxide, but the emission of nitrogen oxides and volatile hydrocarbons needs to be reduced further, by about 40 and 46%, respectively.

The natural environment is affected

The emission of sulphur dioxide, nitrogen oxides and ammonia contributes to acidification of the natural environment, but also to eutrophication (process of nutrient enrichment) of many natural areas as nitrogen oxides and ammonia act as fertilisers. The total emission of acidifying substances has fallen by 40% since 1990. The emission of these substances has also decreased on a European scale, leading to a fall of around 70% in sulphur deposition in Denmark. All in all, this means that the problem of acidification of natural areas, e.g. forests, has largely been solved.
The nutrient enrichment effect of nitrogen deposited from the air means that the critical level for almost 70% of Denmark's sensitive nature areas has been breached. The emission and deposition of nitrogen as a whole has been reduced by around 20% since 1990, but this has been far from sufficient to protect the sensitive areas in Denmark.

Air pollution impacts on human health

Nitrogen oxides also have a direct impact on our health. They can depress the function of our lungs and our ability to resist lung infection. The EU has set a maximum level for nitrogen oxides which has to be adhered to from 2010. At present, this level is sometimes exceeded in some areas. In one of the roads in Copenhagen with the most traffic (Jagtvej), the level is permanently above the limit value.

The emission of small particles has a great significance for human health, especially in urban areas where the largest part of the particles stems from road traffic. A study undertaken by Denmark's National Environmental Research Institute (NERI) reveals also that wood-burning stoves in private houses emit small particles and that these comprise almost 50% of the total emission of particles. Curbing the emission of particles has meant that the amount of particles in cities has almost halved in the past 10–15 years, even though traffic levels have risen. Particle pollution, however, is still associated with a significant health-damaging effect, and it is especially the very small particles which are considered dangerous, as these can penetrate far down into the lungs and into the blood. Particle pollution is controlled with help from limit values set by the EU. The current level in Danish cities is under, but close to, these limits.

Nutrient discharges to the aquatic environment have fallen

% of waterworks' wells, and in 6% of wells, e limit values for drinking water have been ceeded. In around 25% of drinking water ells, nitrate is found and the limit value is ceeded in 1% of wells.

sticides are the main reason when the thorities close drinking water wells. The mber that has to be closed each year has lved since 1997. This is due, in particular, the fact that wells in the most problematic eas have already been closed.

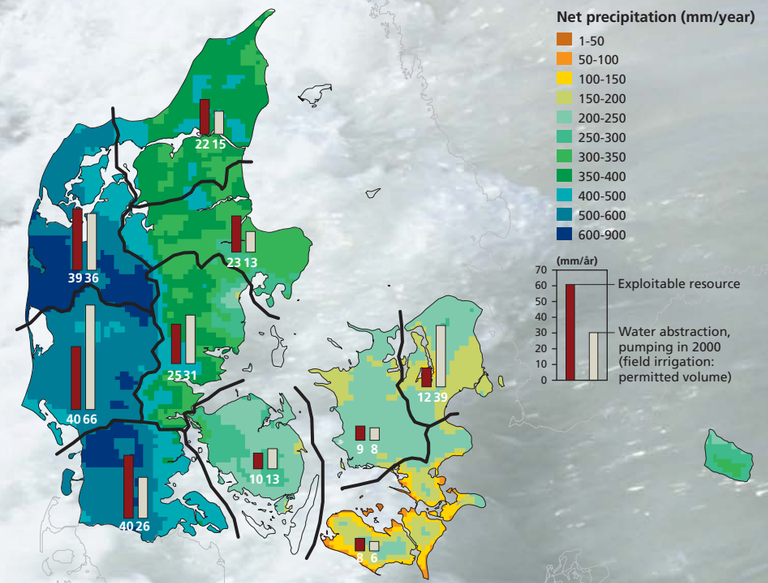
new study of the population's attitude wards treatment which cleans drinking ter versus groundwater protection reveals t Danes are willing to pay extra to protect oundwater and that we prefer to protect oundwater rather than clean it.

utrient discharges to the water vironment have fallen

utrient discharges to the water environ-ent have fallen markedly since the end of e 1980s, when the first plan for the aquatic vironment came into force. The target set in e Plan for the Aquatic Environment I was to duce the total discharge of nitrogen by 50% d that of phosphorous by 80%. Over 90% our wastewater is cleaned very effectively. e discharge of nitrogen via wastewater has len by around 74%, while the corresponding ure for phosphorous is around 86%.

The goal, in the Plan for the Aquatic Environment I, to reduce the discharge of phosphorous was already achieved in the mid-1990s, but it has been more difficult to reach the goal for nitrogen, where agriculture is the dominant source. Therefore, in 1991, the Danish parliament adopted an action plan for sustainable development in agriculture ("Handlingsplan for en bæredygtig udvikling i landbruget") and the Plan for the Aquatic Environment II was put into action in 1998. The leaching of nitrogen from agricultural land fell by around 48% from 1989 to 2003 and the target in the National Action Plans for the Aquatic Environment was, therefore, considered achieved.

Nitrogen and phosphorous discharges to fjords and marine areas vary along with rainfall. Discharges are greatest in wet years and lower in dry years. When the differences in rainfall from one year to the next are corrected for, discharges of nitrogen and phosphorous from land have fallen around 43% and 81%, respectively, from 1989 to 2003. The major source of nitrogen discharges is agriculture, whereas for phosphorous, agriculture, wastewater treatment and sparsely built-up areas contribute with equal amounts.



Exploitable water resources are compared with water abstraction in 2000. For the country as a whole, there is sufficient water. However, the map shows that there are large geographical differences in the size of the water resource and the demand for water. In the capital city area, Funen as well as East and West Jutland, water abstraction is greater than the available water resource.