Environment Switzerland 2011

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Office for the Environment FOEN

Federal Statistical Office FSO

Data sources

SI A statistical institution

IF An official institution within the field in question

RI A research institute

IO An interest group

☐ Data from several sources, cannot be attributed to any one category, or this attribution is not relevant

Data acquisition methods

FS Random sampling, systematic monitoring network or full survey covering the entire country or canton

R+ Pragmatically defined monitoring network, i.e. covering "typical circumstances" and all regions and situations

R Pragmatically defined monitoring network, i.e. covering "typical circumstances", but excluding certain regions and situations

M Calculation model

E Estimation or expert opinion

■ Several acquisition methods involved, method cannot be attributed to any one category, or this attribution is not relevant

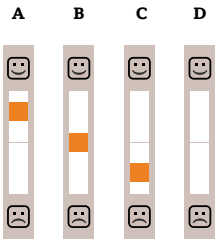
Link types

Link to a chart (» G6.1 ...
Link to a map (» M11.1 ...
Link to a figure (» F1.1 ...

Link to a chapter (» Chapter 5 ...
Link to the bibliography (» FSO 2006 ...

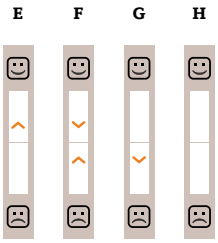
Diagram evaluation tool

The pictograms combine information on state:



A Good
B Adequate
C Poor
D Impossible to evaluate

and trend:



E Positive
F Stable
G Negative
H Impossible to evaluate

Environment Switzerland 2011

Published by
the Federal Office for the Environment FOEN and
the Federal Statistical Office FSO
Bern/Neuchâtel 2011

Imprint

Published by
Federal Department of the Environment, Transport, Energy and Communications (DETEC)
Federal Office for the Environment (FOEN), Bern
www.bafu.admin.ch/en

Federal Department of Home Affairs (FDHA)
Federal Statistical Office (FSO), Neuchâtel
www.statistics.admin.ch

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Design and layout
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Source to be referenced
FOEN/FSO (ed.), Environment Switzerland 2011, Bern and Neuchâtel 2011, 101 pages.

Writing completed on
20 December 2010

Orders/distribution
BBL, Publications distribution office, CH-3003 Bern
Tel. +41 (0)31 325 50 50, fax +41 (0)31 325 50 58
verkauf.zivil@bbl.admin.ch, www.bundespublikationen.admin.ch
Order numbers: 810.400.051eng (English), 810.400.051f (French), 810.400.051d (German), 810.400.051i (Italian)

PDF file: www.bafu.admin.ch/ud-1039-e

FSO, CH-2010 Neuchâtel
Tel. +41 (0)32 713 60 60, fax +41 (0)32 713 60 61
order@bfs.admin.ch, www.statistics.admin.ch » Services » Swiss statistical publications
Order numbers: 810.400.051eng (English), 810.400.051f (French), 810.400.051d (German), 810.400.051i (Italian)

PDF file: www.environment-stat.admin.ch » Publications

Price
CHF 10.– (incl. VAT)

ISBN
978-3-303-02117-0 (e), 978-3-303-02115-6 (f), 978-3-303-02114-9 (d), 978-3-303-02116-3 (i)

Language versions
This report is available in French, German, Italian and English as a print publication or PDF file.

Print run
4,000 in German, 1,500 in French, 500 in Italian, 1,000 in English

Paper
Recystar, 100 % recycled paper

Cover
Cover photo: Pear tree, Stefan Jäggi

Additional information
Federal Office for the Environment (FOEN)
Environmental Monitoring Section
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Acknowledgement
The publishers would like to thank all the scientists and the experts within the federal administration who provided invaluable suggestions and comments.

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Foreword

The environment concerns us all. It not only meets our needs for raw materials, energy and nutrition, it also provides us with space for recreation and leisure. Hence it contributes to the attractiveness and, ultimately also, the prosperity of our country. For this reason, reliable and transparent information about the environment is crucial, not least as a basis for political debate. This publication contributes to the availability of such information.

As was the case for the 2007 and 2009 editions, the "Environment Switzerland 2011" report was compiled jointly by the Federal Office for the Environment and the Federal Statistical Office. It provides a systematic overview of the state and development of the environment in Switzerland and demonstrates, in particular, the impact of our lifestyle on the environment. The report also takes stock of the measures already taken to improve the quality of the environment and identifies areas in which action is currently being taken. Part III "Switzerland in the international context" enables us to compare the progress made on environmental issues in Switzerland with that in other European countries.

One thing emerges clearly from reading this environmental report: the state of the environment in Switzerland cannot be summed up in a single word. The encouraging success stories of recent years contrast sharply with the serious environmental problems that remain to be resolved.

In October 2010, the Federal Council set the course for the creation of a greener economy and strengthened the resolve to improve the conditions necessary to increase resource efficiency in production and consumption. This will also reduce the pressure on the environment, for example through the creation of incentives for the conservation of resources and the promotion of environmentally sound economic activities. Such a strategy will benefit both the environment and the economy.

Bruno Oberle, Director
Federal Office for the Environment

Jürg Marti, Director
Federal Statistical Office

Overview

The report "Environment Switzerland 2011", which was compiled jointly by the Federal Office for the Environment (FOEN) and the Federal Statistical Office (FSO), provides an overview of the current state of the environment in our country.

Overall, it may be noted that considerable progress has been achieved in the area of environmental protection in recent decades. For example, pollution by heavy metals, dioxins, polychlorinated biphenyls (PCB) and persistent organic pollutants (POPs) has decreased. The ambient air quality standards for most air pollutants are complied with in Switzerland today and the quality of both surface waters and the groundwater is generally good. Thanks to the implementation of the Montreal Protocol, which was signed in 1987, the ozone layer is recovering and should regain its pre-1980 state around 2060. The remediation of contaminated sites and the drawing up of the natural hazard maps are proceeding apace. A nature discovery park and two regional nature parks were recently awarded the park label and 14 other parks were added to the list of candidates for the label. Such parks should contribute to ensuring better protection for habitats and landscapes. A look beyond the borders of Switzerland (» Part III "Switzerland in the international context") confirms that Switzerland is performing well on environmental issues compared with other European countries. For example, at 11 %, organic farming accounts for a relatively high proportion of farming in Switzerland.

However, all of these success stories should not distract us from the fact that the situation in Switzerland is far from perfect when it comes to the environment. As the report also shows, much of the aforementioned progress – for example the improvements in air and water quality – was achieved before the turn of the millennium and the situation has not changed considerably since then. For example, the ambient air quality standards for particulate matter (PM10), ozone (O_3) and nitrogen dioxide (NO_2) are still being exceeded by a substantial margin and the level of micropollutants in lakes and rivers remains problematic.

With regard to climate change – an environmental problem that has been the focus of considerable public attention in recent years – there are no successes worthy of mention to report from the Swiss perspective. The volume of greenhouse gases emitted year on year has stagnated since 1990, the base year of the Kyoto Protocol, could only be reduced marginally. The purchase of foreign emissions certificates will be necessary, therefore, to enable us to achieve our Kyoto target. The main source of greenhouse gas emissions is the burning of fossil fuels: while the consumption of heating fuels has declined by 23 % since 1990, motor fuel consumption increased by over 15 % over the same period. On average, the temperature in Switzerland is 1.8 °C warmer than it was in 1970 and this rise in temperature has had corresponding effects on flora and fauna, the hydrological regime and water management, tourism, agriculture and forestry, and on the health of the population.

Stagnation can also be observed in relation to the conservation of biodiversity. It has not yet been possible to halt the loss of animal and plant species and the decline in their habitats. There are many reasons for this. In particular, the fragmentation of the landscape, a phenomenon associated with rising mobility, the increasing need for residential, industrial and commercial space, and, as a result of this, the sealing of soils, urban sprawl and intensive agriculture all contribute to the impairment of ecosystems.

However, it has been possible to decelerate some of these developments in recent years – for example, urban sprawl, the rises in energy consumption and the increase in the volume of municipal solid waste (MSW) incinerated (this does not apply to the total volume of MSW, however). Hence, the pressure they exert on the environment is not growing quite as strongly as it was a few years ago. It is still increasing, however.

Environmental pollution does not usually come to a halt at national borders, as pollutants can be transported by air or water and as product components, and thus cause damage in areas far removed from their location of origin. Similarly, production-related environmental impacts do not necessarily arise where a product is ultimately consumed or used. Therefore the production of consumer goods, their production methods and our consumption habits have environmental impacts abroad. These have gained in importance as a result of the constant rise in imports. In 2008, almost 70 % of Switzerland's resource requirements were covered by imports and the trend is an upward one.

Like the two preceding editions, the "Environment Switzerland 2011" report presents an ambivalent picture of the state of the environment. Encouraging successes contrast sharply with serious ongoing environmental problems. Naturally, the question arises as to how these problems will be resolved. This report provides an overview of measures that have already been taken and measures that are planned with a view to improving the quality of the environment. In addition, the FOEN provides an insight into its ongoing activities in the section entitled "Stocktaking of environmental policy implementation" (» Part I) and identifies under the heading "Current developments" areas of activity that will occupy us in the years to come.

Introduction

The purpose of the Environment Switzerland reports is to provide clear and accessible information about the state of the environment and its development as required by Swiss law (Federal Constitution, the Environmental Protection Act and the Federal Statistics Act). The reporting is based on appropriate, reliable and relevant information and on validated official data. The information presented in the Environment Switzerland reports can be used as a basis for environmental and sectoral policy debate.

Structure of the report

The "Environment Switzerland 2011" report is divided into three parts: "Stocktaking of environmental policy implementation" (Part I), "State of the environment" (Part II) and "Switzerland in the international context" (Part III). This seventh report in the Environment Switzerland series contains an assessment of Swiss environmental policy, and its target readership includes both decision-makers and members of the general public who are interested in environmental issues. More detailed information, for example about the data and indicators used in the report, is available on the internet.

Conceptual framework and methodological principles

The approach taken in this edition of Environment Switzerland is similar to that adopted in the 2007 and 2009 reports which, in turn, were based on the standardised European DPSIR model.[1] Thus, in addition to the "pure" environmental topics, the report also explores the main human activities that influence the environment.

Experts from the federal Swiss administration were involved in the selection of the indicators and compilation of the texts.

Evaluation of the information in the diagrams

The information provided in the diagrams was evaluated with the help of pictograms (» front page flap). Each pictogram indicates the state of the environment and the development trend for the topic in question. Thus, the salient findings of the report can be identified at a glance. The evaluations were conducted on the basis of objectives enshrined in legislation or established in plans of action. Uniform criteria were defined at the outset to enable the systematic and transparent evaluation of the diagrams throughout.

The state of the environment in the different areas considered was assessed on the basis of the average of the last three years' available data of relevance to the objective in question. A four-level evaluation scale was applied:

- good state: objective attained;
- adequate state: objective almost attained;
- poor state: objective not attained;
- impossible to evaluate: no objective defined or insufficient data available.

The development trends presented here refer to a period of ten years up to the last year, for which data were available and are assessed in terms of the objective in question. The development trends were also evaluated on a four-level assessment scale:

- positive trend: marked development toward the objective;
- stable trend: little or no change;
- negative trend: marked development away from the objective;
- no evaluation possible: no objective defined or insufficient data available.

The indicators presented in this report are generally based on the data available up to the end of 2010.

Since some figures have been rounded up or down, their sums may differ from the totals stated.

[1] DPSIR: Driving forces, Pressures, State, Impacts, Responses.

I. Stocktaking of environmental policy implementation

This overview takes stock of environmental policy implementation in Switzerland. It assesses the effects of this policy against the objectives and targets enshrined in legislation or established in action plans and strategies so as to provide answers to the following questions for each of the topics examined:

- Where do we stand today?
- Where are the problems and what are their causes and impacts?
- Which measures are being taken?

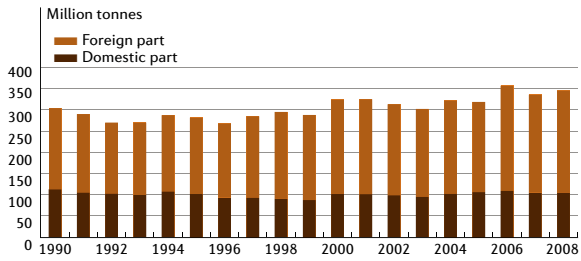
This synoptic presentation provides a rapid overview of the status of the environment and of the effectiveness of the measures taken to date. Under the heading "Current developments", current and upcoming tasks are expanded on and areas that require action from the perspective of the Federal Office for the Environment are identified. The key messages are backed by relevant indicators for evaluating whether the objectives have been attained. Part II of the report provides more in-depth insights into the various fields.

The topics addressed are: Resources – Biotechnology – Chemicals – Ozone layer – Contaminated sites – Waste – Non-ionising radiation – Air – Climate – Waters – Soil – Forests – Landscape – Biodiversity – Natural hazards – Major accident risks – Noise and vibrations – International cooperation.

Resources

Since the beginning of the century, approximately 330 million tonnes of materials have been extracted, consumed or displaced annually in Switzerland and abroad to meet the requirements of the Swiss economy and households. This corresponds to around 44 tonnes per person. Compared with 1990, total material consumption has increased by around 14 %. While the imports of finished products increased by 61 % and accounted for around 35 % of imports in 2008, the proportion of imported raw materials consumed has decreased by 2 % since 1990. Switzerland is increasingly dependent on third countries. Moreover, our consumption patterns and the shift toward a service economy are resulting in the increasing transfer of the associated environmental impacts abroad. The decoupling of the economy and resource use in accordance with the aim of sustainable development has not yet been achieved. The federal authorities aim to bring about a shift in demand on the part of both the public and private sectors to products that meet high economic, ecological and social standards through the introduction of an integrated product policy (IPP). At the centre of this policy are life-cycle thinking and the involvement of all stakeholders.

G1 Resource consumption[1]



[1] Total material requirement of the Swiss economy (TMR), excluding water and air.

Source: FSO

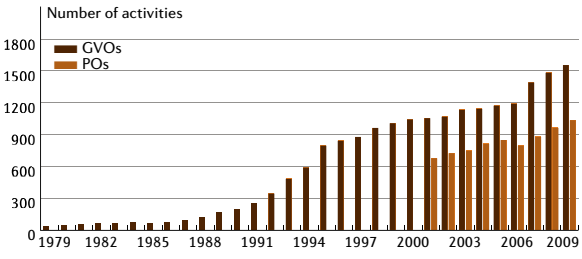
SI

Current developments Goods that can be reused as secondary raw materials (paper, glass, construction and demolition waste, metals) and goods that would cause ecological problems if landfilled or incinerated (batteries, electrical and electronic waste) have been recycled for a long time in Switzerland. To achieve the decoupling of economic growth and resource consumption, a more comprehensive policy of sustainable materials management that takes our resource consumption abroad into account would have to be implemented on the basis of these already established recycling systems.

Biotechnology

Genetically modified organisms (GMOs) and pathogenic organisms (POs) are used by research and industry in contained use systems. The use of GMOs and the number of activities involving POs have increased further in recent years. These activities are reported or authorised on the basis of the risk they pose to human health and the environment. Three projects involving the experimental release of GMOs for research purposes have been carried out since 2007 and were completed in late 2010. Two of the projects involved the release of transgenic wheat with enhanced fungal resistance and the third involved the release of a hybrid between transgenic wheat with enhanced fungal resistance and a species of wild grass.

G2 Activities involving the contained use of genetically modified organisms (GMOs) and pathogenic organisms (POs)



Source: FOEN

IF R

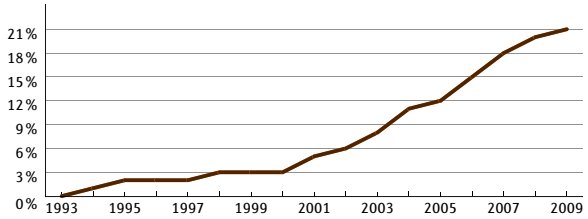
Current developments Following the extension of the GMO moratorium by parliament in 2010, the cultivation of GMOs in the agricultural sector is further prohibited until 2013. Additional information needs to be obtained to enable the assessment of the possible coexistence of GMO and GMO-free agriculture. A more in-depth risk assessment of GMOs is needed in particular.

Chemicals

Switzerland is one of the world's most important exporters of chemicals and pharmaceuticals. Thanks to the efficient and stringent implementation of the chemicals legislation and associated ordinances, the environmental impacts of known pollutants such as heavy metals, dioxins and polychlorinated biphenyls (PCBs) and persistent organic pollutants (POPs) have declined markedly in recent years. However, little if anything is known about the environmental effects and fate of chemicals that are still being released today. Particular attention needs to be paid to chemicals with specific mechanisms of action, such as immunotoxicity or hormonal activity, and chemicals with special characteristics such as nanomaterials.

Current developments There is a need to consolidate the scientific foundations, on which the assessment of chemicals and their effects on human health and the environment rests, and to improve our level of knowledge about the hazardous characteristics of chemicals that are released into the environment.

G3 Proportion of the substances on the OECD HPV chemicals list that have already been assessed



100 % = 4,638 chemicals on the OECD HPV (High Production Volume) list, which are produced or imported by at least one OECD member country in volumes exceeding 1,000 tonnes per year (reference year 2007).

Source: OECD

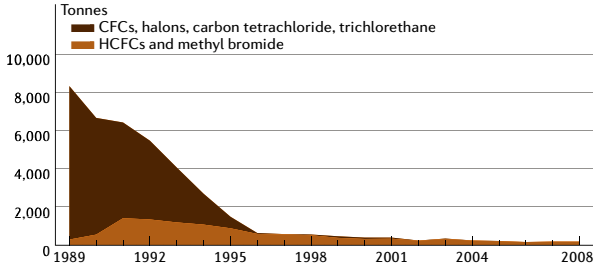
E

Ozone layer

The thickness of the ozone layer over Switzerland has decreased by approximately 5 % since 1980. As a result, the intensity of UVB radiation reaching the earth's surface has increased. Greater exposure to UV radiation can cause skin damage leading to skin cancer in humans. The seasonal depletion of the ozone layer over the Antarctic can exceed 60 %; this phenomenon is referred to as the ozone hole. In very cold winters, the concentration of ozone over the Arctic can also decline by up to 15 %. The smaller ozone holes that arise as a result can also develop over Switzerland. Thanks to the implementation of the Montreal Protocol on the protection of the ozone layer, which was signed in 1987, the concentration of ozone-depleting substances in the stratosphere has declined. With the exception of hydrochlorofluorocarbons (HCFCs), which will not be completely banned until 2015, the use of such substances has been practically eliminated in Switzerland since 1996.

Current developments If current efforts continue worldwide, the ozone layer is expected to recover to pre-1980 levels around 2060. Hence, the implementation of measures for the protection of the ozone layer must be continued.

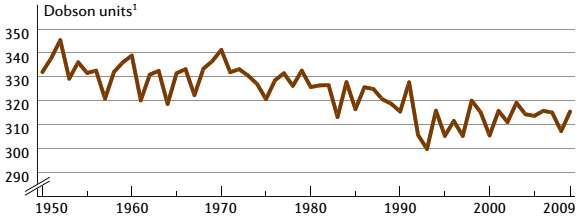
G4 Imports of ozone-depleting substances



Source: FOEN

IF E

G5 Ozone layer over Switzerland



[1] One Dobson unit (DU) is equivalent to a layer of pure ozone that would be 0.01 mm thick if measured at ground level at a temperature of 0 °C and a pressure of 1 atmosphere. Thus, if all ozone contained in a column of air was brought down to the surface of the earth, 330 DU would represent a 3.3 mm thick ozone layer.

Source: METEOSWISS

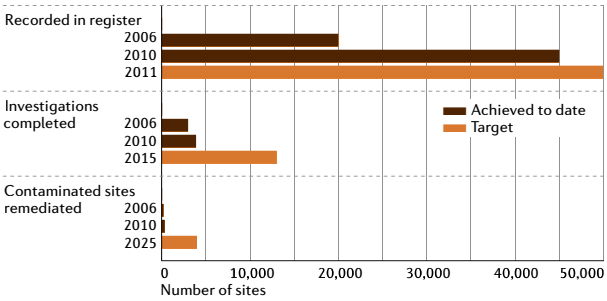
IF R

Contaminated sites

Around 50,000 sites designated as "polluted" can be found in Switzerland. To date, 90 % of these sites have been recorded by the cantons in publicly accessible registers. Over 4,000 of the sites are classified as "contaminated sites" which means that they require remediation. Investigations and remediation work are already under way in the most urgent cases. 30 % of all of the necessary investigations have been completed and approximately 350 sites have been remediated. The total costs of all of the necessary remediation work are estimated at around CHF 5 billion.

Current developments Of the 50,000 polluted sites, 13,000 require more in-depth investigation. It will be possible to accelerate the pace of remediation markedly when the cantonal registers and the investigations of the polluted sites have been completed. The federal authorities provide approximately CHF 30 million annually for the remediation of contaminated sites.

G6 Milestones in contaminated site treatment



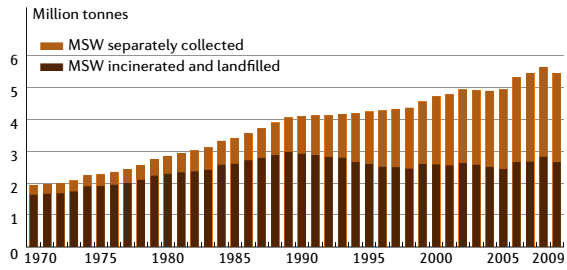
Source: FOEN

Waste

Despite some brief fluctuations due to economic factors, the volume of municipal solid waste (MSW) produced in Switzerland has increased steadily over the past 40 years. In 2009, a total of 5.46 million tonnes of waste were generated, which equates to 700 kg per person. Half of MSW arisings are collected separately and recycled. This volume has more than doubled over the past 20 years. At the same time, the per-capita proportion of non-recycled waste has declined from a high of 432 kg per inhabitant in 1988 to the current level of 340 kg per person. This MSW is incinerated in clean processes. The incineration plants generate electricity and heat that meet around 2 % of the country's final energy consumption. In 2009, approximately 1.8 million tonnes of hazardous waste underwent special processing, was disposed of domestically or exported in compliance with the provisions of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Waste disposal in Switzerland is generally financed in accordance with the polluter-pays principle.

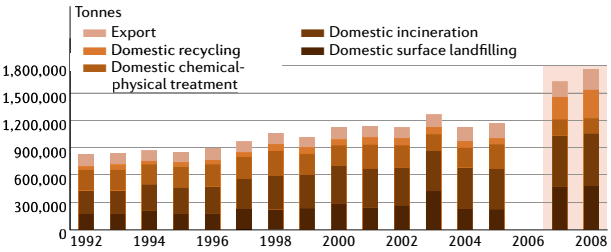
Current developments Because the production and use of consumer goods cause greater environmental impacts than waste disposal today, the focus of decisions relating to consumption and production must be shifted toward the promotion of products that conserve resources. The adoption of a sustainable approach to the use of non-renewable resources, such as metals and gravel, is also gaining in importance.

G7 Municipal solid waste



Source: FOEN

G8 Disposal of hazardous waste



Complete data are not available for 2006. Values for the years prior to 2006 were obtained using a different method and are not comparable with the values for the years after 2006.

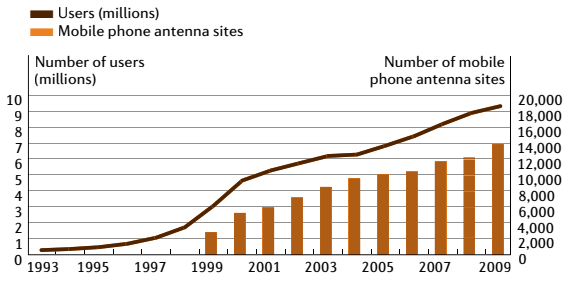
Source: FOEN

Non-ionising radiation

The impact thresholds for non-ionising radiation (radiation generated by electrical installations, power lines, mobile telephone antennas etc.) are generally complied with in Switzerland. However, the level of exposure to non-ionising radiation has risen in recent years. The increase was caused by rising electricity consumption and the rapid spread of mobile telecommunication. The current state of scientific knowledge does not indicate clearly whether or to what extent long-term exposure to non-ionising radiation is damaging to health. This needs to be clarified through research. Based on the precautionary principle prescribed by the Swiss Environmental Protection Act, the limits imposed for long-term exposure to mobile telephone and broadcasting antennas, high-voltage power lines, transformer stations and catenaries are stricter in Switzerland than those applied in most other countries.

Current developments An additional contribution to the reduction of the impact of non-ionising radiation can be made through the promotion and use of low-radiation technologies.

G9 Mobile telecommunication in Switzerland



Source: OFCOM

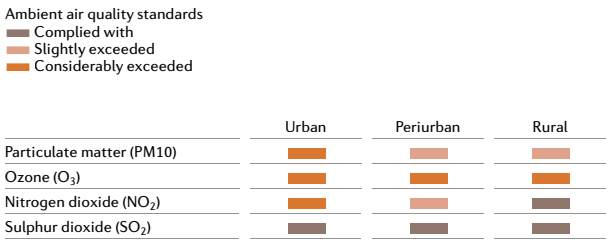
IF FS

Air

Thanks to the implementation of air pollution control measures, air quality in Switzerland has improved substantially over the past 25 years. However, excessive levels of exposure to particulate matter (PM10), ozone (O_3) and nitrogen dioxide (NO_2), which can cause respiratory and cardiovascular diseases, and carcinogenic air pollutants, such as diesel soot and benzene, remain problematic. Moreover, high acid and nitrogen inputs from the air – in particular of ammonia (NH_3) and nitrogen oxides (NO_x) – have negative impacts on soil and water quality, the stability of ecosystems and biodiversity. Measures with lasting effect are needed to reduce the pollutant emissions. These include deploying the best available technology in vehicles, industrial plants, combustion installations and agriculture, increasing public awareness, and implementing incentive measures such as the mileage-related heavy vehicle tax (MRHVT) and the VOC incentive tax.

Current developments The Federal Council updated the Air Pollution Control Strategy and defined national emissions targets in September 2009. In addition to the continuation and further development of existing national measures, sustained efforts are also required at international level. Moreover, framework conditions in other policy areas, for example climate and energy policy, should be organised in a way that enables the exploitation of synergies with air pollution control.

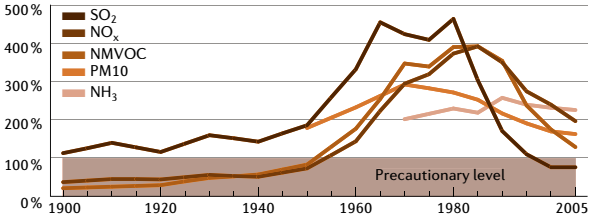
G10 Exceedance of ambient air quality standards established by the Ordinance on Air Pollution Control (LRV), 2010



Source: FOEN

IF R+

G11 Air pollutant emissions



Source: FOEN

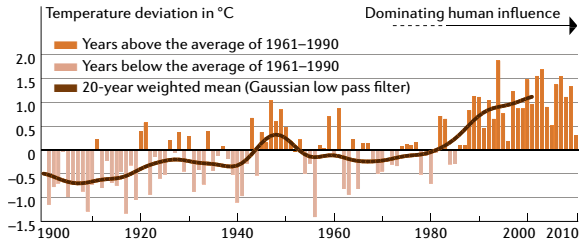
IF M

Climate

The air temperature in Switzerland has increased by an average of 1.8 °C since 1970. This increase cannot be explained by natural forcing alone (e.g. variations in the activity of the sun). According to current scientific understanding, the main cause of the observed changes is very likely to be the increase in the natural greenhouse effect due to human activity. Greenhouse gas emissions as defined by the Kyoto Protocol (excluding emissions caused by international aviation and shipping, and by land-use changes) remained almost constant in Switzerland between 1990 and 2009. Under the Kyoto Protocol, Switzerland has committed to reducing its greenhouse gas emissions by an average of at least 8 % between 2008 and 2012 compared with 1990 levels. The CO_2 Act, which forms the legislative basis for Swiss climate policy, specifies a reduction target of at least 10 % for the same period. In order to achieve this target both the implementation of reduction measures in Switzerland and the purchase of foreign emission certificates are necessary. In the context of the negotiations on an international follow-on climate protection agreement, the international community stated at the end of 2010 in Cancún that the average global warming of the earth's surface until the end of this century should be limited to a maximum of 2 °C above the pre-industrial level. The Intergovernmental Panel on Climate Change (IPCC) assumes that the industrialised states will have to reduce their greenhouse gas emissions by at least 25 % to 40 % compared with the 1990 baseline in order to be able to achieve this two degree target.

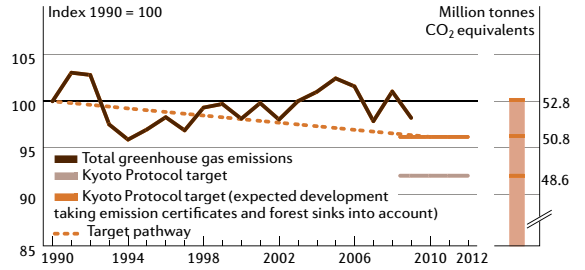
Current developments Discussions are currently underway in parliament about the legislation that will supersede the Swiss CO_2 Act from 2013. The measures and instruments that will enable Switzerland to reduce, by 2020, its greenhouse gas emissions by at least 20 %, as compared with the 1990 baseline, are due to be enshrined in this new legislation.

G12 Annual mean temperature in Switzerland
Deviation from average of 1961–1990



Source: METEOSWISS IF R+

G13 Greenhouse gas emissions
In accordance with the Kyoto Protocol (excluding international aviation and shipping, and land-use changes)



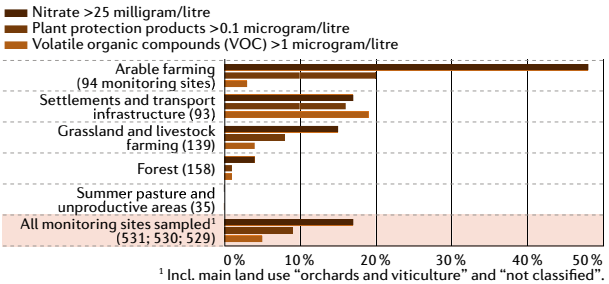
Source: FOEN IF M

Waters

The water quality in Swiss lakes and rivers improved markedly in recent decades, in particular with respect to nutrient pollution. This development was mainly enabled by major investments in the sewage infrastructure and the ban on phosphates in detergents. Micropollutants from households, industry, agriculture and other diffuse sources (e.g. transport routes, sealed surfaces) continue to be a challenge, however. Many surface waters are impaired in terms of the space available to them, their structure and their flow regimes, and are no longer able to fulfil their natural functions. In the Central Plateau, around 40 % of watercourses are in a poor structural condition; the corresponding figure in settlement areas is over 80 %. Swiss groundwater quality is generally good. However, in urban and intensively farmed areas, the level of contamination with nitrate and other undesirable substances, such as plant protection products and chlorinated hydrocarbons, is often too high. According to current knowledge, human health is not at risk from the recorded concentrations of contaminants in the groundwater.

Current developments Recent years have seen a transition in Switzerland from a purely qualitative focus in the protection of water bodies to a more holistic approach. Such holistic management of the resource water must promote the rehabilitation of surface waters, reduce the negative environmental impacts of hydropower generation (hydropeaking, reduced connectivity and impaired bedload regime), consistently implement the solutions developed to mitigate contamination with micropollutants, and further reduce diffuse pollution through the adoption of targeted measures. The same applies to undesirable substances in the groundwater.

G14 Groundwater quality: exceedance of the limits prescribed by the Waters Protection Ordinance, 2009
Based on the main land use in the catchment area

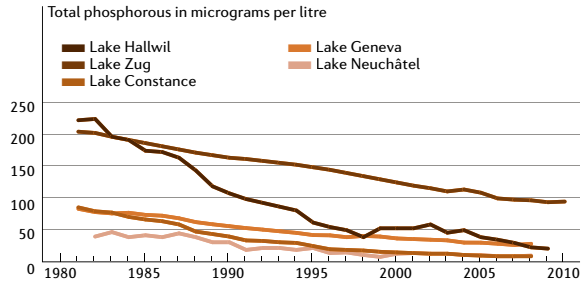


[1] Incl. main land use "orchards and viticulture" and "not classified".

Source: FOEN

IF R+

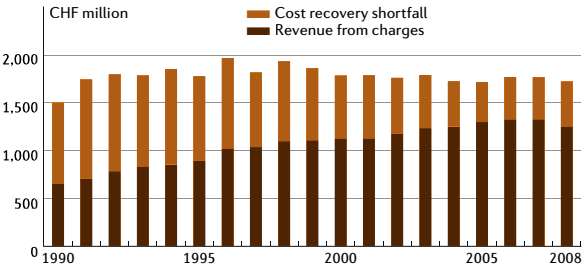
G15 Phosphorous levels in lake water



Source: FOEN

IF R

G16 Level of coverage of public expenditure on sewage treatment



Source: FSO

SI FS

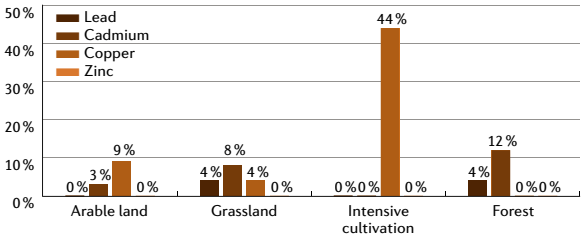
Soils

The changes in land use in Switzerland continue: 11 ha of agricultural land are lost on average every day. Chemical contamination of open soil is widespread. The guideline values for heavy metals are exceeded in around 15 % of tested soils. Responsibility for these pressures lies with new infrastructure, intensive agriculture and forestry, and activities such as transport, leisure events, illegal waste incineration and backfilling. The greatest remedial effect has been achieved up to now through the limitation of emissions of airborne pollutants, the regulations governing the use of substances and organisms and the requirements regarding effluent reinfiltration. Physical pressures such as soil compaction and erosion remain problematic.

Current developments The loss of soil fertility must be avoided. Better protection must also be provided to fertile soils through the Spatial Planning Act.

G17 Soil pollution, 2000–2004

Exceedance of guideline values by land use type in percentages (101 monitoring sites)



Sources: FOEN; FOAG; ARE

IF R

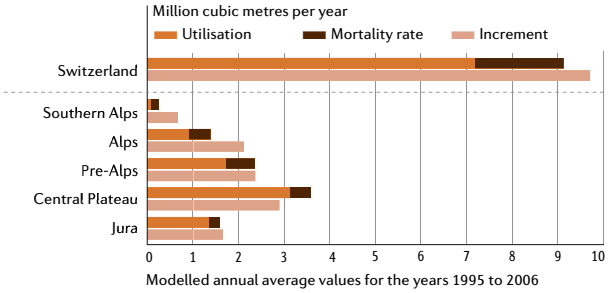
Forests

Forests in Switzerland cover an area of 1.3 million ha, that is almost one third of the country. This area increased by almost 5 % between 1995 and 2006 as a result of the recolonisation by forest of land that is no longer used for cultivation and pasture. Whereas the standing volume in the southern Alps increased by almost 20 %, it declined by around 7 % in the Central Plateau. The high level of atmospheric nitrogen inputs from combustion processes (transport, heating, industry) and agriculture pose a problem for the forests. These inputs acidify the soil and disrupt the nutrient balance. The ambient air quality standards for nitrogen inputs are exceeded in 95 % of the Swiss forest area. The function of the forest as a groundwater filter is jeopardised in severely polluted areas. It may also be expected that the forest ecosystem will come under additional pressure as a result of the consequences of climate change.

Current developments The main challenge for the next few years is to meet the rising demand for wood in an economically viable and ecologically sustainable way. The protective function of the forest and its use as a recreational area must also be safeguarded. Species and habitat diversity should be conserved through the creation of sufficiently large and interconnected areas for the protection and promotion of biodiversity; under the Swiss National Forest Programme it is planned to establish forest reserves (protected areas) in at least 10 % of Swiss forest area by 2030.

G18 Forest utilisation, mortality rate and increment

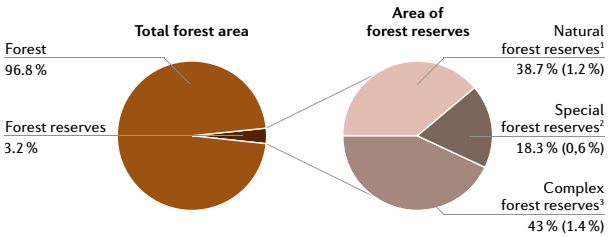
Amounts in stemwood



Source: WSL, NFI3

FS

G19 Forest reserves, 2007



[1] Forest reserves in which no further silvicultural interventions are carried out and the forest can evolve naturally.
[2] Forest reserves in which biodiversity is promoted through targeted interventions.
[3] Forest reserves containing areas of both natural forest and special forest.

Source: FOEN

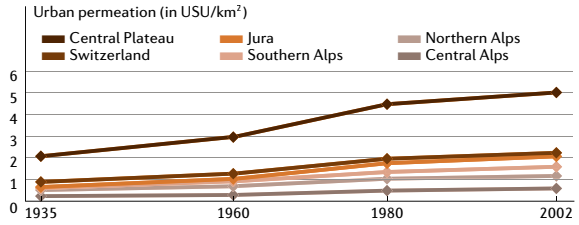
FS

Landscape

Switzerland has many remarkable natural and cultural landscapes which provide a wide variety of services to people, for example recreation, tourism and agricultural production. They also provide habitats for plants and animals. However, many landscapes are under pressure from the loss of diversity, the increasing extent of soil sealing and urban sprawl. The negative consequences of these developments include the loss of cultural landscapes, open space and local recreational areas. The Landscape 2020 vision presents ways in which these trends can be counteracted.

Current developments The federal authorities are committed to enabling the landscape to develop while conserving its character, ensuring the long-term preservation of the services provided by the landscape to people (tourism, cultivation, attractiveness, identity etc.) and heightening the awareness these services are due. Existing landscape protection areas, such as those listed in the Federal Inventory of Landscapes and Monuments of National Importance (BLN), are being upgraded. The creation of new parks of national importance will also favour sustainable development in the associated regions.

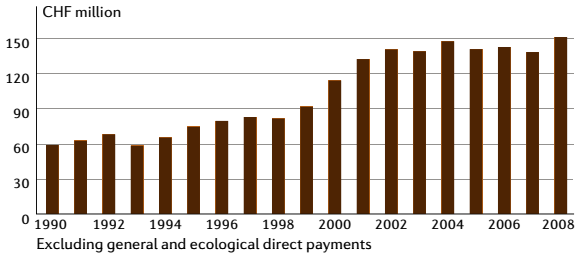
G20 Urban sprawl[1]



[1] The extent of urban sprawl, which is measured in "urban sprawl units (USU) per km²", indicates the extent to which a landscape is penetrated by buildings. The more areas are built on, the more dispersed the buildings are, and the lower their utilisation density (number of inhabitants and jobs), the higher the level of urban sprawl.

Source: Jaeger et al. 2008 RI

G21 Net public expenditure on nature conservation (adjusted for inflation)



Excluding general and ecological direct payments

Sources: FFA; FSO SI FS

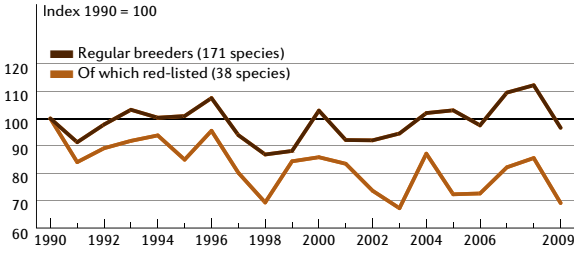
Biodiversity

Switzerland has almost 40,000 known species of flora, fauna and fungi. Of the 13,500 species that have been examined and inventoried, approximately 3,700 are on the Red Lists of endangered species. Ecosystems are under great pressure from urban sprawl, the sealing of soil, intensive agriculture and the expansion of transport infrastructure. In addition, flora and fauna are also increasingly threatened by the presence of invasive species introduced by humans (e.g. the signal crayfish and Japanese knotweed).

Current developments The main aim of Switzerland's National Biodiversity Strategy, which will be presented to parliament in early 2012, is the long-term conservation of biodiversity and the ecosystem services it provides. The strategy rests on the following principles: designation, conservation and interconnection of sufficient areas in which biodiversity is a priority, the sustainable use of resources, the increased recognition of the economic value of biodiversity, and the assumption of greater responsibility for global biodiversity by Switzerland.

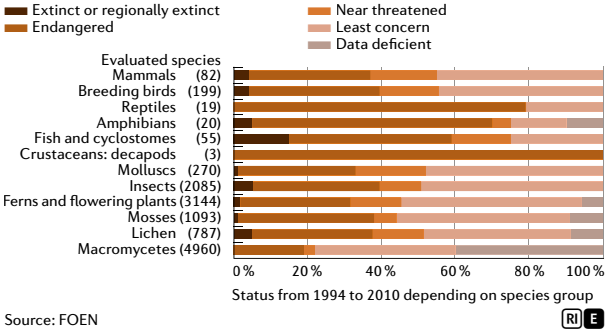
G22 Breeding bird populations

Population trends among Switzerland's breeding bird species



Source: Swiss Ornithological Institute, Sempach, Swiss Bird Index®

G23 Extinct, endangered, near threatened and least concern species groups



Status from 1994 to 2010 depending on species group

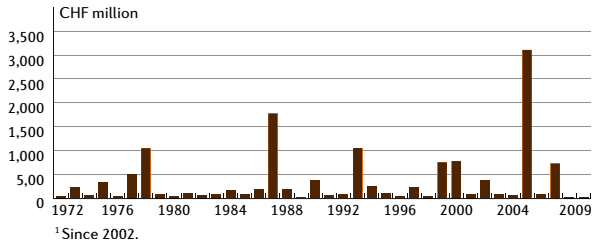
Source: FOEN

Natural hazards

The management of natural hazards has always been important in Switzerland. The average annual cost of damage caused by natural hazards in the period 1972 to 2009 totalled CHF 350 million per year (adjusted for inflation based on prices in 2009). For the same period the losses due to flood damage alone amounted to CHF 13.2 billion. The extent of the damage caused by natural disasters is constantly increasing, particularly due to the expansion of settlement areas and the associated rise in the value of assets potentially at risk. The cantons are required to compile hazard maps by the end of 2011. The comprehensive nature of these maps will make it easier to pinpoint key risks and take them into account in the context of spatial planning. Moreover, urgent rehabilitation projects are due to be carried out in the coming years and decades on a large number of major watercourses, for example the Rhine and Rhone, as many bank protection structures and dikes are showing signs of wear and tear.

Current developments Measures to provide protection against natural hazards have to be adapted constantly to changing conditions (e.g. the effects of climate change). Long-term financing must be secured to ensure that remediation projects and other measures can be carried out in a targeted and efficient way. Organisational measures, which enable coordinated action, in particular in the course of warning, alerting and intervention operations, must also be continued.

G24 Cost of storm damage in Switzerland (floods, debris flows, landslides, rockfall processes[1])
Data adjusted for inflation (base year 2009)

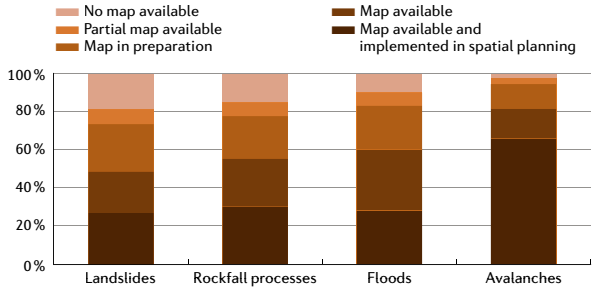


[1] Since 2002.

Sources: FOEN; WSL/SLF

RI E

G25 Status of natural hazard mapping, 2010 (in % of area)



Source: FOEN

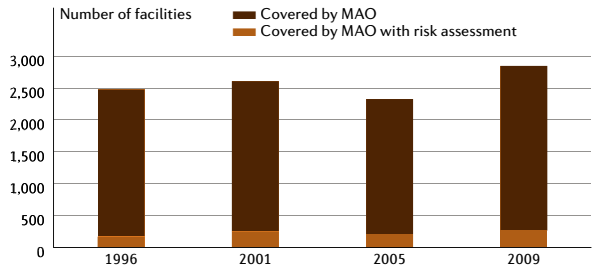
IF FS

Major accident risks

In 2009, some 2,600 facilities, 4,000 km of railway lines, 7,850 km of roads and a 20 km stretch of the Rhine were covered by the Major Accidents Ordinance (MAO). The operators of these facilities and transport routes are personally required to take all appropriate measures, which are both available in terms of the latest safety technology and economically viable, to minimise the risk of a major accident. The installations are regularly inspected by the competent authorities. For roughly 9 % of these facilities a major accident would cause extensive damage to the population and environment. Consequently, they must submit a risk assessment and keep it up to date.

Current developments The continuous development of industry and technology means that the prevention of major accidents is a an ongoing federal and cantonal task. The timely coordination of spatial planning and major accident prevention is gaining in importance as land use intensifies across Switzerland.

G26 Facilities covered by the Major Accidents Ordinance (MAO)



Source: FOEN

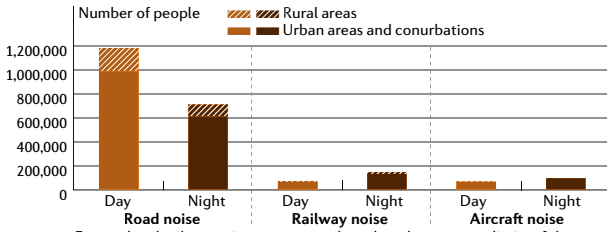
IF R+

Noise and vibrations

In Switzerland, approximately 1.3 million people are exposed to excessive levels of noise during the day and 955,000 at night. Most of this noise is caused by traffic. In addition, around 40,000 people have to cope with levels of vibrations that exceed the guideline values. Noise affects people both psychologically (e.g. discomfort, stress, nervousness) and physically (e.g. hearing loss, high blood pressure, cardiovascular problems). Since the entry into force of the Swiss Environmental Protection Act around CHF 2 billion has already been spent on noise abatement on roads and railway lines. A further CHF 3 billion will be spent to complete the planned noise abatement measures by 2018.

Current developments In future, noise abatement will focus more strongly on the avoidance of noise at its source. Incentive systems will also be developed to promote quiet technologies. The objective of extending noise protection to all inhabited areas must be retained.

G27 Number of people exposed to noise impacts in excess of the exposure limits, by settlement type, 2009



For road and railway noise: assessment based on the exposure limits of the Noise Abatement Ordinance (NAO); for aircraft noise: >60 dB(A) by day, >50 dB(A) at night.

Source: FOEN

IF M

International cooperation

The conservation of life-sustaining natural resources is one of Switzerland's five foreign policy objectives. Switzerland has ratified numerous international agreements and plays an active role in most of the international organisations involved in environmental issues and sustainable development. Particular areas of interest here include climate change, the protection of biodiversity, chemicals, the strengthening of international environmental governance, including its financing, and the relationships between trade and environment. Relations with the EU are also being intensified in the area of the environment. Switzerland is also committed to ensuring that greater account is taken of environmental issues in the context of the World Trade Organisation's Doha Round and in the development of free trade agreements. It also provides financial support for the implementation of environmental agreements in developing countries through both the Global Environment Facility (GEF) and in the context of its bilateral and multilateral development cooperation. Switzerland's contribution to the fifth replenishment of the GEF (2010–2014) is expected to total around CHF 125 million.

Current developments Switzerland continues to support the adoption of coherent, comprehensive, effective and efficient measures at international level. It is particularly committed to the areas of climate (where it is seeking the adoption of binding targets for all major emitters), biodiversity (where it supports the adoption and implementation of ambitious and quantifiable aims for all sectors), and chemicals and waste (where it aims to close gaps that continue to exist, for example, in relation to heavy metals, POPs and PIC lists, and electronic waste). Switzerland is also working toward the strengthening of synergies in international environmental regimes and the adoption of global objectives.

II. State of the environment

Human activities often have adverse effects on the environment. The links between human activities and environmental impacts are discussed in this part of the report using detailed indicator-based analysis. The explanations provided will help the reader to gain a better grasp of the sometimes complex interconnections between human activity, the environment and the measures taken.

This section supplements the information on the individual environmental topics presented in Part I. The analyses and explanations provide an overview of the current state of the environment, its development and the measures initiated.

The following topics are examined: Resources and material flows – Energy – Transport and mobility – Economy and production – Households, consumption and tourism – Agriculture – Air quality – Climate change – Waters – Soils – Landscape – Biodiversity – Forests – Natural risks – Risk of major chemical and biological accidents – Noise and vibrations – Health.

1. Resources and material flows

Since the early 21st century, an average of approximately 330 million tonnes of materials have been extracted, consumed or displaced each year in Switzerland and abroad to meet the requirements of the Swiss economy and households. This corresponds to around 44 tonnes per person. The total material requirement has increased by 14 % since 1990. This resource consumption is associated with ever-increasing environmental impacts both at home and abroad.

Context

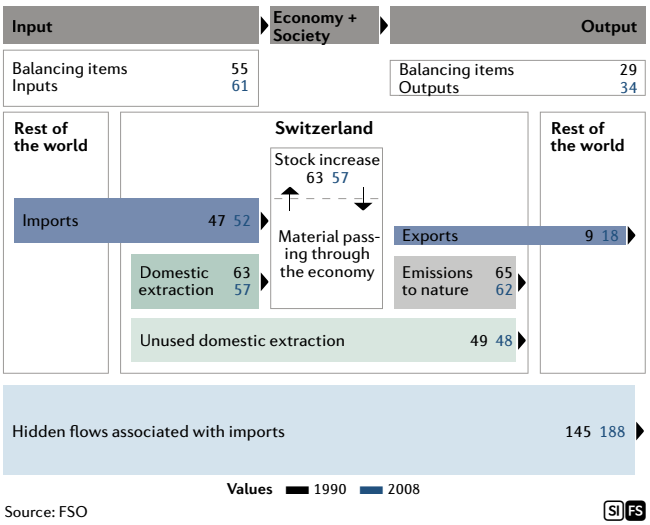
The economic activities and consumption taking place in Switzerland displace and consume large amounts of material: natural resources are depleted, products manufactured and goods consumed. The raw materials are extracted in Switzerland or abroad, processed into products, often transported across large distances, sometimes stored for years and recycled in part until, sooner or later, they are released again into the environment, as waste or other emissions (» F1.1). These flows represent the total amount of materials which are removed from nature each year and contribute to the functioning of the Swiss economy, including households. For example, in 2008, around 350 million tonnes of materials (excluding water and air) – i.e. around 45 tonnes per person – were extracted, consumed or displaced in Switzerland and abroad to meet the needs of the domestic economy and households. Hence, the total material requirement (TMR), comprising all of the direct and indirect material flows[1] associated with Switzerland's economic activities, has increased by 14 % since 1990 (» FSO 2008). The resident population of Switzerland increased by around 14 % over the same period and gross domestic product (GDP) grew by around 27 % in real terms.

In 2008, the Swiss economy extracted 57.3 million tonnes of materials and imported an additional 52.4 million tonnes. These imports are associated with hidden flows of around 190 million tonnes of materials. This corresponds to almost four times the amount of the imported materials. Overall, the input of materials in Switzerland is greater than the quantity of materials that leaves Switzerland in the form of exports and emissions (output). In 2008, this led to a stock increase (input minus output) of 57 million tonnes in Switzerland (» FSO 2010a), which can be explained, in particular, by construction activity. When the per capita material flows for 2008 are compared with the 1990 data, a 21 % reduction in domestic extraction may be observed for this period while imports only decreased slightly. In contrast, the per capita hidden flows associated with imports grew by over 14 % over this period and exports almost doubled.

Material productivity indicates the relationship between the value added produced and the total material requirement of the economy. Material productivity was subject to strong fluctuations between 1990 and 2008 (» G1.1). Closer analysis reveals that this period divides into two phases: whereas TMR declined, GDP remained almost constant between 1990 and 1996. This may be explained mainly by the stagnation of the economy and the strong decline in the activity of the construction sector. As soon as the economy began to recover after this period, TMR started to increase again. To date, there has been no absolute decoupling of economic development and resource consumption. Absolute decoupling arises when the economy grows and resource consumption declines at the same time. This can be achieved through the reduction of resource requirements, the recycling of materials (shift to a cyclic economy) and technological progress (greater material efficiency). »

[1] The indirect flows include both unused and hidden flows. The latter comprise materials consumed in the exporting countries for the production and transport of import goods for Switzerland. Therefore they refer to the material flows generated abroad through Switzerland's economic activity.

F1.1 Material flows in Switzerland, 1990/2008
(Flows in millions of tonnes)



Source: FSO

Impacts

The surplus materials that accumulate annually in Switzerland (stock increase) require, among other things, increasing amounts of land. As a result, settlement and infrastructure area are generally expanding at the expense of agricultural and natural area. Between the periods 1975–1985 and 1992–1997, settlement and infrastructure area in Switzerland increased by 13.3 % (» Chapter 10). On the other hand, the accumulated materials constitute a stock of raw materials: if their composition is known, the potential recycling value of future waste flows may be predicted.

The proportion of imported raw materials has decreased by 2 % since 1990 while imports of finished products increased by 61 % and accounted for approximately 35 % of overall imports in 2008 (» G1.2). Switzerland is increasingly dependent on third countries. Moreover, our consumption habits and the transition to a service economy are increasingly transferring environmental impacts abroad.

Measures

The Federal Council supports integrated product policy (IPP) with a view to formalising the principles of sustainable development at product level (» Federal Council 2008). By creating better national and international framework conditions, it is attempting to bring about a shift in demand on the part of the public and private sectors to products that comply with high economic, ecological and social standards over the course of their entire life cycle. It is also intended to apply the principles of IPP in all phases of the formulation and implementation of product-related policies. Criteria and instruments are being developed for all IPP-relevant policy areas that will make it easier to identify the links between the three dimensions of sustainable development (ecological, economic and social) and will promote the implementation of this policy.

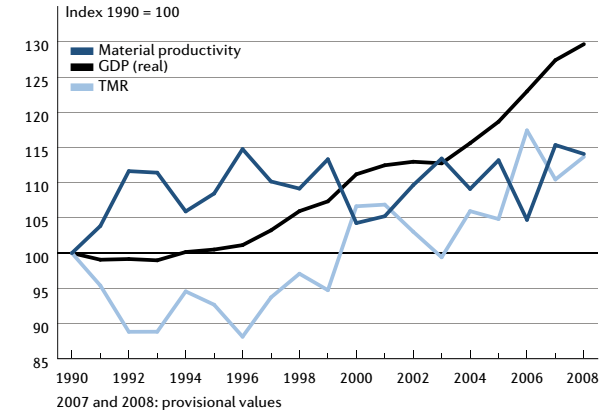
On the occasion of the World Summit on Sustainable Development in Johannesburg in 2002, a ten-year framework programme was launched, whose objective is to promote environmentally and socially sustainable production and consumption models (10-Year Framework of Programmes on SCP) (» United Nations 2005). The Marrakech Task Force on Sustainable Procurement, which is led by Switzerland, developed a systematic approach that is intended to enable governments, local authorities and the private sector to introduce or further develop sustainable procurement. The development of products produced under more environmentally sound, resource conserving and socially sustainable conditions is promoted through cooperation between procurement departments and suppliers. In addition, greater awareness is being fostered among procurement offices of the fact that, in addition to the price of a product, the entire life-cycle costs, including waste disposal or recycling costs, should be taken into account in purchasing decisions. •

Internet links

www.statistik.admin.ch » Themen » Raum, Umwelt » Umweltgesamtrechnung (f g)

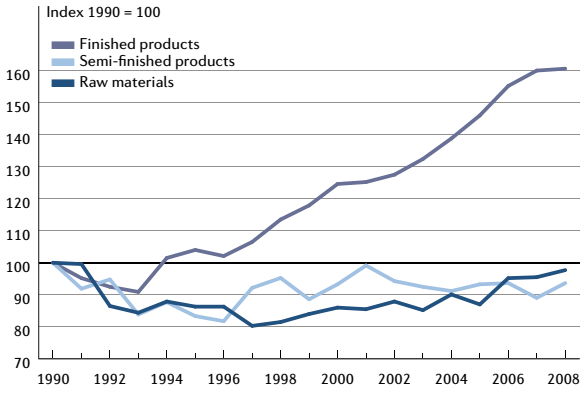
www.bafu.admin.ch/waste » Sustainable Material Management

G1.1 Material productivity, total material requirement (TMR) and gross domestic product (GDP)



Source: FSO

G1.2 Imports by degree of processing of goods



Source: FSO

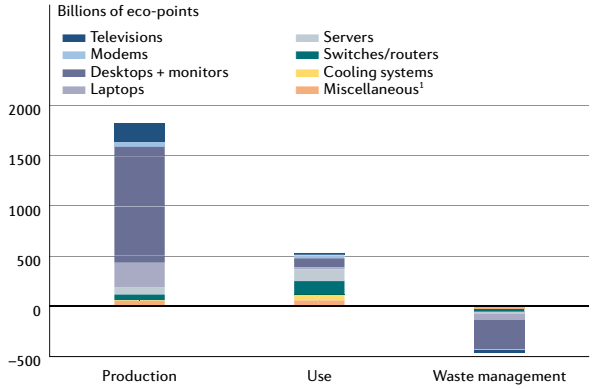
Internet-related material flow

In order to identify materials that are – or will become – important, as well as areas susceptible to sustainable materials management, comprehensible data must be gathered about substances, goods and services, their material flows and environmental impacts. An example of such a survey is the study of the material flows and environmental impacts generated by internet in Switzerland (» FOEN/EMPA 2010).

In 2008, 128,400 tonnes of materials were stored in Swiss internet infrastructure (desktop computers, laptops, modems, mobile telephones, servers etc.). Of these materials, 48,100 tonnes were newly acquired and 20,600 tonnes were recycled. The infrastructure associated with access technologies is growing by an average of around 50 % per year as existing devices are replaced or added to in the wake of technological progress. The fibre optic network is also constantly being expanded. Of the 20,600 tonnes of materials recycled, around 66 % was utilised materially, 32 % was utilised thermally and just 2 % was landfilled.

The most environmentally relevant phase in the Swiss internet service lifecycle is the production of the associated infrastructure (» G1.3). The manufacture of devices consumes increasing amounts of resources, while their lifespan is often relatively short. Hence, the impacts generated by production account for an increasing share of the overall environmental impact. Moreover, these impacts from production mostly arise abroad. The electricity consumption generated by internet use is also an important factor. The overall negative effect on the environment (measured here in eco-points) can be compensated somewhat by the recycling and thermal utilisation of the waste.

G1.3 Environmental impact of the entire internet service in Switzerland, 2008



[1] Mobile phones, antennas, transmitters, cables, DSLAM/CMTS, splitters.

Source: FOEN

2. Energy

Final energy consumption in Switzerland increased by almost 10 % between 1990 and 2009, with transport accounting today for the largest share. In 2009, 18.9 % of this energy came from renewable sources. Based on the Renewable Energy Action Plan, this percentage should increase to around 24 % by 2020. The federal government also aims to reduce fossil-based energy consumption by 20 % between 2010 and 2020.

Context

Apart from hydropower and, to a lesser extent, wood energy, the energy resources currently available to Switzerland are finite and not always obtainable. 80 % of the energy resources used in Switzerland come from abroad. Along with oil, natural gas, coal and coal products, these also include nuclear combustibles and, in winter, electricity. Primary energy must be converted into final energy for consumption purposes. Around 24 % of primary energy is lost in this process (» G2.1). Most of it is released as waste heat.

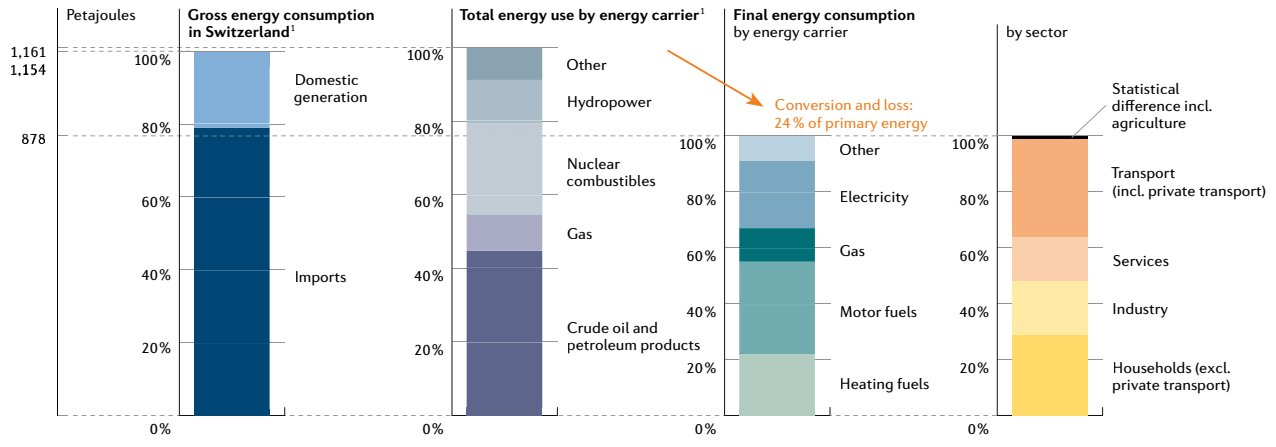
Between 1990 and 2009, final energy consumption in Switzerland rose by almost 10 % (» G2.2). The main causes of this were population growth, larger homes, more and heavier vehicles, longer travel distances, increased industrial production and increased construction activity. Although technical progress increases energy efficiency, it also causes new energy uses. Transport accounts for most energy consumption (35 %) and is followed by households (29 %, excluding private transport), industry (19 %) and services (16 %) (» SFOE 2010a).

The contribution made by renewable energies to final energy consumption fluctuates and increased from almost 16 % in 1990 to almost 19 % in 2009. 12.1 % of the final energy consumption originates from hydropower and 4.1 % from wood or biogas (» G2.3). In 2009, around 2 % of electricity was generated using solar power, biomass, biogas, wind power and energy from waste (» SFOE 2010b).

Whereas the consumption of heating fuels declined by over 23 % between 1990 and 2009, the consumption of motor fuels increased by around 16 % over the same period and consumption of natural gas rose by approximately 68 %. In 2009, fossil energy carriers accounted for around 67 % of Switzerland's final energy consumption.

Electricity consumption rose by around 23 % between 1990 and 2009. During the 1990s, its share of final energy consumption remained stable at around 21 %; by 2009 it had increased to approximately 24 % (» SFOE 2010c). A good 53 % of electricity consumption is covered by renewables, over half of this by hydropower.

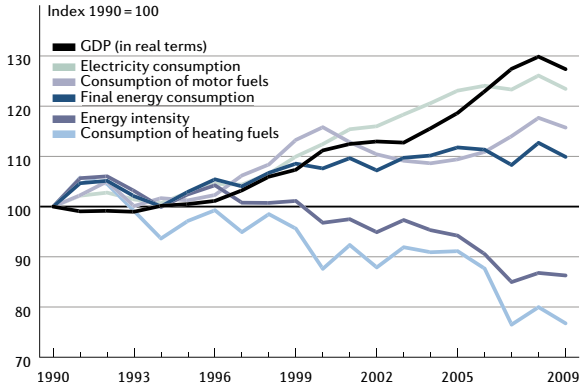
G2.1 Gross energy consumption, total energy use and final energy consumption, 2009



[1] The difference between gross energy consumption and total energy use corresponds to the import/export balance for electricity.

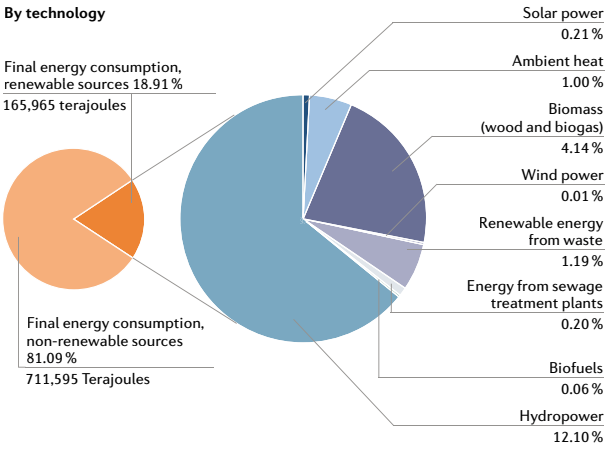
Source: SFOE, Overall energy statistics

G2.2 Gross domestic product (GDP), energy intensity and energy consumption



Sources: FSO; SFOE, Swiss overall energy statistics

G2.3 Share of renewables in final energy consumption, 2009



Source: SFOE, Swiss renewable energy statistics

At 10 %, final energy consumption has increased less rapidly since 1990 than gross domestic product (GDP), which rose in real terms by around 27 % during this period. Hence, energy intensity (ratio of energy consumption to GDP) declined by almost 14 % (» G2.2).

Impacts

The combustion and consumption of fossil and other heating and motor fuels contaminate the air with pollutants such as nitrogen oxides (NO_X), particulate matter (PM10) and sulphur dioxide (SO_2). In the case of NO_X, over 90 % of emissions are energy-related and transport is the main source (» Chapter 3). In addition, the combustion of fossil energy carriers emits carbon dioxide (CO_2), in particular, but also methane (CH_4) and nitrous oxide (N_2O) into the atmosphere. These energy-related greenhouse gas emissions account for over 80 % of Switzerland's total greenhouse gas emissions (» Chapter 8). At around 31 %, the main source of these emissions is, again, transport (including household transport), followed by households (in particular heating) at around 20 % (» FOEN 2009a).

The generation of nuclear power produces radioactive waste. According to the Nuclear Energy Act[1], to protect human life and the environment against radioactive radiation, this waste – along with demolition material arising from the decommissioning of nuclear installations – must be deposited for long-term storage in a deep geological repository. Due to the longevity of nuclear waste, a deep geological repository must guarantee the effective insulation of the environment from radioactive waste for a period of around one million years. Until a deep geological repository has been constructed, the radioactive waste is stored above ground in well-secured locations, in interim storage depots at the nuclear power plants and in two storage sites in the canton of Aargau.

The infrastructure necessary for the production and transport of energy can cause damage to nature and the landscape. Power lines and pylons, reservoirs, dams and wind farms alter the appearance of the landscape. Wind farms can cause nuisance to residents and disturb birds and bats. Hydropower generation affects the water balance and hence also aquatic organisms, in particular fish (» Chapter 9).

Measures

The Swiss Confederation's energy policy is focused on four main areas: energy efficiency, renewable energies, the replacement of existing large-scale power plants and construction of new ones, and foreign energy policy. The federal government has formalised the objectives for two of these areas with the energy efficiency[2] and renewable energies[3] action plans. Based on these plans, the consumption of fossil energy sources is to be reduced by 20 % in the period between 2010 and 2020. Over the same period, the share of total energy consumption to be accounted for by renewables is to increase by 50 % (to around 24 %) and the rise in electricity consumption to be limited to a maximum of 5 %.

In accordance with the cantonal model provisions for energy (Mustervorschriften der Kantone im Energiebereich, MuKEn), which were updated in 2008, from 2011 new buildings may only consume around half as much heat energy (4.9 l of heating oil per m^2) as they do today (» ENDK/ENFK 2008). This corresponds to a shift toward the requirements of the Minergie standard. The cantons have also introduced a national voluntary energy performance certificate for buildings (Gebäudeenergieausweis, GEAK)[4] which shows, based on standardised assumptions regarding its use, how much energy a residential building requires for heating, hot water, lighting and other electrical appliances. »

[1] Nuclear Energy Act of 21 March 2003 (Kernenergiegesetz, KEG), SR 732.1.

[2] Energy Efficiency Action Plan, SFOE, February 2008.
[3] Renewable Energy Action Plan, SFOE, February 2008.
[4] www.geak.ch.

Buildings programme

In early 2010, the federal authorities and cantons launched a national programme to promote the renovation of buildings and use of renewable energies. Based on the partial earmarking of funds raised by the CO_2 levy on heating fuels (utilisation of part of the funds exclusively for this purpose), a maximum of CHF 200 million has been made available annually for the programme up to 2020. Combined with cantonal contributions, a total of between CHF 280 and 300 million is provided for the programme. Funding is available for improvements to the insulation of individual elements, i.e. the windows, walls and roofs, of existing heated buildings which were constructed prior to the year 2000. The use of renewable energies, waste heat utilisation and the optimisation of building services are also funded in some cantons.

› Switzerland has introduced minimum requirements for the tax exemption of biofuels, e.g. bioethanol, biodiesel and biogas[5]: first, the tax exemption only applies to fuels that generate 40 % less greenhouse gas emissions compared to petrol – from crop cultivation to fuel consumption – and do not cause considerably greater environmental impacts. Moreover, the cultivation of the raw materials must not endanger either the rainforests or biodiversity. Second, the social legislation applicable at the site of production must be complied with, or, at least, the provisions of the core conventions of the International Labor Organization (ILO). As a result, biogenic fuels from cereals, corn, soya and palm oil do not usually qualify for tax exemption.

The Swiss Confederation revised the Energy Ordinance[6] so as to reduce the electricity consumption of household appliances, electric motors and electrical and electronic devices. Accordingly, since January 2010, such appliances and devices may only be sold if they fulfil the defined efficiency requirements. The regulations applicable to household lamps were harmonised with the EU regulations in September 2009. Through the phased tightening of efficiency requirements, lamps in the worst energy classes F and G will disappear completely from the Swiss market from the end of 2012.

Recommendations for the planning of wind power facilities and small hydropower plants were compiled in the course of 2010. The recommendations are intended to provide the authorities with an aid to decision-making in the case of possible conflicts of interest in the application of spatial planning instruments (cantonal structure plan, land-use plan, planning permission).

In April 2008, the Federal Council passed the conceptual part of the Sectoral Plan for Deep Geological Repositories (» SFOE 2008). This marked the commencement of a process that should lead to the selection of a site for a deep geological repository for radioactive waste within a period of ten years. •

Internet links

www.statistik.admin.ch » Themen » Energie (f g)

www.bafu.admin.ch/energy (f g)

www.sfoe.admin.ch » Topics

[5] DETEC Ordinance of 3 April 2009 on Proof of the Positive Aggregate Environmental Impact of Fuels from Renewable Feedstocks (Treibstoff-ökobilanz-Verordnung, TrÖbiV), SR 641.611.21.

[6] Energy Ordinance of 7 December 1998 (Energieverordnung, EnV), SR 730.01.

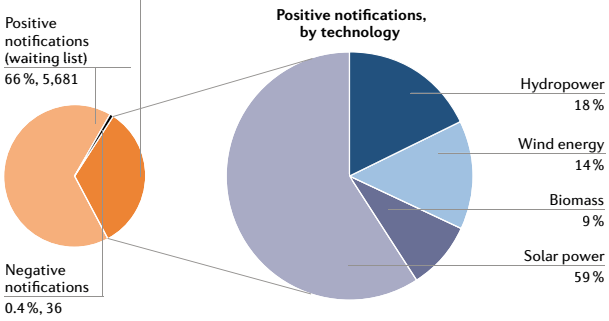
Cost-covering remuneration for feed-in to the electricity grid (CRF)

The revision of the Energy Act[1], which was passed by parliament in 2007, stipulates that energy generation from renewable sources must be increased by at least 5,400 GWh by 2030, which corresponds to around 10 % of electricity consumption in the year 2000. To this end, the Act contains a package of measures for the promotion of renewable energies (» SFOE/FOEN/ARE 2010; FOEN/SFOE/ARE 2011) and of efficiency in the electricity sector. The main plank of this policy is the cost-covering remuneration for feed-in to the electricity grid for electricity generated from renewables, which came into force in early 2009: producers are paid a cost-covering contribution for each kilowatt-hour they feed into the electricity grid. It is planned to remunerate electricity from small hydropower generators (up to 10 MW), solar installations, wind power, geothermal energy, wood and biowaste for a period of 20 to 25 years. A sum of CHF 264 million is available each year for these payments and their level is continually adapted. In summer 2010, the Swiss parliament decided to increase the contribution paid from CHF 0.6 to 0.9/kWh. Hence, from 2013, CHF 500 million will be made available for this measure.

Up to the beginning of February 2010, 2,856 installations had received positive notification of their qualification for this support; 1,841 installations had been realised and already benefit from the CRF. A positive notification does not mean that a project conforms to the environmental legislation and will be authorised.

[1] Energy Act of 26 June 1998 (Energiegesetz, EnG), SR 730.0.

G2.4 Cost-covering remuneration for feed-in to the electricity grid (CRF)
Status on 01. 01. 2010



Source: Stiftung KEV 2009

IF FS

3. Transport and mobility

Between 1990 and 2009, the volumes of private motorised transport and road freight transport in Switzerland increased by 16 % and 45 % respectively. Passenger and freight transport by rail also increased by 47 % and 14 %. Each Swiss resident travels an average distance of 19,100 km per year. The impacts of this increasing mobility include, among other things, greater greenhouse gas emissions and noise pollution, and the fragmentation of the landscape by transport infrastructure.

Context

The exchange of goods is indispensable to economic development, therefore freight transport is an unavoidable component of economic activity. Passenger transport facilitates occupational mobility as well as tourism and leisure activities. Apart from accidents, the downside of mobility is the environmental impacts it causes: transport is the main cause of noise pollution and a major contributor to greenhouse gas emissions, air pollution, the destruction of habitats and the degradation of the landscape. Hence, while transport makes an important contribution to the quality of life, it also impairs it.

In 2005, every resident in Switzerland travelled an average of 19,100 km at home and abroad by various means of transport and on foot (» FSO/ARE 2007). Private cars were used for almost three quarters of all journeys undertaken in Switzerland in 2009. Public transport accounted for 20 % of these journeys and non-motorised transport (walking, cycling, inline skating etc.) for 6 %. Since 1995, little change has been observed in the division between private, public and non-motorised transport, which is referred to as the modal split (» FSO 2010b).

The distances travelled by people by road and rail have increased by around one sixth since 1990. Population growth explains part of this development, although other causes also exist, e.g. greater distances between home and work, the centralisation of shopping and service facilities and the greater accessibility of remote holiday and leisure destinations. In 2005, leisure activities accounted for 45 % of daily distances travelled; this exceeds considerably the distances travelled for work and education purposes (27 %) and for shopping (11 %) (» SFO/ARE 2007) (» Chapter 5).

In 2009, four million passenger cars were registered in Switzerland. Motor vehicle stock has increased by 40 % since 1990. In 2009, there were an average of 514 passenger cars per 1000 inhabitants in Switzerland. In 2005, 81 % of households had at least one car and 30 % had two or more. 70 % of households have at least one bicycle. Approximately 48 % of the population over 16 years had a public transport pass in 2005.

In 2009, the combined distance and volume of goods transported in Switzerland amounted to a good 26 billion tonne-kilometres, which represents an increase of 32 % since 1990 (» G3.1). 64 % of freight is transported by road. The goods transport performance per unit of gross domestic product (GDP), also referred to as freight transport intensity, also increased by 4 % between 1990 and 2009. The reasons for this include, for example, the concentration of production in fewer locations with a view to increasing productivity through economies of scale, the trend for just-in-time deliveries (elimination of material stocks) and increasing consumption (» FSO 2010b).

Between 1990 and 2009, transalpine freight transport volumes rose by 56 %; the share accounted for by rail transport declined from 81 % to 61 % over the same period. Whereas 1.4 million trucks crossed the Alps in 2000, the corresponding figure for 2009 was almost 1.2 million (» FOT 2010). The transfer goal of limiting the number of transalpine truck journeys to 650,000 per year in accordance with the Freight Transport Transfer Act[1] must be achieved within two years of the opening of the Gotthard Base Tunnel. From 2011, the intermediary target of a maximum of one million journeys per year must not be exceeded.

A sharp increase in air traffic is also observed. Take-offs and landings are particularly disruptive for people living close to airports: as well as generating noise, they are fuel-intensive and generate above-average pollutant emissions. The number of scheduled and charter movements at the three Swiss national airports (Zurich, Geneva and Basel Mulhouse) have increased by almost one third since 1990 (» FOCA 2008).

Transport is Switzerland's biggest energy consumer. Its share of final energy consumption has increased by 18 % since 1990 and was 35 % in 2009. Most of this consumption is accounted for by road transport. Over 95 % of the energy required by transport is supplied by petroleum products (» Chapter 2).

[1] Federal Act of 19 December 2008 on the Transfer of Transalpine Heavy Goods Traffic from Road to Rail (Güterverkehrsverlagerungsgesetz, GVVG), SR 740.1.

Impacts

The increasing mobility of the Swiss population is causing a rise in transport-related greenhouse gas emissions and air pollution caused by particulate matter (PM10) and nitrogen dioxide (NO_2). In 2010, road transport was responsible for over half of the nitrogen oxide emissions (NO_X) in Switzerland. Transport-related CO_2 emissions (excluding international air traffic) have increased by around 13.7 % since 1990 and amounted to 16.3 million tonnes in 2009, which corresponds to around 37 % of Switzerland's total CO_2 emissions. The main source here is motorised road transport which accounts for around 98 % of the total CO_2 emissions generated by transport. Around 70 % of these emissions come from passenger cars (» G3.2; Chapter 8). In a comparison with the EU15 Member States, motor fuel consumption by passenger cars in Switzerland was found to be the highest, at 8.84 l/100 km, (» SFOE/FOEN 2007). For newly-registered cars too, Switzerland is among the countries with the highest motor fuel consumption (6.86 l/100 km in 2009) (» SFOE 2010d).

Motorised transport is also the main cause of noise pollution. Over 90 % of the traffic-related exceedances of the impact thresholds for noise pollution are caused by road traffic (» Chapter 16).

The traffic flows in transalpine goods transport are concentrated on a few axes. Due to the narrowness of the valleys, even low volumes of traffic generate high concentrations of air pollutants in certain weather conditions. Increased noise propagation also arises here. Between 2003 and 2009, nitrogen dioxide (NO_2) and particulate matter (PM10) pollution tended to show a slight decline. Noise pollution remained more or less unchanged. Overall, many people along the Gotthard route (A2) – from Basel via Lucerne and Lugano to Chiasso – are still subject to noise pollution levels that exceed the applicable impact thresholds.

Roads and railway lines dissect habitats and thus impair the ecological connectivity of various animal populations (» Chapter 12). In the Central Plateau, for example, very few areas of over 10 km^2 remain that have not been fragmented (» Jaeger et al. 2007). Moreover, transport infrastructure alters the landscape considerably and limits the opportunities available for tranquil recreation. One third of the settlement areas are consumed by transport infrastructure (» Chapter 11).

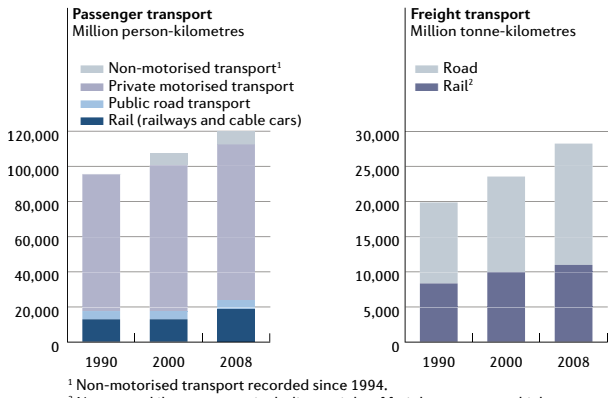
The use of the different means of transport generates costs that are borne not by those who create them but by third parties (usually the general public). This can involve, for example, negative effects on the environment, climate or health. These costs, which are known as external costs, were estimated at CHF 8.5 billion for 2005. 95 % of these costs were accounted for by road traffic and 5 % by rail traffic. With a share of 47 % (CHF 4 billion), accident costs and health costs generated by air pollution represent the dominant cost factor here. Around 14 % (CHF 1.2 billion) of these external costs arise from climate and noise. In passenger transport, the external costs per passenger-kilometre are 3.8 times higher for road transport than for rail transport; in freight transport they are around seven times higher per tonne-kilometre (» ARE/FOEN 2008).

Measures

The aim of Swiss transport policy is to combine the advantages offered by the different means of transport by promoting public transport, non-motorised transport and the transfer of freight from road to rail. It also aims to reduce transport-related environmental impacts to a harmless level in the long term and to reduce energy consumption. It is also intended to implement measures to ensure that external costs are borne by the transport users who cause the pollution.

The mileage-related heavy vehicle tax (MRHVT) was introduced in 2001. As a result, for the first time in Europe, freight transport was billed for external costs. Moreover, the MRHVT contributes to the financing of major rail projects and to the transfer of freight transport from road to rail. »

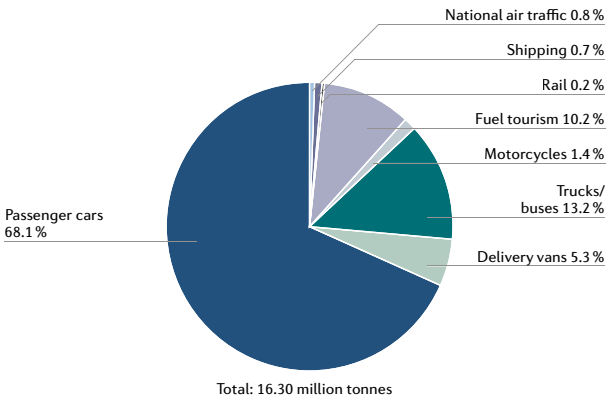
G3.1 Transport volumes



¹ Non-motorised transport recorded since 1994.
² Net tonne-kilometres: not including weight of freight transport vehicles (and trailers), and swap bodies in multimodal transport.

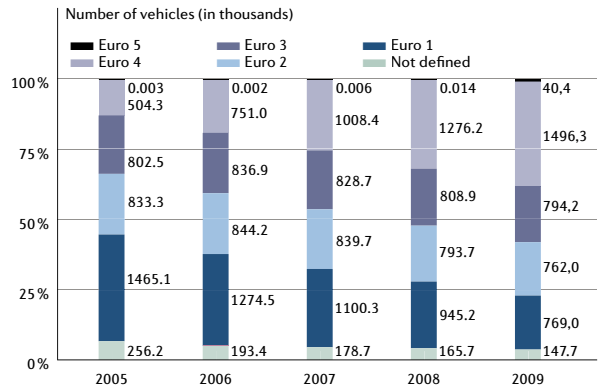
Source: FSO

G3.2 CO_2 emissions generated by transport, 2009
In accordance with the Kyoto Protocol (excluding international aviation and shipping)



Source: FOEN

G3.3 Passenger cars, by emissions categories (Euro standards)



Sources: FEDRO; FSO

The exhaust emissions regulations for vehicles in Switzerland have been harmonised with the EU regulations and are tightened periodically (» G3.3). The Euro 5 emission standard has been applicable to passenger cars since September 2009. In the case of diesel passenger cars, this exhaust standard prescribes limit values for particulate emissions which can currently best be achieved using particle filters.

The federal authorities will invest some CHF 2 billion in measures to reduce noise pollution on the roads by the remediation deadlines of 2015 and 2018. The total cost of the measures is expected to reach around CHF 4 billion. Up to now, 78 % of the funding has been used for structural measures, i.e. noise barriers and covers. With regard to measures that reduce noise at its source, for example low-noise road surfaces, the federal government is investing in research and promotes the use of such surfaces. Measures to remediate railway noise are also being implemented.

From 2008 to 2027, the federal government plans to provide a total of CHF 6 billion from the infrastructure fund to support urban transport projects and will cover between 30 % and 50 % of the costs of such projects. The aims of the agglomeration programme include the reduction of environmental pollution.

To mitigate the problems posed to animals by the fragmentation of habitats, animal crossings are constructed during remediation work on national highways that intersect wildlife corridors. In addition to supporting connectivity among animal populations, such crossings also promote safety as they help to avoid accidents involving animals.

In the case of major new transport infrastructure or major modifications to such infrastructure, the question as to whether a project is compliant with the environmental protection regulations is established through the completion of an Environmental Impact Assessment (EIA). The implementation of an EIA is compulsory for projects involving roads, large carparks, railway lines and airports. Based on the assessment carried out by the environmental authority, the authority that grants the planning permission for such projects decides on their environmental soundness and may impose requirements if necessary.

Other examples of measures for the reduction of the environmental impact of transport include stricter emissions-based landing charges for aeroplanes and discounts on the MRHVT for trucks fitted with efficient particle filters.

Internet links

www.statistics.admin.ch » Topics » Mobility and transport

www.bafu.admin.ch/transports (f g)

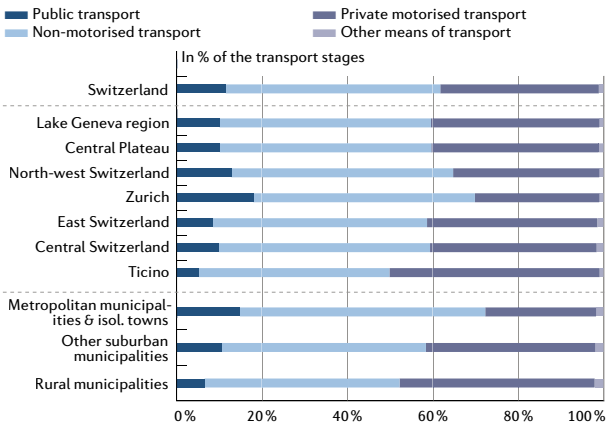
www.bav.admin.ch

www.are.admin.ch

Regional comparison: choice of means of transport

A clear difference can be observed between urban and rural areas in the choice of means of transport. The level of motorisation in cities and suburban municipalities with well developed public transport systems is lower than in the rest of Switzerland.

G3.4 Regional differences in the choice of means of transport, 2005



Sources: FSO; ARE

4. Economy and production

Increasing economic output does not necessarily go hand in hand with increasing environmental pollution. In the case of greenhouse gas emissions, at least, it has been possible to observe a relative decoupling of emissions and economic output in recent years. Hence, while gross domestic product (GDP) rose by 18.7 % in real terms between 1990 and 2005, the emissions generated by the economy only grew by 3 %. Nonetheless, Switzerland's wide-ranging economic activities have consequences for the environment – both at home and abroad.

Context

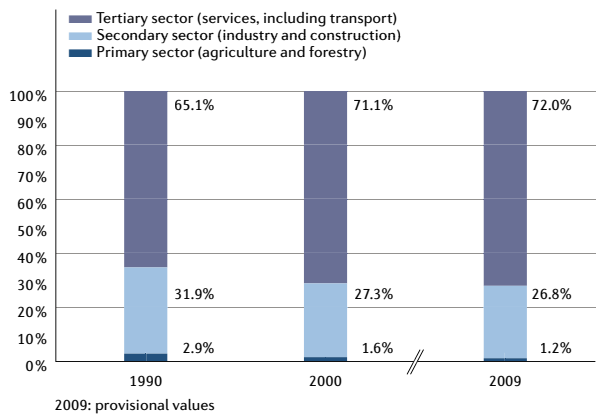
Between 1990 and 2009, Switzerland's gross domestic product (GDP) increased in real terms by 27.4 % . Since 1990, the share of GDP generated by agriculture and forestry (primary sector) has declined from 2.9 to 1.2 % (» G4.1) and the contribution of industry and construction (secondary sector) decreased from 31.9 to 26.8 %. As opposed to this, the contribution of the tertiary sector to GDP increased from 65.1 to 72 % over the same period.

The chemical and pharmaceutical industry is Switzerland's leading export sector. The sector mainly manufactures life science products, for example pharmaceutical products, vitamins, fine chemicals, diagnostics and plant protection products.

Business energy consumption (excluding the transport sector) increased by 8.5 % from 1990 to 2009. Over the same period, total drinking-water consumption decreased by 17 %, a development that can be explained especially by efforts made by industrial and commercial sectors.

A relative decoupling of economic output and the greenhouse gas emissions generated by the economy took place between 1990 and 2005; in other words, the increase in emissions was lower than that of economic performance (» G4.2). Absolute decoupling would arise if emissions declined and the economy continued to grow. The observed gain in efficiency may be explained by the transfer of emissions-intensive activities abroad along with technological progress and structural changes. Overall, the emissions generated by the economy increased in this period by 3 % to 39.2 million tonnes of CO_2 equivalents, while GDP rose by 18.7 % in real terms. Emissions in the primary sector declined by 7.3 % and thus recorded a considerably less pronounced decline than value added (–12.9 %). Emissions in the secondary sector decreased by 1.3 %, while value added rose (11.2 %). Although emissions increased in the tertiary sector (10.1 %), their growth was considerably lower than that in value added (20.5 %). Hence efficiency in the secondary and tertiary sectors increased by 13 % and »

G4.1 Changes in contributions of economic sectors to gross domestic product (GDP) over time

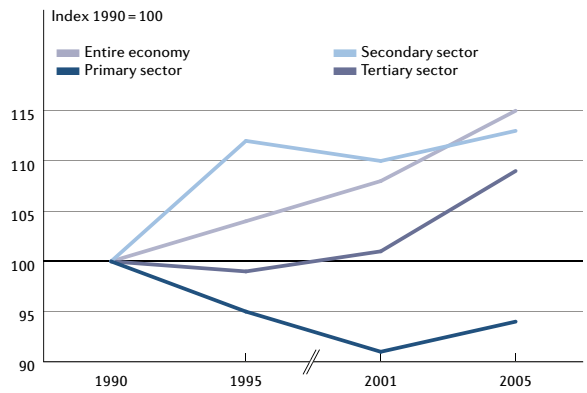


2009: provisional values

Source: FSO

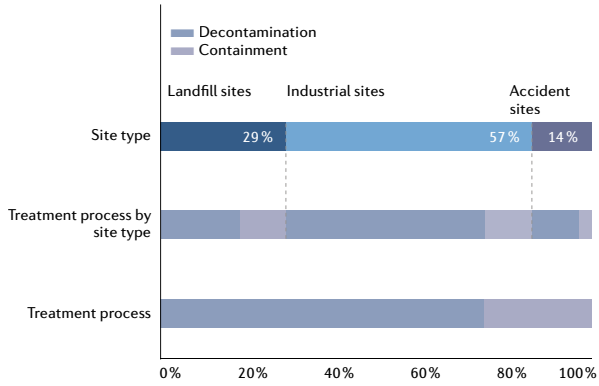
G4.2 Greenhouse gas efficiency of the economy

Gross value added (in real terms) per volume unit of greenhouse gases emitted



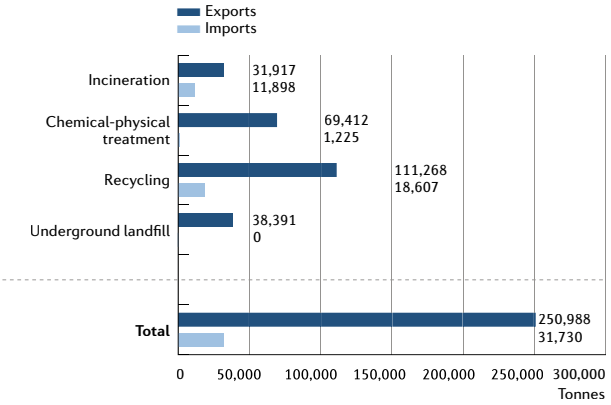
Source: FSO

G4.3 Remediation of contaminated sites in 2005: site types and treatment processes



Source: FOEN

G4.4 Imports and exports of hazardous waste, 2009



Source: FOEN

› 9 % respectively over a period of 15 years. This perspective does not take into account, however, the environmental impact generated abroad by products imported into Switzerland (» BFS 2009a; Chapter 1).

There are around 50,000 designated polluted sites in Switzerland, in which waste has been deposited or which have been contaminated as a result of industrial activities or accidents. If polluted sites cause damage or harmful effects to the environment or risk doing so, they are referred to as contaminated sites. Over 4,000 sites have been classified up to now as contaminated sites; around 350 of them have been remediated (» G4.3).

In 2009, 1.8 million tonnes of hazardous waste were generated in Switzerland by industrial production, the construction sector and the remediation of contaminated sites (» FOEN 2009b). Hence the volume of hazardous waste generated between 1992 and 2009 more than doubled; the biggest increase was recorded between 2006 and 2007 due to the volumes of contaminated excavated material generated by the remediation of contaminated sites. The share of total waste represented by harzardous waste in 2009 was over 40 %: 30 % of this hazardous waste was incinerated, 36 % landfilled following appropriate pretreatment, 13 % underwent chemical-physical treatment and 21 % was recycled. The disposal of 14 % of the hazardous waste was carried out abroad (» G4.4).

In late 2009, around 2,300 activities involving the use of genetically modified organisms (GMOs) and pathogenic organisms (POs) were registered in Switzerland. Around 60 % of these activities involved GMOs and the remaining 40 % centred on POs. An enormous increase in the use of GMOs in contained systems was recorded in the early 1990s. A renewed increase in such activities has also been observed since 2007 (» G2). GMOs are used in research, diagnostics and the manufacture of pharmaceutical and industrial products.

Impacts

Switzerland's wide-ranging economic activites have consequences for the environment. These activities are one of the main sources of emissions of volatile organic compounds (VOCs) and particulate matter (PM10) (» Chapter 7). Moreover they are also the source of over 60 % of Switzerland's greenhouse gas emissions (» SFO 2009a).

If not managed correctly, chemicals and hazardous waste pose a threat to the enviroment. Chemical substances can damage, inter alia, the central nervous system and immune system in humans and animals; however, each substance ultimately has its own ecotoxological risk potential. Chemicals can find their way into the environment both directly (e.g. plant protection products) and indirectly (e.g. pharmaceutical products via sewage treatment plants) and interfere with metabolic processes (» Chapter 9). In addition to the production and use of chemicals, their transport, storage and disposal also pose risks for the environment.

Problems with high concentrations of polychlorinated biphenyls (PCBs) arise occasionally in Swiss watercourses, for example in the Birs and Saane rivers and in the Upper

NAMEA

NAMEA stands for National Accounting Matrix including Environmental Accounts. It is a statistical tool developed by Eurostat, the statistical information service of the European Union, which enables the combining, by sector, of data from the national accounts with environmental data (e.g. emissions, energy, energy taxes, material flows and environmental protection expenditures) (» G4.2). Hence, NAMEA should contribute to achieving a better understanding of the interaction between economic activities and the environment (» FSO 2009a).

Rhine. The causes have only been identified in part. Old landfills, junk yards and other sites contaminated with PCBs have been identified as possible point sources. Even small volumes of PCBs can affect human health (e.g. damage to the immune system and suspected carcinogenic effects).

Measures

Numerous regulations for the protection of the environment have been passed in recent years. The chemicals ordinances (in particular the Chemicals Ordinance, the Biocidal Products Ordinance and the Chemical Risk Reduction Ordinance)[1], which were enacted by the Federal Council in 2005 as part of the harmonisation of Swiss and EU law, resulted, for example, in biocidal products being declared subject to authorisation, and in the definition of stricter requirements for the biodegradability of detergents and cleaning products. In addition, the use of certain heavy metals, such as lead, cadmium, mercury and chromium, is prohibited in electrical and electronic equipment and in vehicles; the use of lead in paints is also banned as are certain persistent organic pollutants (POPs) such as brominated diphenyl ethers and paraffins. POPs were previously used in numerous durable goods but their use is now heavily restricted or prohibited throughout the world (POPs Convention).[2]

Many substances that were already available on the market before the introduction of testing obligations (existing substances) have not yet been tested and assessed to date or only inadequately tested and assessed. Of the 4,638 existing substances which are produced at levels exceeding 1,000 tonnes a year in OECD member countries, 956 had been tested and assessed by the end of 2009 (» G3). To resolve this problem the European Community enacted the new REACH regulation[3] on 1 July 2007 which aims to achieve the safer manufacture and production of chemicals in the EU. This should accelerate the processing of existing substances considerably. Another adaptation of the Swiss chemicals legislation is currently in preparation.

To avoid causing damage to the environment, stringent regulations are now applicable to the construction and operation of landfills and to the management of waste that poses a threat to the environment. The key regulations here are those defined in the Ordinance on Movements of Waste[4] and the Technical Ordinance on Waste[5], the latter is currently being revised. Exports of hazardous waste are only authorised if the waste will be disposed of in an environmentally sound fashion abroad. Exports to non-OECD countries are prohibited.

Some 13,000 of Switzerland's approximately 50,000 polluted sites require closer investigation. Responsibility for this task rests with the cantonal agencies and individual federal authorities. Twenty-three cantons and two federal »

[1] Ordinance of 18 May 2005 on Protection against Dangerous Substances and Preparations (Chemikalienverordnung, ChemV), SR 813.11; Ordinance of 18 May 2005 on the Placing on the Market and Handling of Biocidal Products (Biozidprodukteverordnung, VBP), SR 813.12; Ordinance of 18 May 2005 on Risk Reduction related to the Use of certain particularly dangerous Substances, Preparations and Articles (Chemikalien-Risikoreduktions-Verordnung, ChemRRV), SR 814.81.

[2] Stockholm Convention of 22 May 2001 on Persistent Organic Pollutants (POPs Convention), SR 0.814.03.

[3] Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

[4] Ordinance of 22 June 2005 on Movements of Waste (Verordnung über den Verkehr mit Abfällen, VeVA), SR 814.610.

[5] Technical Ordinance on Waste of 10 December 1990 (Technische Verordnung über Abfälle, TVA), SR 814.600.

Nanotechnology

In the nano sciences and technologies, researchers from the fields of physics, chemistry, biotechnology, medicine, computer science and material sciences work with surfaces and structures ranging in size from the atomic scale to around 100 billionths of a metre (nanometres). Hence nanotechnology makes use of special physical or chemical characteristics that cannot be observed on a larger scale. It is viewed as one of the most promising technological developments of recent years and is very important for Switzerland as a location for research and business. In addition to the promising potential for health and the environment, the new technology also presents some risks, however. Nanoparticles can pose a hazard potential due to their special physical-chemical characteristics which are not displayed by the material when it is in the form of larger particles or solutions (» TA-SWISS 2006).

The Institute for Work and Health (IST) was commissioned by the Swiss National Accident Insurance fund (SUVA), to survey how, where and in what quantities nanoparticles are already being used by industry in Switzerland. In addition, it established how many employees potentially come into contact with nanoparticles and which protection strategies are implemented. The results of the survey revealed, among other things, that 600 companies work with nanoparticles and around 1,300 employees are exposed to them (» IST 2008).

In April 2008, the Federal Council adopted the Synthetic Nanomaterials Action Plan (» FDHA/FDEA/DETEC 2008). The conditions necessary for the sustainable use of nanotechnology are to be created on the basis of this Action Plan. In terms of support for the implementation of the Action Plan, the relevant federal authorities developed instruments for the assumption of responsibility and made them available to businesses for use and testing. The Action Plan also contributed to the promotion of research in the field of nanotechnology.

› authorities have already completed their registers of polluted sites. Registers that are not yet available are due for completion by the end of 2011. The investigations of the polluted sites should be completed by 2015. Remediation in urgent cases must be undertaken by 2017 and a deadline of up to 2025 has been set for the remaining contaminated sites (» G6). This stepwise procedure is regulated by the Contaminated Sites Ordinance.[6] The Confederation can subsidise the treatment of polluted sites. Approximately CHF 30 million is available for this purpose annually, financed by a tax on the landfilling of waste.[7]

Regulations also apply to the handling of GMOs and pathogenic organisms (POs) in contained systems. These are defined in the Containment Ordinance.[8] The precautionary principle is basically applicable in the area of biotechnology as the information available about the long-term and indirect environmental impacts of GMOs is currently insufficient. There is a moratorium on the use of GMOs in agriculture until 2013 (» Chapter 6).

In addition to the passing of regulations, other measures have been taken to reduce the environmental impacts of economic activities. For example, incentive taxes are levied on heavy traffic (mileage-related heavy vehicle tax, MRHVT), carbon dioxide (CO_2) and on volatile organic compounds (VOCs).

Although environmental protection generates costs, it can also help to avoid expenses (e.g. in the health sector) that would arise from greater pollution. In 2003, the environmental protection expenditure of businesses was approximately CHF 2.5 billion. A real decline of around 7 % has been recorded in this spending since 1993. This reduction can be explained by structural changes, the introduction of cleaner production processes that do not give rise to any additional spending on environmental protection and the development of more effective technologies for the treatment of environmental pollution. Swiss industry is not penalised when compared at international level. It devoted about CHF 1.28 billion to environmental protection in 2003, which corresponds to almost 1.4 % of its value added. This financial burden is comparable with that of European industry (EU15) (» FSO 2006).

In October 2010, the Federal Council set the course for the development of a greener economy (» FOEN 2010a). It confirmed its intention to improve general conditions so as to increase resource efficiency in production and consumption – measures that will serve both the environment and the economy. The emphasis here is placed, inter alia, on the "greening" of the tax system with a view to the reinforcement of the incentives for the protection of resources, the provision of information on the use of environmental resources by consumption and production and on the promotion of clean technology sectors. The Swiss Cleantech Masterplan shows how Switzerland can become a leading cleantech location (» OPET 2010). •

Internet links

www.statistics.admin.ch » Topics » National economy

www.statistik.admin.ch » Themen » Raum, Umwelt » Umweltgesamtrechnung (f g)

www.bafu.admin.ch/economy

www.bafu.admin.ch/state-chemicals

www.bafu.admin.ch/state-contaminatedsites

www.bafu.admin.ch/state-biosafety

www.bafu.admin.ch/state-hazardouswaste

www.bafu.admin.ch/nanotechnology

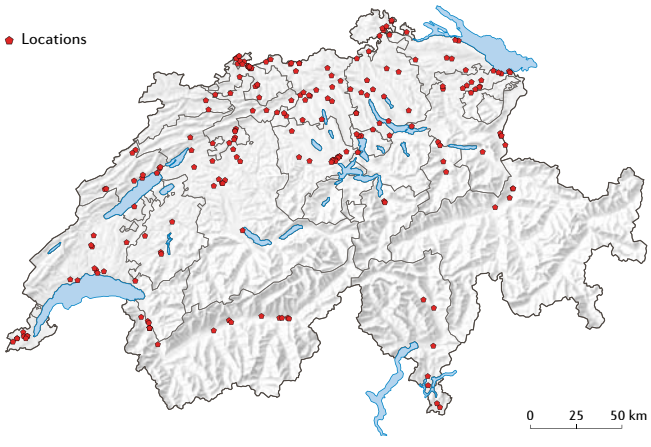
www.bafu.admin.ch/swissprtr

www.ta-swiss.ch

Regional comparison: Swiss Pollutant Release and Transfer Register (SwissPRTR)

The Swiss Pollutant Release and Transfer Register (SwissPRTR) is a publicly accessible register containing information about the release of almost 90 pollutants into the air, water and soil. The information, which may be consulted on the FOEN website, enables the identification of pollutant sources and their local, regional or even national importance.

M4.1 SwissPRTR: locations of registered facilities, 2010



Source: FOEN Map: FSO, ThemaKart

[6] Ordinance of 26 August 1998 on the Remediation of Contaminated Sites (Altlasten-Verordnung, ALTLV), SR 814.680.
[7] The basis for this is provided by the Ordinance of 26 September 2008 on Charges for the Remediation of Contaminated Sites (Verordnung über die Abgabe zur Sanierung von Altlasten, VASA), SR 814.681.
[8] Ordinance of 25 August 1999 on the Contained Use of Organisms (Einschliessungsverordnung, ESV), SR 814.912.

5. Households, consumption and tourism

Between 1990 and 2009, household consumer spending in Switzerland rose by 28 % in real terms, roughly in line with the economy. On average, 200 litres of water are consumed per person per day and 700 kg of waste are generated per capita annually. Approximately half of the waste is collected separately. The manufacture, transport and use of products cause far greater environmental impacts than their orderly disposal.

Context

The consumption of goods and services accounts for a large part of our impact on the environment.

Between 1990 and 2009, the Swiss population increased by 15 % from just under 6.8 million to almost 7.8 million. Based on household scenarios, it is assumed that the number of private households increased over the same period by almost 20 %, while the average number of persons per household declined from 2.3 to 2.2 . In parallel, the average living space per person rose by 12.8 % between 1990 and 2000.

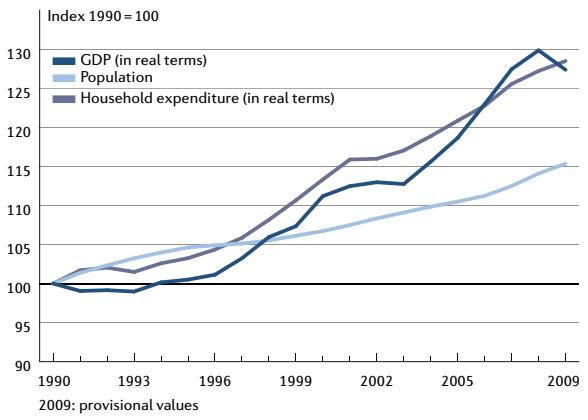
Gross domestic product (GDP) rose by around 27 % in real terms between 1990 and 2009 and household consumer spending grew by 28 %. The latter reached CHF 310 billion at current prices in 2009 (» G5.1).

Households account for around 29 % of final energy consumption – excluding that used for transport. Energy consumption has remained relatively constant since 1990 (» G5.2). At around one third of final energy consumption, transport is the biggest energy consumer group. Final energy consumption in this sector increased by 16 % between 1990 and 2009 (» Chapter 2).

Water consumption by households and small businesses has decreased by around 10 % since 1990 and was 573 million m³ in 2009. Per-capita water consumption has declined by over 22 % since 1990 to 200 litres per person per day (» G5.2).

In addition to the population and the economy, the volume of municipal solid waste (MSW) generated annually also grew. The waste mountain has increased in size by 33 % since 1990. In 2009, each Swiss inhabitant produced around 700 kg of waste. The volume of MSW collected separately has more than doubled since 1990 from 160 to 360 kg per person per year. Switzerland achieves high collection quotas for individual waste categories: 95 % for glass, 84 % for tinplate, 88 % for paper and card, and 81 % for PET (» FOEN 2009c). The remaining MSW is incinerated in an environmentally sound fashion. Electricity and heat are harnessed in the process and provide around 2 % of Swiss final energy consumption. »

G5.1 Gross domestic product (GDP), population and household expenditure

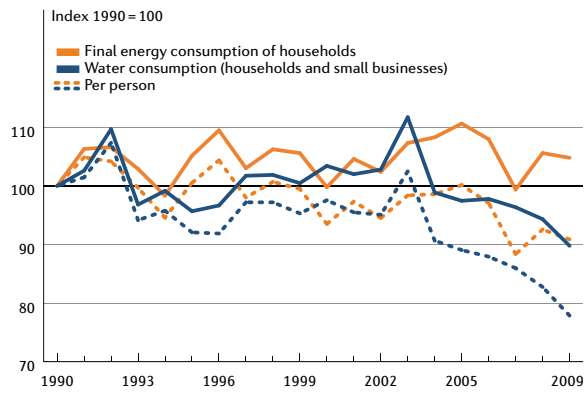


2009: provisional values

Source: FSO

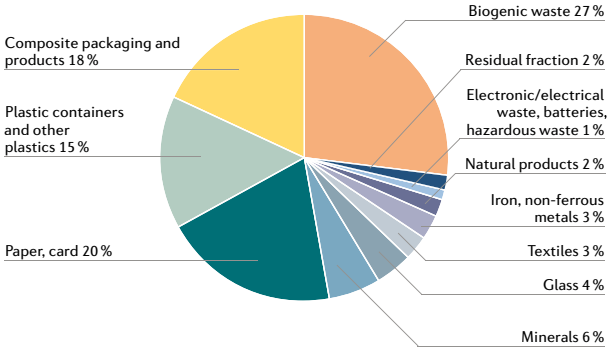
SI FS

G5.2 Household final energy and water consumption



Sources: SVGW; SFOE

G5.3 Composition of municipal solid waste, 2001/2002



Source: FOEN

IF E

› Biogenic waste from kitchens and gardens and food leftovers account for 27 % of incinerated household waste and the largest category by weight. Paper and card, which account for 20 %, come next and are followed by composite products and composite packaging at 18 %, and plastics at 15 % (» G5.3). The increasing habit of discarding food and drinks packaging, free newspapers, cigarettes and other objects on public ground is generating a need for greater human and financial resources in the area of waste disposal. This littering generates annual costs of CHF 200 million (» FOEN 2011a).

Impacts

The consumption of goods and services has impacts on the environment at local, regional and global levels. Switzerland imports almost all important industrial raw materials and non-renewable energy carriers and increasing numbers of finished products (» Chapters 1 and 2). Hence consumption has direct and indirect environmental impacts in the countries of production. Almost all consumption-related decisions have an impact on the environment: with respect to habitation, the choice of location, the total heated living space, the choice of energy carrier and the thermal quality of the building are crucial. The increase in living space per person and in second homes has prompted the expansion of development zones and settlements and created a need for additional infrastructure. In the area of mobility, the distance covered by the routes travelled and the choice of means of transport are crucial, while, in the case of consumer goods, the key factors are the volumes purchased, the origin and quality of the goods and the production methods used. With respect to nutrition, finally, diet, production methods and the origin of the food are crucial with respect to impact made on the environment. Meat production has the greatest environmental impact in this context (» FOEN 2006a).

Measures

Switzerland has implemented numerous measures since the 1980s to reduce the environmental impacts generated by the consumption of goods and services. These include the passing of laws and regulations (e.g. the ban on mercury and polychlorinated biphenyls [PCBs]), the creation of financial instruments, for example the incentive taxes for the reduction of air pollution (» Chapter 7), the levies on refuse bags, the provision of advice, communication and information about waste and consumer topics, the promotion of new technologies such as heat pumps and solar power, private initiatives such as the establishment of new standards (the Minergie and Minergie-P building energy standards) and labels (FSC for wood and the bud for organic agriculture), and, finally, transport and mobility-related measures (» Chapter 3).

Although the total volume of municipal solid waste (MSW) generated has risen in recent years, the Swiss government's waste management policy has greatly reduced the level of environmental pressure caused by waste management. This progress can be attributed among other things to the introduction of stringent waste management standards, highly effective infrastructure (in particular the waste incineration plants), improvements in the separate collection of waste, the imposition of take-back and recycling obligations for various products, and a financing system based on the polluter-pays principle.

Different initiatives exist at commune and town/city level in the cantons to curb littering in public places. These include, for example, information and awareness-raising campaigns and cooperation between the authorities and businesses (codes of behaviour). The commercial and retail trade sectors also engage in efforts to reduce littering.

If the environmental impact caused by consumption is to be further reduced in the future, apart from targeting changes in consumer behaviour, the problem must also be tackled from the beginning of the production chain. The manufacturing and use of most products causes far greater environmental pressure than their orderly disposal. For this reason, in addition to avoiding the generation of waste, it will become more important to exert an influence on production. This approach can be fostered, for example, through partnerships with industry and commerce, through the consideration of the results of life cycle assessments (» Box "Ecological market transparency and life cycle assessments"), through information and awareness-raising for both producers and consumers (e.g. through campaigns and credible and comprehensible environmental product information) and through international agreements. •

Internet links

www.statistics.admin.ch » Topics » Population

www.statistics.admin.ch » Topics » National economy

www.statistics.admin.ch » Themen » Tourismus (f g)

www.bafu.admin.ch/state-wastemanagement

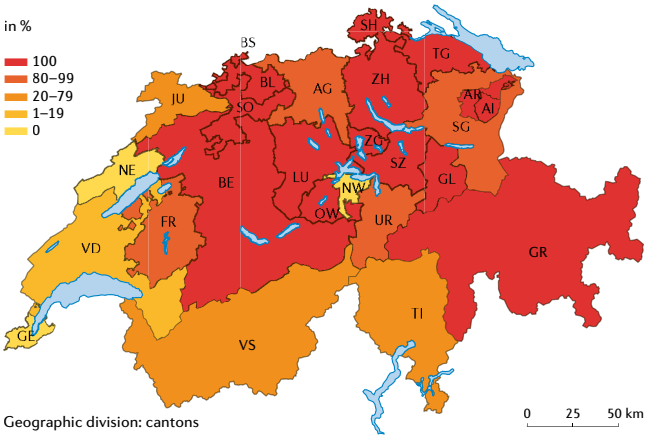
www.bafu.admin.ch/products

www.bafu.admin.ch/tourism (f g)

Regional comparison: polluter-pays principle (waste disposal fees)

76 % of the population throughout Switzerland finances waste disposal fully or in part through the payment of "polluter-pays" charges (refuse-bag fees). In the cantons of Western Switzerland, Nidwalden and Ticino, waste disposal is financed by non-volume-based charges or from tax revenues.

M5.1 Percentage of the population subject to volume or weight-based waste disposal fees, 2006



Geographic division: cantons

Source: FOEN

Map: FSO, ThemaKart

Ecological market transparency and life cycle assessments

We all consume to satisfy our needs for nutrition, heat, protection, mobility and leisure activities. According to the Global Footprint Network, with its current consumption patterns, the Swiss population consumes over four times the volume of resources available in Switzerland (» ARE/SECO/FOEN/FSO 2006) and 70 % of the materials consumed originate from abroad (» Chapter 1). To reduce our drain on resources, individuals, companies and the public sector need to opt more often for resource-conserving alternatives when making choices related to the consumption and production of goods. In order to achieve this, it is necessary that the environmental impacts arising from the consumption of goods and services be quantifiable and definable.

Life cycle assessments (LCAs) are one method of numerically expressing the ecological effects of products throughout their life cycles (» Chapter 1; Box "Internet-related material flow"). An LCA inventories all of the main environmental impacts that a product causes over its entire life cycle – from the extraction of the raw materials to production, transport and use of a product, and, finally, its disposal. The federal authorities promote the life-cycle-based way of thinking through the support and further development of existing LCA methods and the use of LCAs by the administration and businesses. An example of the greater consideration of the life cycle in consumption decisions is the requirement to provide "Proof of the positive aggregate environmental impact of fuels from renewable feedstocks" introduced in 2009 under the Biofuels Life Cycle Assessment Ordinance[1].

[1] DETEC Ordinance of 3 April 2009 on Proof of the Positive Aggregate Environmental Impact of Fuels from Renewable Feedstocks (Treibstoffökobilanz-Verordnung, TrÖbiV), SR 641.611.21.

Sport and tourism

With a gross value added of CHF 14.5 billion in 2009 (2.9 % of total gross value added) and a total of 145,000 employees in full-time equivalents (4.1 % of total workforce), tourism is one of the most important sectors of the Swiss economy (» FSO 2010c).

Switzerland's diverse and beautiful landscape is viewed by foreign visitors as its greatest attraction by far as a tourism destination (» Tourism Switzerland 2009). The pressure on nature and the landscape is increasing, however, as open-air sporting activities are gaining in popularity and are taking place outside of formal organisational structures (e.g. sport associations) (» FOSPO 2008). Conflicts arise mainly in landscapes and habitats which are both very attractive for sport and recreational use, and highly sensitive and worthy of protection.

The interference in the ecosystem is particularly striking in the case of winter tourism: the area of artificial snow slopes is constantly increasing in Switzerland and reached 33 % in 2008 (» STV 2008; G5.4). Large volumes of water are consumed in the production of artificial snow (around 18 million m³ in winter 2007/08). In addition, the setting up of artificial snow installations often requires extensive excavation work for the laying of cables and pipes and for the construction of pump stations and reservoirs. The trend for artificial snow use could increase further as a result of climate change (» Chapter 8).

Efforts are being made on various fronts to maintain access to attractive local recreational spaces and tourism regions in a way that is compatible with the needs of the environment:

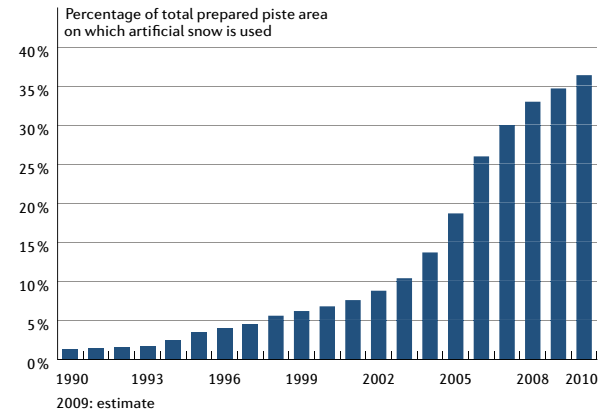
- *The creation of parks of national importance aims to boost sustainable development, specifically by developing nature-based tourism services in these regions (» Chapter 11).*
- *The federal authorities support the creation of nature-based tourism services through the Innotour tourism innovation promotion programme.*
- *The "Respektiere deine Grenzen" ("Respect your limits")[1] campaign was launched in cooperation with the Swiss Alpine Club (SAC) in 2009. The aim of the campaign is to provide better protection to habitats of wild animals, thus granting them greater tranquillity.*
- *The project for the updating of the Federal Inventory of Landscapes and Natural Monuments of National Importance (BLN) promotes, among other things, quiet recreation (» Chapter 11).*

Transport is the biggest cause of resource consumption in the field of sport and tourism; both travel to and from tourism destinations and motorised sporting activities must be taken into account here. In 2005, leisure traffic was responsible for almost 45 % of distances travelled in Switzerland and for 41 % of the associated movements; around 12 % of it were connected with sporting activities (» FSO/ARE 2007). The car is the dominant means of transport here: almost 70 % of all distances covered by leisure traffic are travelled by car (» Chapter 3).

To reduce the impacts of leisure traffic on the environment, the federal government developed the Federal Leisure Transport Strategy in 2009. The strategy proposes measures to promote a shift from private motorised transport to public transport, to encourage the use of non-motorised transport and to reduce the length of trips undertaken for leisure activities. It is also planned to create attractive, competitive and commercially viable leisure travel products and services. A new centre of competence on leisure traffic "Kompetenzzentrum Freizeitverkehr" was established in 2009 for this purpose (» Federal Council 2009a).

[1] www.respektiere-deine-grenzen.ch

G5.4 Artificial snowmaking



Source: Seilbahnen Schweiz

6. Agriculture

Agriculture has made significant ecological progress over the past two decades. In 2009, 11 % of utilisable agricultural area was used for the purpose of ecological compensation. However, agricultural activities continue to cause environmental impacts. Agriculture faces the challenge of improving the integration of environmental protection and biodiversity conservation into its production methods.

Context

Natural processes are influenced by agriculture in a variety of ways: fertilisers (farmyard manure, mineral fertilisers) provide nutrients for plants and the soil is worked for sowing, crop maintenance and harvesting. In addition, plant protection products are used to fight weeds, fungi and pests, and animal diseases are treated using veterinary pharmaceuticals. Depending on the particular time, scale and method involved, agricultural activities can harm the environment, in particular water bodies and watercourses and biodiversity.

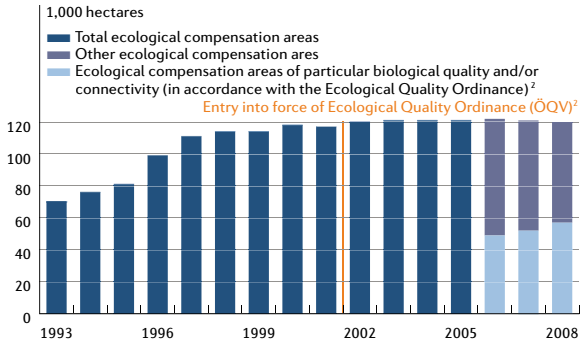
Over one third of Switzerland's territory is used for agriculture and Alpine grazing. Hence agriculture bears considerable responsibility for the quality of Swiss cultural landscapes. According to the Swiss Federal Constitution, the federal authorities must ensure that agriculture makes a substantial contribution to national food security, the conservation of life-sustaining natural resources, the stewardship of the cultural landscape and the country's regionalised settlement pattern by implementing a system of production that is both sustainable and market-oriented.

The area of land used for agriculture declined by 2.3 % between 1996 and 2009. According to the Swiss land-use statistics, two thirds of this land take was for new settlement and infrastructure areas. One third became forest area, a development that can be largely explained by the abandonment of farming in the mountain region (» FSO 2009b; 2010d). Around 11 % of Switzerland's utilisable agricultural area is farmed organically (» K6.1). Ecological compensation areas increased from 1993 and have remained constant at approximately 120,000 ha since 2001 (» G6.1).

In 2008, Swiss agriculture covered 62 % of domestic food requirements in terms of energy (» FSO 2010e). In the case of foodstuffs of animal origin, the level of self-sufficiency is 93 %, and in the case of milk products, production outstrips domestic demand. However, Swiss agriculture is highly dependent on other countries for agricultural production inputs (e.g. animal feed, energy, fertilisers, plant protection products, seed material, machinery). Excluding imported animal feed, the net level of self-sufficiency in 2008 was 55 %. Hence the environmental impacts arising from the production of animal feed arise, in part, abroad (» FOAG 2009). »

G6.1 Ecological compensation areas

Areas qualifying for subsidies[1]

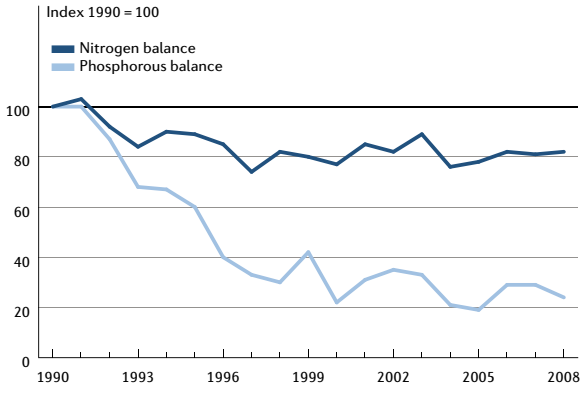


[1] The number of standard fruit trees is converted into units of area, one tree corresponds to one are.
[2] It is not possible to provide a breakdown of the ecological compensation areas for 2002 to 2005.

Source: FOAG

IF FS

G6.2 Nitrogen and phosphorous surpluses



Source: FSO, in accordance with OECD methodology

SI M

Agriculture is responsible for around 10 % of Switzerland's greenhouse gas emissions, the main share of which is accounted for by methane (CH_4) and nitrous oxide (N_2O) (» Chapter 8). Around 66 % of Swiss methane emissions originate from livestock-keeping and 75 % of nitrous oxide emissions from agriculture (farmyard manure storage and manure management).

Nitrogen (N), which occurs in many forms in nature, is of vital importance for plant growth. Mineral fertilisers and animal excreta constitute the main source of nitrogen inputs from agriculture. Part of the nitrogen reaches the air in the form of ammonia emissions (NH_3), another part is leached into the groundwater as nitrate (NO_3). At around 94 %, agriculture is the main source of ammonia emissions in Switzerland (» FOEN 2009d). These emissions are generated for the most part by livestock farming. The requirements of the Waters Protection Ordinance[1] regarding the nitrate content of the groundwater are sometimes exceeded in catchment areas dominated by arable farming (» Chapter 9). The nitrogen surpluses declined between 1990 and 2008 by around 18 % (» G6.2), however, their level has stagnated at around 100,000 tonnes per year since the beginning of this century.

In addition to nitrogen, phosphorous (P) is another important plant nutrient. Agriculture is mainly responsible for the still high phosphorous content of some of the lakes in the Central Plateau. Water bodies in catchment areas with intensive livestock-keeping, for example Lakes Baldegg, Hallwil, Sempach and Zug, have high phosphorous levels (» G15).

Over 350 chemical active agents and over 60 organisms are currently authorised in plant protection products in Switzerland. In 2009, almost 2,300 tonnes of plant protection products, of which fungicides (products that kill or inhibit fungi) and herbicides (weed killers) are the main types, were sold.

Impacts

Nutrient-poor, species-rich grassland ecosystems have become rare in Switzerland, in particular in intensively farmed valley areas. In the mountain region there is a trend toward the more intensive farming of favorable areas, while the area of fallow lands is increasing due to abandonment of farming in less suitable areas, which, however, are often valuable from an ecological perspective (» Stöcklin et al. 2007).

Ammonia is particularly harmful to ecosystems that depend on low-nitrogen conditions, for example, forests, mires and species-rich meadows. Excessive nitrogen inputs give rise to a reduction in species diversity, and can disrupt the soil balance through acidification and thus lead to the release of substances (e.g. heavy metals) that may be toxic to living organisms.

Elevated input of phosphorous into water bodies causes the excess production of plant biomass and hence nutrient saturation (eutrophication) in lakes and ponds. This can result in a reduction in biodiversity, higher water treatment costs and restrictions on the use of lakes for leisure activities.

Plant protection products can reach water bodies and watercourses through rainwash, percolation, leaching and drainage. Sometimes (in 9 % of samples tested by the national groundwater monitoring network NAQUA; G14) these products are measured in groundwater in concentrations that exceed the limit admissible under the Waters Protection Ordinance of 0.1 µg/l (» Chapter 9).

The agricultural management of soil can result in its compaction or erosion. Various soil functions are impaired as a result and losses in yield can also arise (» Chapter 10). Erosion contributes to the nutrient pollution of water bodies.

Measures

The federal government has implemented measures on different levels to reduce the negative impacts of agriculture on the environment. In 2008, it defined environmental objectives for the agriculture sector on the basis of acts, ordinances, international agreements and Federal Council resolutions (» FOEN/FOAG 2008).

The majority of dry meadows and pastures are the result of extensive agricultural use and play an important role in the conservation and promotion of species diversity. In early 2010, the Federal Council passed a new ordinance which adds an inventory of dry meadows and pastures to the existing federal inventories (Dry Meadows Ordinance).[2] This establishes the basis for the protection and conservation of dry meadows and pastures of national importance and makes an important contribution to the promotion of biodiversity (» Chapter 12).

[1] Waters Protection Ordinance of 28 October 1998 (Gewässerschutzverordnung, GSchV), SR 814.201.

[2] Ordinance of 13 January 2010 on the Protection of Dry Meadows and Pastures of National Importance (Trockenwiesenverordnung, TwwV), SR 451.37.

Moratorium on genetically modified organisms (GMOs)

In 2005, the people and the cantons voted in favour of the popular initiative "for food from GMO-free agriculture". The initiative states that genetically modified plants may not be cultivated by Swiss agriculture. The ban, which was originally limited to five years, was extended by a further three years by parliament in March 2010. A deciding factor for this extension was the fact that a National Research Programme on the Benefits and Risks of the Deliberate Release of Genetically Modified Plants (NFP59) is currently being carried out and is expected to present its findings in mid-2012.

Direct payments

Since 1999, agricultural holdings must present proof of ecological performance (PEP) to receive direct payments. The following six criteria must be met: balanced use of fertilisers, crop rotation, targeted use of plant protection products, suitable soil protection measures, species-appropriate livestock farming and ecological compensation areas. Almost all farms now fulfil the PEP requirements. This has contributed to the fact that agricultural production in Switzerland is more environmentally sound today (» G6.1).

In 2012, the Swiss parliament will decide on the revision of the Federal Agriculture Act. As part of this process, direct payments are to be more strongly oriented towards the desired public services to be provided by agriculture (» Federal Council 2009b). It is planned to create five new permanent direct payments instruments: cultural landscape contributions, security of supply contributions, biodiversity contributions, landscape quality contributions and animal welfare contributions. These changes are expected to come into force in 2014.

The federal government promotes the diversity of varieties in the cultivation of agricultural products and supports, in particular, the increased use of local varieties (crop plants) and breeds (livestock).

According to article 62a of the Waters Protection Act[3], the federal authorities support the cantons in the remediation of polluted water bodies. To this end, it finances most of the costs and reduced yields incurred by agricultural holdings as a result of the implementation of measures to reduce these pollutant inputs.

Other agricultural policy measures include the obligation to provide proof of ecological performance (PEP), contributions for biological quality and connectivity (Ecological Quality Ordinance)[4], the ecological direct payments (» Box "Direct payments") and the "Sustainable Use of Natural Resources" programme. The latter promotes regional and sector-specific projects that aim to achieve the more efficient use of nitrogen, phosphorous and energy, the optimised use of plant protection products or greater protection of the soil and biological diversity. The focus of the projects currently being supported by the programme is the reduction of ammonia emissions. •

Internet links

www.statistics.admin.ch » Topics » Agriculture, forestry

www.bafu.admin.ch/state-water

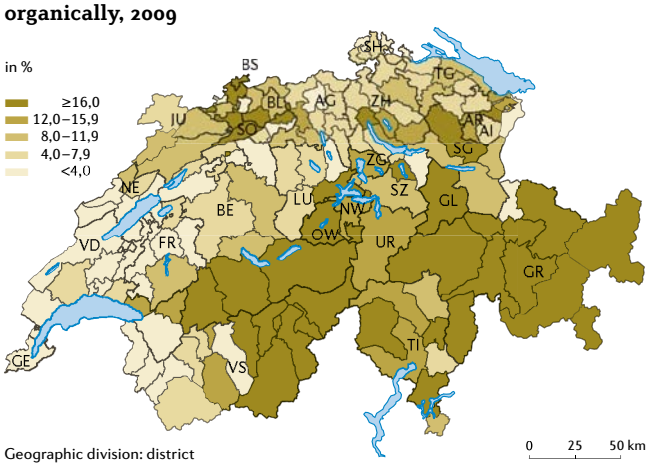
www.bafu.admin.ch/state-soils

www.foag.admin.ch

Regional comparison: percentage of utilisable agricultural area farmed organically

11 % of utilisable agricultural area is farmed organically. In hill and mountain regions, the proportion is higher as the conversion to organic production in livestock farming is easier than, for example, in arable farming or vegetable production.

M6.1 Percentage of utilisable agricultural area farmed organically, 2009



Geographic division: district

Source: FSO

Map: FSO, ThemaKart

[3] Federal Act of 24 January 1991 on the Protection of Water (Gewässerschutzgesetz, GSchG), SR 814.20.

[4] Ordinance of 4 April 2001 on the Regional Promotion of the Quality and Connectivity of Ecological Compensation Areas in Agriculture (Öko-Qualitätsverordnung, ÖQV), SR 910.14.

7. Air quality

Air pollutant emissions have been greatly reduced in recent decades thanks to the implementation of numerous measures. The ambient air quality standards specified in the Air Pollution Control Ordinance are complied with for nine of the twelve main air pollutants in Switzerland today. However, the ambient air quality standards for nitrogen dioxide, ozone and particulate matter are still exceeded, in some cases massively, with corresponding impacts on human health and the environment.

Context

Clean air is an indispensable necessity of life for plants, animals and humans. Human beings influence air quality through the combustion of fossil heating and motor fuels, industrial processes and agricultural activities. Gases and dust particles enter the atmosphere during these processes which are referred to collectively as emissions. The pollutants are transported by wind and can undergo chemical and physical change as a result (transmission). Finally, they impact on humans and the environment.

The quality of the air is constantly monitored and analysed at national level by the National Air Pollution Monitoring Network (NABEL)[1] and at cantonal and communal levels. Switzerland is also involved in an international air pollutant monitoring network.

Since 1990, it has been possible to reduce the emissions of sulphur dioxide (SO_2) by 85 %, of particulate matter (PM10) by 40 %, of nitrogen oxides (NO_x) by 50 % and of volatile organic compounds (VOCs) by 65 % (» G11). Compared with similarly densely populated areas in Western Europe, Switzerland's per capita emissions of air pollutants are considerably lower.

In the case of nine of the twelve main air pollutants, for which ambient air quality standards have been specified in the Air Pollution Control Ordinance,[2] the pollution levels throughout Switzerland are below these limits. The ambient air quality standards continue to be exceeded, in some cases massively, for nitrogen dioxide (NO_2), ground-level ozone (O_3) and particulate matter (» G7.1 and G7.2) (» FOEN 2010b).

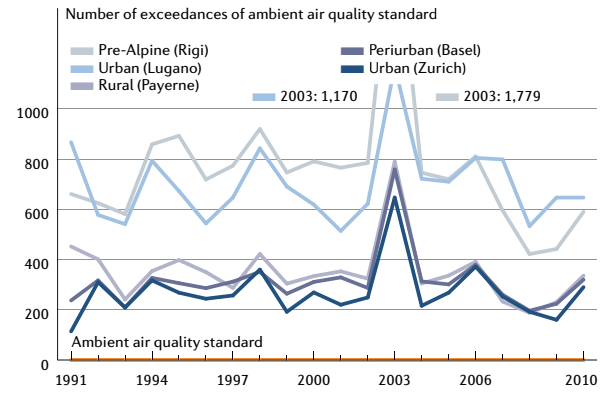
The concentrations of NO_2 in the air decreased markedly over the period 1990–2000 and slightly since the year 2000. The ambient air quality standard for NO_2 (30 µg/m³, annual average) is still markedly exceeded in some places, particularly near busy main roads (» G10).

Ground-level ozone arises when precursors (in particular NO_x and VOCs) are chemically altered by intensive

[1] Data collected by the national air pollution monitoring network (NABEL): www.bafu.admin.ch » Topics » Air » Air pollution » National Air Pollution Monitoring Network (NABEL).

[2] Ordinance of 16 December 1985 on Air Pollution Control (Luftreinhalte-Verordnung, LRV), SR 814.318.142.1.

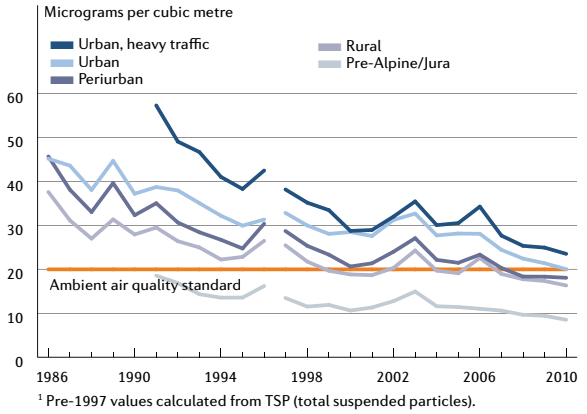
G7.1 Exceedences of the ambient air quality standard for ozone (O3)[1]



[1] 1-hour ambient air quality standard: 120 µg/m³ may only be exceeded once per year at most. Ozone levels were extremely high in 2003 due to the hot summer.

Source: FOEN, NABEL

G7.2 Annual mean values for particulate matter (PM10)[1]



[1] Pre-1997 values calculated from TSP (total suspended particles).

Source: FOEN, NABEL

solar radiation. This process gives rise to summer smog. The formation of summer smog and the accompanying elevated ozone concentrations are indications of severe atmospheric pollution. High levels of particulate matter and nitrogen oxides concentrations in winter are known as winter smog. This is formed when ground-level air masses do not mix sufficiently in high-pressure meteorological conditions. Under these conditions, pollutants such as particular matter and nitrogen oxides can accumulate and their concentrations can exceed the ambient air quality standards prescribed by the Air Pollution Control Ordinance for several days in succession.

Impacts

Air pollution has adverse effects on human beings, ecosystems, buildings and materials. Between 3,000 and 4,000 people in Switzerland die prematurely each year as a result of the effects of air pollution (» ARE 2004; 2008). The greatest threat is posed by excessive particulate matter and ozone pollution which can cause respiratory and cardiovascular diseases. Around 40 % of the Swiss population is exposed to excessive particulate matter concentrations at their place of residence (» Chapter 17).

High nitrogen inputs from the air cause extensive eutrophication of ecosystems. This affects, in particular, forests, species-rich meadows and dry grasslands, Alpine heaths, raised bogs, and fens. Numerous species, which are adapted to nutrient-poor habitats, are endangered as a result, and many of them are included in the Red Lists (» Chapter 12). Alpine lakes and forest soils acidify due to excessive pollutant deposition. High ozone levels in summer also cause damage to the leaves and needles on trees. Extended periods of elevated ozone concentrations have negative effects on plant growth and, depending on the crop and weather conditions, this can cause harvest losses of up to 15 % (» Fuhrer 1995). In addition, buildings, monuments and materials can be attacked, bleached and damaged by acidic pollutants.

Air pollution in Switzerland generates health care costs of around CHF 5.1 billion every year (» ARE 2008; Chapter 17).

Measures

The Swiss Environmental Protection Act (EPA)[3] obliges the federal authorities and cantons to protect human beings, fauna and flora from air pollutants that are harmful or cause nuisance. In accordance with the precautionary principle, emissions must be limited as far as technologically and operationally feasible and economically viable. If it is found that air pollutant concentrations are harmful or cause nuisance, emission limits have to be tightened. Moreover, the polluter-pays principle applies, according to which the generator of the emissions must bear the costs arising from their limitation.

Since the entry into force of the Ordinance on Air Pollution Control, the federal authorities, cantons and communes have implemented a large number of measures to counteract air pollution. In addition to the strict emission rules for combustion installations, industrial facilities and motor vehicles, and the quality standards for heating and motor fuels, the measures introduced include the mileage- »

[3] Federal Act of 7 October 1983 on the Protection of the Environment (Umweltschutzgesetz, USG), SR 814.01.

The main air pollutants

- *Particulate matter (PM10) consists of particles with a maximum diameter of 10 micrometres (µm). These are emitted directly into the atmosphere or can form from precursor substances. Particulate matter causes diseases of the respiratory and cardiovascular system. The carcinogenic components of diesel engine exhaust fumes and from wood combustion are particularly harmful. Motorised transport, agriculture, forestry, industry and commerce (including construction sites) are the main sources of PM10.*
- *Nitrogen oxides (NO_x) are precursor substances for the formation of ozone and cause the acidification and eutrophication of natural ecosystems, such as mires and forests, and the formation of secondary particles, e.g. particulate matter (PM10). The main source is motorised road transport through the combustion of motor fuels (» Chapter 3).*
- *Volatile organic compounds (VOCs) contribute to the formation of ozone and particulate matter. The spectrum of VOCs ranges from non-toxic to highly toxic and carcinogenic compounds (e.g. benzene). The main emitters of VOCs are industry, commerce and motorised transport.*
- *Ozone (O_3) arises in the lowest layer of the atmosphere (troposphere) from the precursor pollutants NO_x and VOCs under the effect of sunlight. Ozone irritates the respiratory tract, reduces lung function and damages plants. It also acts as a greenhouse gas.*
- *Ammonia (NH_3) is a crucial contributor to the eutrophication and acidification of soil and this has detrimental effects on natural ecosystems. Agricultural livestock farming is the primary source of NH_3.*
- *Sulphur dioxide (SO_2) is emitted during the combustion of motor and heating fuels that contain sulphur and is an important precursor substance for the formation of acid rain. Air pollution through SO_2 has been greatly reduced in Switzerland since the 1980s and no longer poses a problem.*

› related heavy vehicle tax (MRHVT) and the the incentive tax on volatile organic compounds (VOCs) (» FOEN/FSO 2007).

The Federal Council revised its Air Pollution Control Strategy[4] in September 2009. It is planned to reduce the emissions of nitrogen oxides by 50 % compared to 2005 levels of particulate matter by 45 % , of ammonia (NH_3) by 40 % and of volatile organic compounds (VOCs) by between 20 % and 30 %. The limit values for emissions from stationary sources (combustion installations, industry, agriculture) and from vehicles and machinery must be reassessed and adjustments proposed if appropriate. Options for the introduction of financial incentives for the cleanest vehicles and machines in the relevant categories are being assessed. In addition, Switzerland aims to support the introduction of ambitious emission limit values based on best available techniques at international level. This cooperation is important as air pollution is also transboundary in its effects. Finally, in cooperation with the cantons, the success of measures implemented in agriculture for the reduction of ammonia levels is monitored through measurements and surveys. •

Internet links

www.bafu.admin.ch/state-air

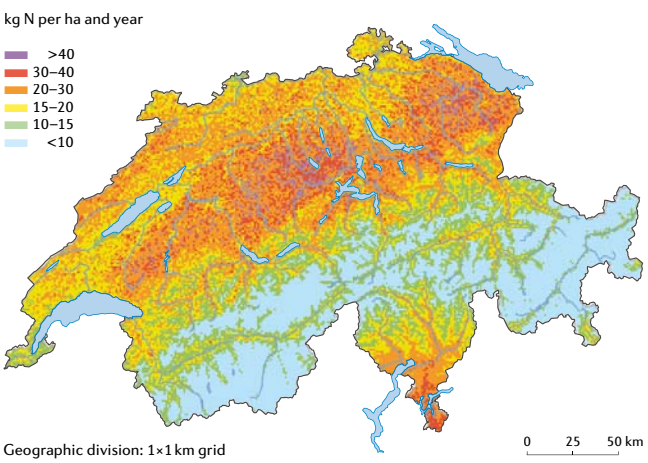
www.cerclair.ch (f g i)

Regional comparison: Nitrogen inputs

The critical loads for nitrogen inputs are 10 to 20 kg of nitrogen (N) per hectare (ha) and year for forests, 5 to 10 kg N per ha and year for raised bogs and 10 to 15 kg N per ha and year for species-rich Alpine meadows. These loads are exceeded markedly, particularly in the Central Plateau and Ticino.

M7.1 Nitrogen input from the atmosphere, 2007

Modelled nitrogen deposition (total input of oxidised and reduced N compounds).



Geographic division: 1×1 km grid

Sources: FOEN; Meteotest

Map: FSO, ThemaKart

IF M

[4] Konzept betreffend lufthygienische Massnahmen des Bundes, BBI 2009–1221, 6586–6616.

8. Climate change

The temperature in Switzerland has risen by an average of around 1.8 °C since 1970. It is very likely that a large part of this warming is attributable to human activities. Switzerland's greenhouse gas emissions remained almost constant between 1990 and 2009. Climate change has impacts on the water regime, flora and fauna, on agriculture and forestry, tourism and water management, and on the health of the population.

Context

Since the mid-20th century, a global warming of the atmosphere has been observed that cannot be explained by natural forcing factors (e.g. variations in sun activity) alone. The temperature in Switzerland has risen by around 1.8 °C on average since 1970 (» G12), with relatively small regional differences (» M8.1). 2000 to 2009 was the hottest decade ever recorded in Switzerland.

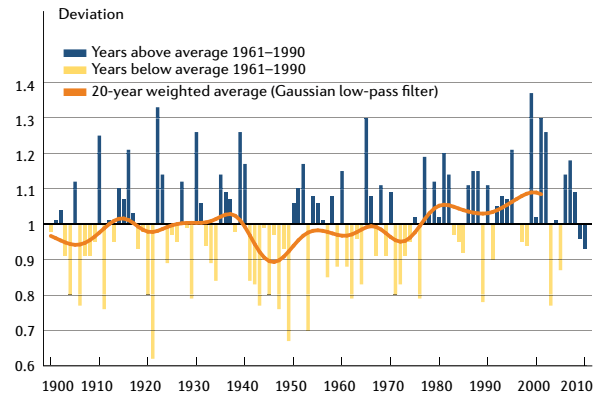
In contrast to the temperature development, it is not possible to identify any clear trend for Switzerland in the average precipitation volume (» G8.1) and maximum number of consecutive dry days (» G8.2).

The main cause of climate change is the intensification of the natural greenhouse effect due to human activities (» IPCC 2007), in particular the combustion of fossil energy carriers and the associated emissions of the greenhouse gas carbon dioxide (CO_2). Industrial processes, land-use changes, agriculture and livestock farming also contribute to a lesser extent to the increase in the levels of greenhouse gases like methane (CH_4), nitrous oxide (N_2O) and synthetic gases (e.g. hydrofluorocarbons [HFCs]) in the atmosphere.

Switzerland's total greenhouse gas emissions as defined by Kyoto Protocol have remained more or less constant since 1990 (» G8.3). In 2009, 51.8 million tonnes of CO_2-equivalants were emitted (excluding international aviation and shipping and emissions arising from land-use changes). CO_2 is responsible for around 85 % of greenhouse gas emissions in Switzerland and is followed by CH_4 at 7 %, N_2O at 6 % and the synthetic gases at approximately 2 %. Emissions of CO_2 were slightly lower in 2009 than in 1990 and those of synthetic gases markedly higher. In 2009, the CH_4 and N_2O emissions, which are mainly generated by agriculture, were 19 % and 11 % lower than the corresponding 1990 values.

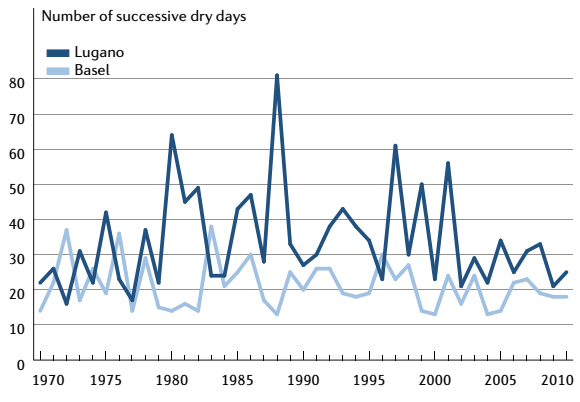
81 % of Switzerland's greenhouse gas emissions are caused by the combustion of fossil energy carriers. Of the total emissions, 32 % are generated by transport, 26 % by industry and waste management, 20 % by private households (in particular heating and excluding transport), 12 % by agriculture and forestry and 9 % by the services sector (in particular heating). Whereas, thanks to better heating and building services technology, heating fuel consump- »

G8.1 Mean annual precipitation in Switzerland
Deviation from the mean 1961–1990



Source: METEOSWISS IF FS

G8.2 Maximum number of successive dry days per year



Source: METEOSWISS IF FS

› tion shows an overall decline, consumption of motor fuel is increasing, mainly due to the rise in motorised transport (» Chapter 3). In recent years, the progression has been particularly marked for private households: their transport-related greenhouse gas emissions rose by 20 % between 1990 and 2005 (» FSO 2009a).

Impacts

Climate change affects various natural systems and socio-economic sectors. The consequences of the altered climatic conditions can be both positive and negative: Changes in precipitation and snow cover and the accelerated melting of the glaciers also influence the water flow regime of rivers: they must accommodate higher flow rates in winter and spring and lower flow rates in summer and autumn (» Chapter 9). Intensive precipitation and the associated flooding and landslides are likely to increase in the long term. The Alpine glaciers have been losing an average of 1 % of their volume annually since the mid-1970s. If this trend continues, a large part of the Alpine glacier area (around 75 %) is at risk of disappearing by the mid-21st century (» OCCC 2008).

Changes in climate influence the dispersion areas of species. For example, over a period of just five years, the dispersion of typical mountain flora in the Alps has shifted around 13 metres higher (» FOEN 2009e). Longer periods of heat and drought promote the spread of bark beetle in spruce forests and weaken the forest as a result. A shift in the habitat of trout has also been observed due to the change in temperature in Alpine watercourses (» Hari et al. 2006).

The change in climate conditions in the direction of higher temperatures and lower summer precipitation levels is associated with an increase in potential evapotranspiration (evaporation and transpiration). This can affect human health among other things (» Chapter 17). In agriculture, the volume of water needed by the crops is rising, which also causes an increase in the irrigation requirement. Calculations show that if the same level of agricultural cultivation is retained, the area requiring irrigation could increase to around 400,000 ha (» Fuhrer and Jasper 2009). This value greatly exceeds the currently irrigated area of around 50,000 ha. Hence, in future, the competition for water resources between aquatic organisms, households, electricity generation and agriculture is likely to intensify.

The rise in winter temperatures is also prompting an upward shift in the snow line. This undermines the snow guarantee of winter sport locations. True high-altitude skiing areas in the cantons of Valais and Graubünden will still be guaranteed snow even if the temperature rises by 4 °C. However, at lower altitudes, an increase of only 2 °C will put half of the skiing areas at risk (» OECD 2007; FIF 2007). This development would be associated with major economic losses for the affected winter sport regions (» Chapter 5). In contrast, the mountain regions are likely to experience greater use in the summer months by visitors seeking a retreat from hotter low-lying areas.

Measures

In order to reduce the influence of human activity on the climate system, emissions of greenhouse gases must be reduced. The initial reduction targets for the period 2008–2012 in industrialised countries are defined at global level in the Kyoto Protocol. The continuation of international climate protection to 2020 is negotiated in the context of the Conferences of the Parties to the United Nations Convention on Climate Change (» Box "Kyoto and post-Kyoto").

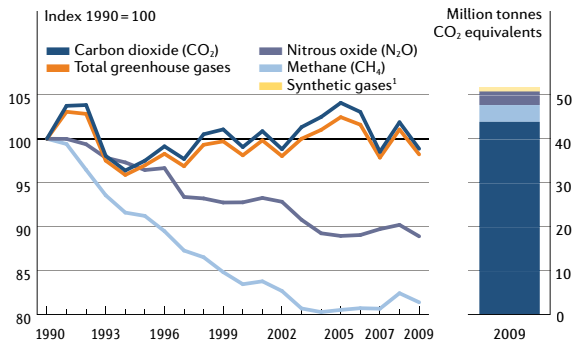
Additional climate policy measures are to be introduced by the end of 2012. They should extend the commitment beyond the first Kyoto period and help to attain the objectives by 2020 (» Federal Council 2009c).

The federal authorities and cantons launched a new buildings programme in early 2010 which replaced that carried out by the Climate Cent Foundation. Under the new programme, a maximum of CHF 200 million per year of the income from the CO_2 tax on heating fuel is being made available for the implementation of CO_2-reduction measures in buildings. A further CHF 80–100 million is to be added to this sum annually by the cantons. The aim is to reduce the annual CO_2 emissions from buildings by approximately 2.2 million tonnes by the end of 2020 (» Chapter 2; Box "Buildings programme").

In addition to the reduction of greenhouse gases, the Swiss government also places a high priority on adaptation to climate change and aims to develop a national adaptation strategy by the end of 2011. Based on climatological data and the analysis of the effects of climate change and the associated risks and opportunities, strategic adaptation targets and sectoral strategies are being developed. The main objective of the strategy is to coordinate adaptation to climate change throughout Switzerland, avoid duplication, exploit synergies and optimise the use of the available resources.

The existing CO_2 Act[1] is only in force until the end of 2012 and must be replaced by a completely revised legis-

G8.3 Switzerland's greenhouse gas emissions
In accordance with the Kyoto Protocol (excluding international aviation and shipping, and land-use changes)



[1] For reasons of presentation, the synthetic greenhouse gas emissions are not depicted as a separate index curve. These increased by 340 % between 1990 and 2009.

Source: FOEN

[1] Federal Act of 8 October 1999 on the reduction of CO_2 emissions (CO_2-Gesetz), SR 641.71.

lative basis. The draft of this new legislation is currently being debated in parliament and is expected to be passed in summer 2011. The targets and measures for Swiss climate policy up to 2020 will be enshrined in this legislation (» Federal Council 2009c). •

Internet links

www.bafu.admin.ch/state-climate

www.meteoswiss.admin.ch » Climate

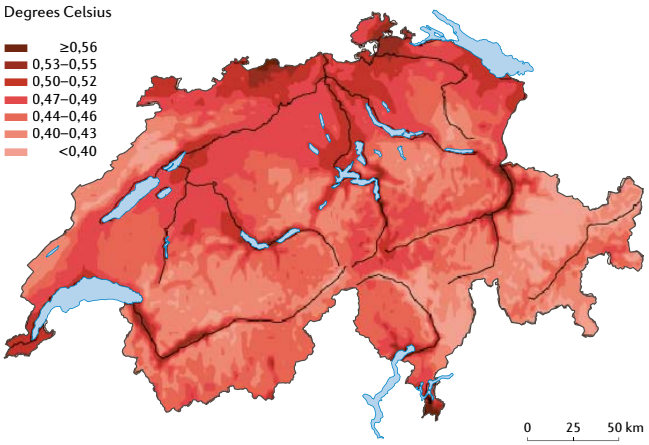
www.proclim.ch

www.statistik.admin.ch » Themen » Raum, Umwelt » Umweltgesamtrechnung (f g)

Regional comparison: trend in mean annual temperatures

Depending on the region, mean annual temperatures increased between 0.4 °C and 0.55 °C per decade in the years 1970 to 2009.

M8.1 Trend in mean annual temperatures, 1970–2009



Source: METEOSWISS Map: FSO, ThemaKart IF M

Kyoto and post-Kyoto

The United Nations Framework Convention on Climate Change (UNFCCC) was signed in 1992. Since then, the parties to the Convention, which number 194 to date, meet annually at the Conference of Parties (COP) to monitor the implementation of the Convention in the participating states. The Kyoto Protocol was passed in 1997 and ratified by Switzerland in 2003. As a result, our country undertook to reduce its average annual greenhouse gas emissions by at least 8 % compared with 1990 levels in the period 2008 to 2012.

The international community is currently negotiating a follow-up regime for the Kyoto Protocol, which is only valid until 2012. At the international climate conference held in Cancún in late 2010, the parties to the Convention acknowledged in the Cancún Agreement that a dangerous anthropogenic disturbance of the climate system can only be prevented if the long-term warming of the earth is limited to less than 2 °C globally (two degree goal). Moreover, the parties are aware that comprehensive adaptation programmes must be developed with international support for states that are particularly badly affected by the impacts of climate change. However, the parties have not yet succeeded in reaching a binding agreement on the reduction of greenhouse gas emissions.

9. Waters

The quality of the water in Swiss lakes and rivers improved in recent decades. Today, water protection policy is increasingly focused on pollutant substances like plant protection products and pharmaceutical products. Structural and spatial deficits and changes in flow regimes impair the natural functioning of watercourses as species-rich habitats: around 10,800 km of Swiss rivers are in need of remediation.

Surface waters

Watercourses and lakes shape and structure landscapes, transport water and bed load, connect valuable ecosystems and, hence, form habitats for numerous plant and animal species. In addition to the quality of surface waters, their structure, the space available to them, the water flow regime and the temperature also play an important role.

The quality of the water in Swiss lakes and rivers improved markedly in recent decades. Excessive nutrient concentrations are only detected in a few lakes in the Central Plateau (» G15). The input of organic trace substances through discharge from urban drainage, agriculture and other sources represents the future challenge in the area of water protection (» Box "Micropollutants").

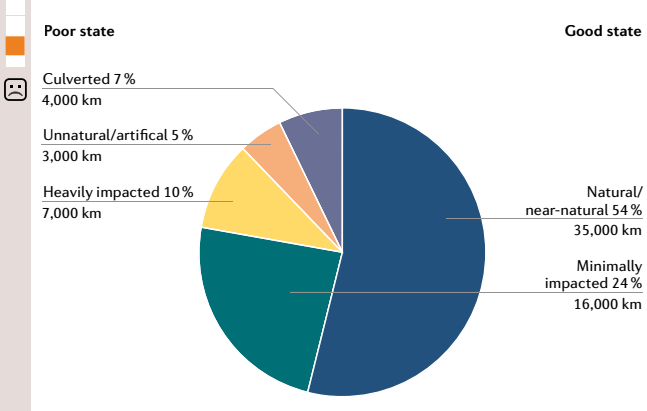
The term ecomorphology describes the quality of a river or stream bed, its banks and surroundings, the interconnectivity of a watercourse and the extent to which it is influenced by human activity. Ecomorphology is a key factor for many characteristics and processes associated with river ecosystems. The availability of adequate space for watercourses is of crucial importance. For centuries, watercourses have been corrected, channelised and culverted. The space allocated to watercourses has been reduced to a single channel in many places. Up to now, 14,000 km or 22 % of the Swiss surface water network (scale 1:25 000) have been altered appreciably through structural intervention (» G9.1), and 100,000 artificial obstacles with a drop in excess of 0.5 m have been built. Approximately 10,800 kilometres of rivers and streams in Switzerland are in need of remediation (» FOEN 2009f).

Engineered watercourses lack the microhabitats (e.g. gravel banks, alternating patterns of deep and shallow water, periodically flooded areas) that are crucial to the survival of aquatic animal species. Artificial obstacles create migration barriers for fish and other aquatic animals. Structural interventions also influence the bed load regime.

In the early 1990s, numerous rivers and streams downstream of water abstraction points for hydropower generation regularly ran dry. As part of the revision of the Waters Protection Act[1] in 1992, adequate residual volumes were decreed for over 200 watercourses. The need for remediation must be investigated in stretches of residual water that have not yet been dealt with. The deadline for the completion of these remediation measures is 2012.

[1] Federal Act of 24 January 1991 on the Protection of Waters (Gewässerschutzgesetz, GSchG), SR 814.20.

G9.1 Ecomorphological state of watercourses, 2006



Source: FOEN

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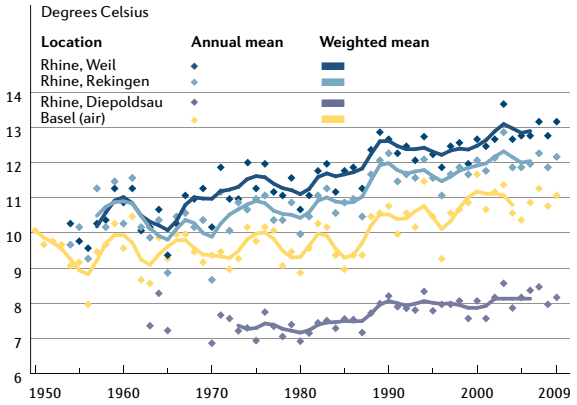
G9.2 Water temperature in the Rhine

Comparison with the air temperature in Basel



Sources: FOEN; METEOSWISS

IF R

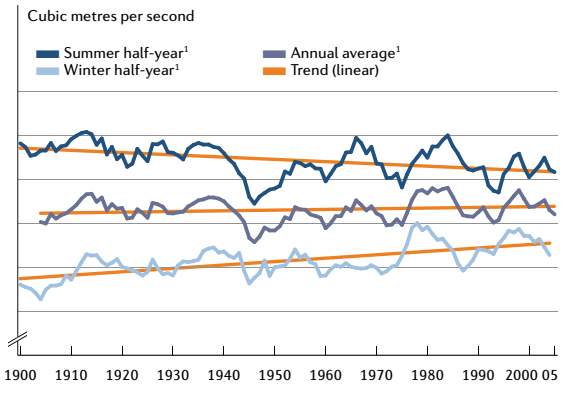
During peak energy production, storage hydropower plants generate fluctuations in downstream watercourses (hydropeaking). As a result, the water level, the flow rate and the river width are subject to very sudden changes, similar to an artificial flood. The strongly fluctuating flow harms the aquatic fauna and destroys their habitats: when the water surges, they are swept away and during low flow, they risk being stranded on banks. Alpine rivers downstream of storage hydropower plants are particularly affected by hydropeaking.

As a result of the entry into force of the cost-covering remuneration for feed-in to the electricity grid (CRF) for the promotion of renewable energies in early 2009, some 500 new small hydropower plants are currently being constructed or planned (» Chapter 2; Box "Cost-covering remuneration for feed-in to the electricity grid (CRF)"). This will increase the pressure on watercourses: according to estimations, 20 % of the projects registered are located on watercourses in protected areas or areas of high natural and landscape value, some of which are of national importance (» FOEN 2009h).

Water temperature is one of the most important regulators of life processes in all water bodies (» SAEFL/BWG/METEOSWISS 2004). The temperature of the Rhine near Basel has increased by over 2°C in the past 50 years (» G9.2). Climate change and discharges of heated water, e.g. from cooling plants and sewage treatment plants, contribute to this development. Similar temperature increases can also be observed in other watercourses on the Central Plateau (» Jakob et al. 2010). Aquatic organisms react sensitively to this general increase in temperature: water temperatures in excess of 18°C to 20°C can trigger stress symptoms in trout, whitefish and grayling. Temperatures in excess of 25°C can be fatal.

In contrast to the temperature, the average discharge of the Rhine has varied less markedly over the past 100 years (» G9.3). However, average discharge tends to increase in winter and decline in summer. The latter can lead to higher water temperatures, higher pollutant concentrations and oxygen depletion.

G9.3 Average Rhine runoff
Basel station, Rheinhalle



¹ 9-year moving average.

Source: FOEN

IF R

Groundwater

Groundwater is an important domestic resource. More than 80% of Swiss drinking water is obtained from it. Groundwater is also a central element of the natural water cycle. It provides the baseflow for many watercourses and supplies valuable habitats like mires and wetlands. According to hydrological estimates, around 50 billion m^3 of groundwater are stored in the Swiss aquifers. The total annual volume of groundwater produced in Switzerland has an estimated monetary value of almost CHF 2 billion (» FOEN 2008).

As demonstrated by the findings of the National Groundwater Monitoring (NAQUA), the quality of Swiss groundwater is generally good to very good. In urban and intensively farmed areas, it often contains excessive concentrations of nitrate and other undesired substances, such as plant protection products and volatile organic compounds (VOCs).

In nature, nitrate is generally only present at very low levels in groundwater. In 2009, nitrate concentrations above 25 mg/l were detected in 17 % of the monitoring stations throughout Switzerland. In areas used predominantly for arable farming, they exceeded this value in 47 % of the stations (» FOEN 2009g) (» G14). Plant protection products were detected in 52 % of the monitoring stations countrywide, with at least one substance exceeding the limit of 0.1 µg/l required by the Waters Protection Ordinance[2] (» G14) in 9 % of the stations. In arable farming areas the required limit was not complied with in 20 % of the stations. Traces of VOCs were detected in 33 % of the stations, with the concentrations of these substances exceeding 1 µg/l in about 5 % of the stations countrywide and in about 19 % of them in settlement areas.

Measures

Switzerland has a good legislative basis for the protection of suface and ground waters in the Waters Protection Act and the associated ordinance. The water protection legislation contains provisions on water quality, water flow regimes, the structure and provision of adequate space for surface waters.

Changes to the Waters Protection Act, Hydraulic Engineering Act, Energy Act and Act on Agricultural Land Rights entered into force in early 2011. With the remediation of watercourses their natural functions are to be restored and the benefits they provide to the society enhanced. At the same time the major negative impacts of hydropower generation on the environment (surge and flow, reduced connectivity and impaired bed load regimes) are to be mitigated.

Recommendations in relation to the prioritisation of small hydropower station projects are currently being de- »

[2] Waters Protection Ordinance of 28 October 1998 (Gewässerschutzverordnung, GSchV), SR 814.201.

› veloped to assist the cantons in the implementation of the cost-covering remuneration for feed-in to the electricity grid (CRF) (» FOEN/SFOE/ARE 2011).

In recent years, a situation analysis was carried out on micropollutants in surface waters. The revision of the water protection legislation is currently being discussed on the basis of the findings of this research. The efficiency of sewage treatment plants (STPs) could be doubled by upgrading them through the addition of an extra treatment stage (e.g. ozonation, use of powdered active carbon), and the input of micropollutants into surface waters and, hence also, into the ground water, could be reduced considerably. This measure would involve around 100 of the total of 700 STPs in Switzerland.

The document Guiding Principles for Watershed Management (» WA21 2011), which was published in early 2011, provide a comprehensive account of the principles of watershed management. This approach to integrated water management in Switzerland enables efficient and targeted water management through regional coordination, the transparent balancing of interests and clear priority-setting, which takes both water protection and use requirements into account. •

Internet links

www.bafu.admin.ch/state-water

www.svgw.ch (f i g)

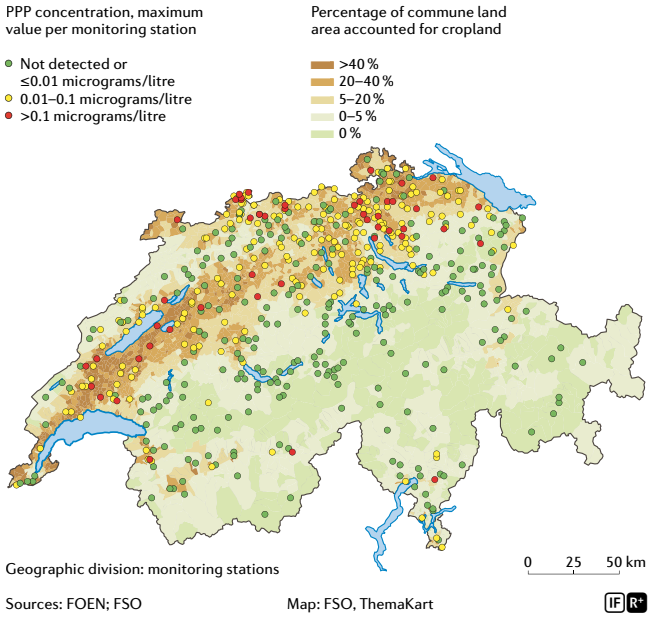
Micropollutants

Substances that enter water bodies as a result of human activity – for example from urban drainage, agriculture, transport routes and sealed areas – and are detected there in concentrations, ranging from a few nanograms to micrograms per litre, are referred to as micropollutants. These are residues from innumerable everyday products, for example plant protection products, material protection products and components of body care products, pharmaceutical products, and cleaning products. Some of these substances have negative effects on aquatic ecosystems, even in very small concentrations. For example, endocrine disruptors can interfere with the hormonal systems of aquatic organisms and impair their fertility.

Regional comparison: groundwater contamination

Groundwater contamination with plant protection products (PPP) varies from region to region. Areas with intensive arable farming and settlements are most severely affected.

M9.1 Concentrations of plant protection products in the groundwater, 2009



Sources: FOEN; FSO Map: FSO, ThemaKart

10. Soils

Soils fulfil a variety of functions. Healthy soils are the basis for human, animal and plant nutrition. Soils filter and store water and provide habitats. However, settlement and transport infrastructure areas are constantly expanding. Between 1985 and 1997, 11 ha of productive agricultural land were lost every day. This rate of loss has since declined by around one quarter. Some of Switzerland's soils also suffer from compaction or marked chemical contamination.

Context

Soil is an important life-sustaining and non-renewable natural resource. Soil has different functions: it produces biomass and provides sustenance for humans, animals and plants. It filters and stores water and breaks down pollutants. It forms the basis of species diversity and is an important carbon sink.

According to Swiss land-use statistics, between 1985 and 1997, 11 ha of productive agricultural land were lost every day (» FSO 2001), however the rate of loss has declined by around one quarter since 1997 (» FSO 2010d). Around two thirds of these 11 ha were used to create new settlements and infrastructure. The areas that remain available for agricultural use in the Central Plateau and Alpine valleys are shrinking. A continuing decline in arable land can be observed in particular. According to the intermediate findings of the land-use statistics survey, a good half of the arable land that has disappeared over the past 24 years has now become meadowland, pastureland, orchard and horticulture area. The rest became industrial, commercial and building area, transport and special urban areas, and recreational and green spaces (» FSO 2009b; 2010d; G 10.1).

Soil compaction is another problem. This phenomenon is caused by agricultural and forestry activities using heavy machinery, for example. Agricultural soil is also at risk from water erosion, in particular on slopes with sparse plant cover. Piste levelling and artificial snow covering also exert pressure on Alpine soils.

Finally, chemical contamination also poses a problem for soil (» Chapter 4). There is no completely uncontaminated soil left in Switzerland. The most contaminated soil is found in settlement areas, i.e. gardens, parks and green spaces.

Impacts

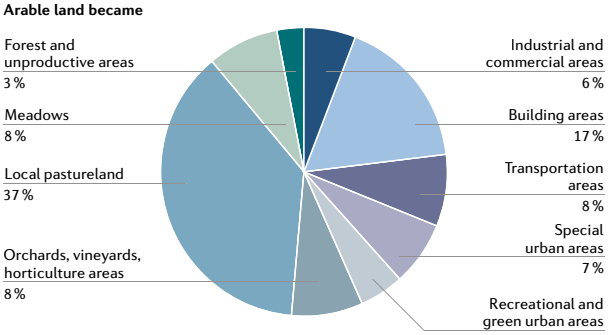
The construction of settlements and transport infrastructure involves the sealing of the soil, which causes it to lose a large proportion of its natural ecological functions (» Chapter 11). Compaction destroys the pores in the soil and its crumb structure. This causes a deterioration in the exchange of gases, the availability of plant nutrients, water storage and water transport. Rain water permeates far more slowly, remains on the surface or runs off more quickly and this increases the risk of erosion. It becomes more difficult for plant roots to penetrate to the subsoil and absorb the nutrients they need.

Contamination with chemicals threatens the soil's fertility, impairs plant growth and can cause damage to human and animal health. In addition, millions of soil organisms are affected by the changes in their habitat. They play a key role in the decomposition of organic material. A change in their living conditions affects the biochemical cycles. The relationships between the different organisms are extremely complex and the consequences of the changes are difficult to estimate. In contrast to the air or water, soil often needs centuries to recover from such impacts.

Measures

If possible, damage to the soil should be avoided. The soil must be given particular protection in places at risk from major impacts, for example building sites, forests, cropland, gardens and green spaces (» FOEN 2006b). »

G10.1 Disappearance of arable land over 24 years (1979/85–2004/09)
63.1 % of total area (West, Central and North Switzerland)



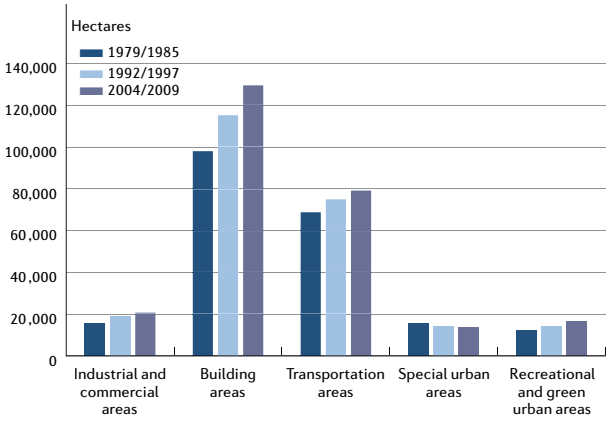
Source: FSO, Land-use statistics

SI FS

Sprawl is slowing down

The third land-use statistics survey of Switzerland is currently in progress. This provides, for the first time, robust data on the change in land use over two periods of 12 years. The analysis for West, Central and North Switzerland, up to and including the canton of Thurgau, has been completed. Hence, the data for 63 % of Switzerland are available. These indicate that settlement area increased by 49,174 ha (23.3 %) over a period of 24 years; this is almost equivalent to the area of Lake Constance (54,120 ha). While settlement growth was 12.8 % from 1983 to 1995, it was only 9.3 % from 1995 to 2007. Settlement area mainly increased at the expense of agricultural land and high quality soil, which declined by 55,105 ha (4.8 %) over the entire period (» FSO 2010d; G10.2).

G10.2 Development of settlement areas over 24 years
For 63.1 % of total area (West, Central and North Switzerland)



Source: FSO, Land-use statistics

The Swiss Environmental Protection Act[1] and the Swiss Ordinance on the Pollution of Soil[2] provide the legislative basis for the protection of soil in Switzerland. The Ordinance stipulates that, during cultivation or construction activities, the soil must be treated in a way that does not cause any lasting damage. Consequently, the federal government and cantons have developed a series of instruments and precautionary measures in cooperation with the construction, agriculture and forestry sectors. These include, for example, the training of consultants who advise the developers of major construction projects on matters relating to the soil, and the increased use of new soil-friendly cultivation methods, for example direct planting in no-till farming.

The precautionary principle is also a priority in the area of chemical soil protection. The implementation of a wide range of measures over the past 20 years (e.g. the ban on leaded petrol, the limitation of the cadmium content of fertilisers and copper content of plant protection products etc.) has already resulted in a noticeable reduction in contaminant inputs, particularly in the case of inorganic substances.

Various ordinances restrict the input of contaminants to an acceptable level. The legally prescribed measures and restrictions are complemented by the voluntary actions of countless individuals. These include, for example, amateur gardeners who avoid using plant protection products (pesticides and herbicides) and use fertilisers sparingly. It is a declared aim of the federal government to increase the population's awareness of the needs of soil protection.

In the context of spatial planning, the cantons are obliged to protect crop rotation areas and to conserve defined minimum areas. •

Internet links

www.bafu.admin.ch/state-soils

www.statistik.admin.ch » Themen » Raum, Umwelt » Bodennutzung, -bedeckung (f g)

www.soil.ch

[1] Federal Act of 7 October 1983 on the Protection of the Environment (Umweltschutzgesetz, USG), SR 814.01.
[2] Ordinance of 1 July 1998 on the Pollution of Soil (Verordnung über Belastungen des Bodens, VBBo), SR 814.12.

11. Landscape

The diversity of the landscape has declined in recent decades and urban sprawl continues: approximately 21 km² of new developed area is created each year. In addition to the protected areas of national importance, parks also play an important role in sustainable landscape development. The Swiss government supports the conservation of existing landscape values and the creation of new ones.

Context

The landscape reflects societal and economic development. For centuries, people have created different kinds of landscapes. Such diverse natural and cultural landscapes with their characteristic regional features and beauty play a very important role in biodiversity, identity, human health and recreation, and tourism. As location factors, they also contribute to the attractiveness of residential and economic areas.

In addition to society's lifestyles and consumption habits, the increase in the population has had a major influence on the development of the landscape in recent decades (» Chapter 5).

Agriculture remains the dominant form of land use in Switzerland. Cropland accounts for 37 % of the country's territory, forest for 31 %, and settlements and infrastructure for around 7 % (» FSO 2001). The area used for settlements and infrastructure is increasing – by approximately 27 km² annually in the 1980s and 1990s – and has led to an increase of urban sprawl as a result (» G20). The latest data from West Switzerland also show that the trend for urban sprawl continues, although it has decelerated somewhat (» FSO 2009b; 2010f).

In many regions of Switzerland there are very few unfragmented areas that are not built on and can thus be defined as "infrastructure-free" (» G11.2). This term is used for areas that have no built infrastructure on a 500 × 500 m surface (» FOEN 2010c).

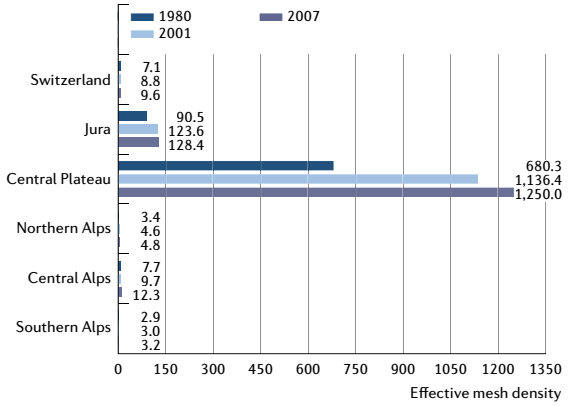
Soil sealing also poses a problem for the landscape. If the number of settlements and transport infrastructure rises, the area of soil that is sealed also expands. Soil sealing is currently increasing at a rate of approximately 1 % per year (» FSO 2009b). Sealed areas are defined as areas that do not allow water to filter through, i.e. levelled, asphalted and concrete-covered surfaces and the land on which buildings stand.

Impacts

Only a small part of the Swiss landscape can be termed natural, that is not directly influenced by humans. There is practically no corner of the landscape where human intervention has not left a mark through agricultural and »

G11.1 Landscape fragmentation

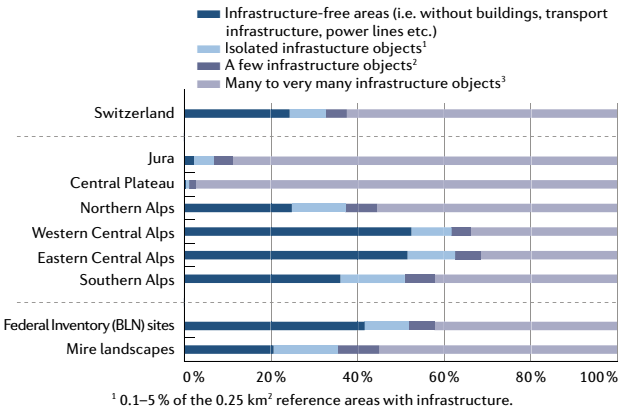
Taking into account roads up to 4th class



The higher the effective mesh density (number of meshes per 1,000 square kilometres), the more fragmented the landscape.

Source: FOEN, LABES

G11.2 Percentage of infrastructure-free areas, 2009



¹ 0.1–5 % of the 0.25 km² reference areas with infrastructure.
² 5.1–10 % of the 0.25 km² reference areas with infrastructure.
³ Over 10 % of the 0.25 km² reference areas with infrastructure.

Source: FOEN, LABES

› forestry, surface mining and the construction of infrastructure, e.g. transport systems, power lines, buildings etc.

Extensive construction activity and the increasing mechanisation of agriculture have resulted in the homogenisation of the landscape which has been cleared and ordered in many locations. As a result, many typical local and regional features have disappeared (» Ewald and Klaus 2009). Apart from the ever-increasing building density, the nature of agricultural use and the way in which the banks of water bodies and watercourses are developed have a direct influence on the quality of the landscape (» Chapter 9).

The continued urban sprawl and soil sealing also have negative impacts on flora and fauna, such as fragmentation of habitats (» Chapter 12). They also lead to the loss of valuable agricultural soil, open spaces and local recreational areas. Whether in the context of landscape as an economic and location factor, the regeneration capacity of natural resources, the provision of local recreational areas or landscape as a source of identity, all of these developments have impacts on the services provided to humans by the landscape.

Measures

The federal authorities act as a role model in the management of the landscape throughout Switzerland. In accordance with the Swiss Nature and Cultural Heritage Protection Act (NCHA)[1] and the Swiss Landscape Concept (SLC) strategy, they are obliged to protect the landscape (including everyday landscapes and settlement landscapes) in the pursuit of their spatially-related activities (» SAEFL/BRP 1998). Building projects are only authorised, subsidised and implemented if such measures are in the public interest. It is a precondition of their authorisation that they blend as well as possible with the landscape. If their construction results in the impairment of habitats that are worthy of protection, the latter must be re-established or replaced. In recent years the environmental monitoring of construction projects has become an important instrument for ensuring the appropriate and legally compliant implementation of environmental measures during major construction projects.

As near-natural elements of the landscape, the ecological compensation areas in agriculture play an important role in both biodiversity and the appearance of the landscape. These areas increased by 70 % to around 120,000 ha since 1992. Examples of such landscape-relevant ecological compensation areas include hedges, extensively used meadows, pastures and dispersed areas and standard fruit tree orchards. Today, the ecological compensation areas account for around 11 % of agriculturally used land. The measures planned under the further development of the direct payments system include landscape quality contributions (» Chapter 6). Improvements in the quality of the landscape in the vicinity of watercourses have also been achieved in recent years: while 120 km of watercourses were culverted annually between 1989 and 2003, around 150 km were deculverted (» SAEFL/FOWG/FOAG/ARE 2003) (» Chapter 9).

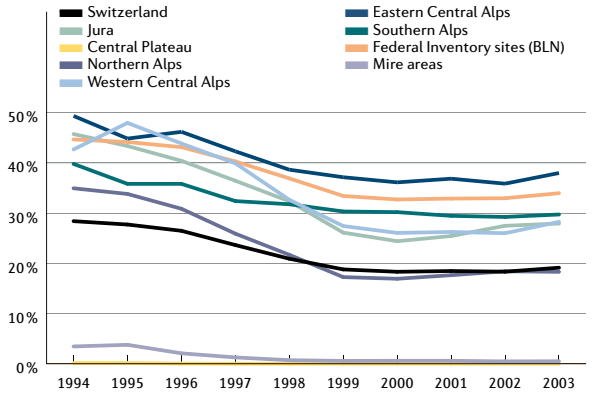
[1] Federal Act of 1 July 1966 on the Protection of Nature and Cultural Heritage (Natur- und Heimatschutzgesetz, NHG), SR 451.

Light emissions

The rhythm of our lives and that of plants and animals is based on the constant alternation of day and night. Artificial light only became an issue with the invention of the light bulb around 150 years ago. The consequences of the developments triggered by this invention are considerable: in the Swiss Central Plateau, instead of nearly 2,000 stars only about a dozen are now visible with the naked eye. Every night millions of insects are burned, fatally attracted by artificial light sources, and migratory birds lose their bearings when flying over well-lit settlement areas. In addition, incorrectly installed or excessively bright street lamps interfere with the sleep patterns of many people.

The Swiss government is working to ensure that artificial light is only used where it is actually required. The aim here is to guarantee not only that landscapes and the living organisms that populate them are protected from excessive light emissions but also that energy and resources are conserved (» SAEFL 2005b).

G11.3 Areas with nocturnal darkness



Source: FOEN, LABES

The Federal Council's mandate for the upgrading of the sites listed in the Federal Inventory of Landscapes and Natural Monuments of National Importance (BLN) aims to ensure the even more effective protection of the relevant landscapes. The BLN lists 162 sites which together cover 19 % of the area of Switzerland. The majority are near-natural cultural landscapes. The upgrading project should be completed by the end of 2011. The Mire Landscapes of National Importance account for a total of 2.2 % of the country. They are subject to comprehensive legal protection (Mire Landscapes Ordinance)[2].

The new parks of national importance play an important role in the sustainable development of landscapes (Parks Ordinance)[3]. These help in the upgrading of landscapes of outstanding beauty. There are three categories of parks of national importance in Switzerland: national parks, which enable the conservation of large-scale natural habitats; regional nature parks, which enable the sustainable use of local resources; and, finally, nature discovery parks, which provide recreational zones near large towns and cities. Up to mid-2010, one nature discovery park (Wildnispark Zürich-Sihlwald) and two regional nature parks (Unesco Biosphäre Entlebuch, Regionaler Naturpark Thal) were assigned the park label, 14 parks have been included in the candidate list and two new park applications are being assessed. Switzerland has other landscapes of global importance, including the following natural landscapes, which are included in the UNESCO list of World Heritage Sites: Swiss Alps Jungfrau-Aletsch (Bern/Valais), Monte San Giorgio (Ticino) and the Swiss Tectonic Arena Sardona (Glarus/Graubünden/St. Gallen). The Lavaux Vineyard Terraces (Vaud) and the Rhaetian Railway in the Albula/Bernina Landscapes (Graubünden) feature among the cultural landscapes on the UNESCO list of World Heritage Sites and the mire-rich pre-Alpine landscape of Entlebuch (Lucerne) and the Swiss National Park (Graubünden) have also been recognised as UNESCO Biosphere Reserves. •

Internet links:

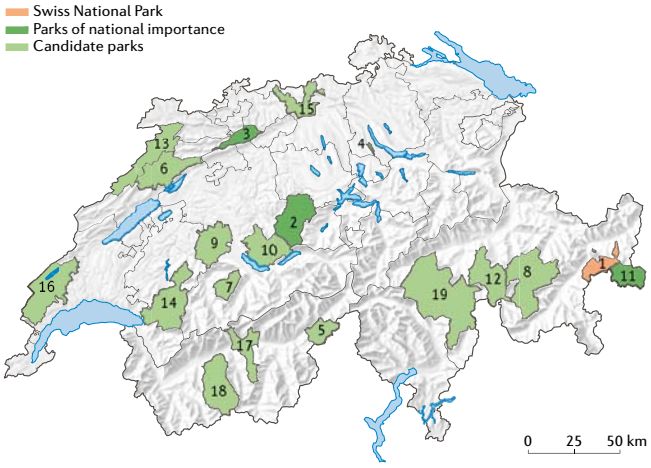
www.bafu.admin.ch/state-landscape

www.statistik.admin.ch » Themen » Raum, Umwelt » Bodennutzung, -bedeckung (f g)

Regional comparison: parks of national importance

Parks of national importance have been created or are planned in many parts of Switzerland. The map provides an overview of the current status of these projects.

M11.1 Parks of national importance, 2010



1 Swiss National Park
2 UNESCO Biosphäre Entlebuch
3 Regionaler Naturpark Thal
4 Naturerlebnispark Wildnispark Zürich-Sihlwald
5 Regionaler Naturpark Landschaftspark Binntal
6 Parc naturel régional Chasseral
7 Regionaler Naturpark Diemtigtal
8 Regionaler Naturpark Parc Ela
9 Regionaler Naturpark Gantrisch
10 Regionaler Naturpark Thunersee-Hohgant
11 Regionaler Naturpark Biosfera Val Müstair
12 Regionaler Naturpark Beverin
13 Parc naturel régional du Doubs
14 Parc naturel régional Gruyère Pays-d'Enhaut
15 Regionaler Naturpark Jurapark Aargau
16 Parc naturel régional Jura vaudois
17 Regionaler Naturpark Pfyn-Finges
18 Parc naturel régional Val d'Hérens
19 Parco Nazionale Adula

Source: FOEN Map: FSO, ThemaKart IF FS

[2] Ordinance of 1 May 1996 on the Protection of Mire Landscapes of Outstanding Beauty and National Importance (Moorlandschaftsverordnung), SR 451.35.

[3] Ordinance of 7 November 2007 on Parks of National Importance (Pärkeverordnung, PäV), SR 451.36.

12. Biodiversity

Biodiversity in Switzerland is under pressure. Over one third of the evaluated species are endangered. Over the past century, in particular, the area covered by habitats of high ecological value has declined considerably. Although some success has been achieved in stemming this loss, the fragmentation of habitats and degradation of ecosystems continues. Switzerland's National Biodiversity Strategy, on which work began in 2009, aims to ensure the conservation of species diversity and the ecosystem services provided by this diversity.

Context

Biodiversity encompasses three dimensions: ecosystem diversity (meadows, mires, forests etc.), species diversity (flora, fauna, fungi etc.) and genetic diversity (subspecies, forms, ecotypes, varieties and breeds).

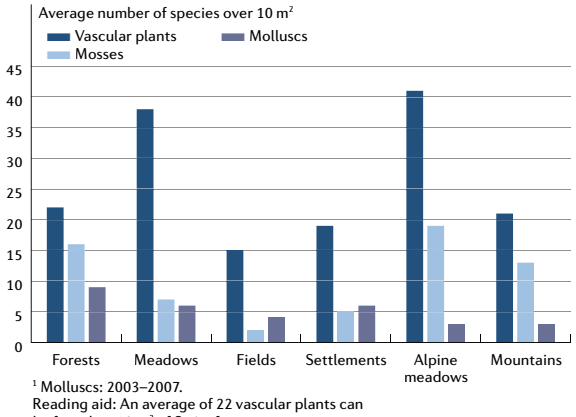
Increasing urbanisation, the development of transport infrastructure and intensive agriculture exert strong pressure on ecosystems. Between 1900 and 1990, a number of ecosystems, such as alluvial zones (floodplains), mires and dry meadows, experienced a marked decline (» Box "Habitat development"). However, this loss has slowed down since 1990 and the situation of some habitats has stabilised (» Lachat et al. 2010). Forest ecosystems are expanding, albeit at the cost of abandoned agricultural areas in the Alps and bush vegetation (» Chapter 13). The ecosystems also play an important role in landscape diversity (» Chapter 11).

There are around 40,000 known species of flora, fauna and fungi in Switzerland. Around one quarter (13,500 species) have been evaluated and inventoried, 3,700 are included in the Red Lists of endangered species, and 236 have been classified as disappeared or extinct (» G23). The number of wild animals recorded by the Swiss Biodiversity Monitoring Programme (BDM)[1] has increased slightly since 1900 (» FOEN 2009i). The native Swiss species have been joined by other species whose ranges expanded naturally or which have been unintentionally introduced. The greatest variety of vascular plant species is found in meadows and pastures, particularly at high altitudes (» G12.1). In contrast, although their natural potential is considerably greater, meadows in lower-lying areas display a relatively low level of species diversity due to intensive agriculture. Large numbers of vascular plant species can also be found in some open areas in settlement zones. According to the BDM, the average number of plant species in meadows and pastures, Alpine meadows, mountain regions and forests has increased over the past four to five years. Similar trends can also be observed for the other species groups such as mosses and molluscs. In the case of plants, this development has mainly benefited the meadow and pasture species, which are found at the mountainous and sub-Alpine level and in Alpine pastures. These include several widespread species which are typical of nutrient-rich meadows and pastures. The species communities are becoming more and more similar as a result.

Flora, fauna, fungi and lichens in Switzerland are increasingly confronted with alien, or exotic, organisms. The latter are organisms introduced intentionally or unintentionally to areas beyond their natural ranges by humans. Invasive alien species proliferate in their new habitats at the cost of the native species by transmitting diseases or attaining high population densities. Examples of such species include the signal crayfish, the harlequin ladybird and the Japanese knotweed. Certain invasive species, for example common ragweed, can also pose a threat to human health.

Up to now little research has been done on the genetic diversity of species living in the wild. It has been established, however, that this diversity correlates positively with ecosystem diversity. It is generally assumed that this diversification of the genetic heritage enables organisms to adapt

G12.1 Numbers of species in different habitats, survey period 2004–2008[1]



[1] Molluscs: 2003–2007.
Reading aid: An average of 22 vascular plants can be found on 10 m² of Swiss forest.

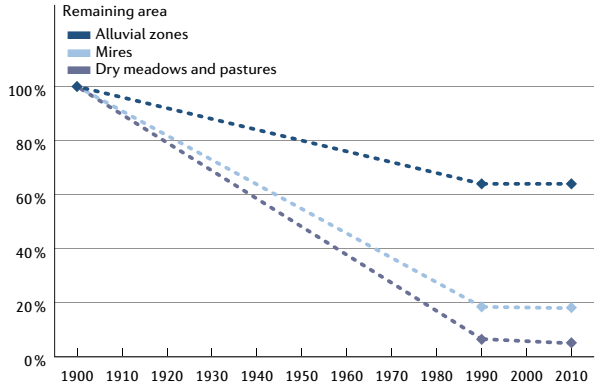
Source: FOEN

[1] www.biodiversitymonitoring.ch

Habitat loss

Two hundred years ago, mires, dry meadows and dry pastures were still very common throughout Switzerland. These three habitat types contain very specific animal and plant species. Their loss would also mean the disappearance of the species that populate them. The pressure on these habitats has increased considerably since 1850. Alluvial zones were lost to watercourse correction and mires were used for peat cutting or were drained to obtain agricultural land. Finally, dry meadows and pastures were overfertilised due to increasingly intensive agriculture or they became overgrown with bushes and trees (» G12.2).

G12.2 Habitats: alluvial zones, mires, dry meadows and pastures



Source: Lachat et al. 2010

E

better to altered environmental conditions and the spread of diseases and parasites. In contrast, more is known about the genetic diversity of cultivated plants. Most agricultural production in Switzerland involves a restricted range of animal breeds and crop varieties, while, in effect, the total number of existing breeds and crop varieties is far larger.

Impacts

Biodiversity makes an important contribution to both the quality of life and economic activity. On an everyday level, this becomes evident in the many services provided by ecosystems. These ecosystem services can be divided into four categories (» MEA 2005):

Provisioning services: ecosystems and their species are production factors for numerous goods such as drinking water, food, energy sources and plant-based clothing fibres. Genetic resources provide the basis for the development of new crop plants, drugs and industrial raw materials.

Regulatory services: the natural species communities in ecosystems provide protection against avalanches and floods, prevent erosion, pollinate crops, store CO_2, and regulate the climate.

Cultural services: ecosystems and their species contribute to landscape diversity. They provide recreational areas for humans and also meet their need for aesthetic beauty.

Supporting services: ecosystems provide services that are not availed of directly by humans but which are, nonetheless, indispensable, for example oxygen production, soil formation and the maintenance of the nutrient and water cycles.

These ecosystem services go largely unnoticed and their economic value is underrated. One study estimates the total economic value of 17 ecosystem services at between USD 16,000 and 54,000 billion per year (» Costanza et al. 1997). The wide range of this estimate reflects the difficulties still involved in making such evaluations.

Measures

The most important measures that ensure the conservation and promotion of biodiversity are contained in a number of instruments of international law, i.e. the Convention on Biodiversity (CBD)[2] and several Swiss legislative acts.[3] These measures aim to conserve the diversity of ecosystems and their services and to guarantee the protection of rare and threatened species.

The Swiss inventories of the biotopes of national importance (alluvial zones, mires, amphibian spawning sites, mire landscapes, and dry meadows and pastures) constitute a cornerstone of the national biodiversity policy (» FOEN 2007). Other natural habitats, such as game reserves, aquatic and migratory bird reserves, the Emerald Network Sites and the forest reserves, also enjoy special protection status. At the end of 2009, the federal authorities proposed 37 sites in Switzerland to the European Council for inclusion in the European Emerald Network. The National Ecological Network project (Réseau écologique national, REN) aims to connect populations and habitats. The designation of stretches of watercourses that are of national importance for the protection of fish species highlights areas in which a special effort is needed to conserve or re-establish aquatic habitats and the associated fauna. The dry meadows and pastures, most of which are the product of extensive farming, also play a central role in the conservation and promotion of species diversity (» SAEFL 2001). »

[2] Convention on Biological Diversity, done in Rio de Janeiro on 5 June 1992, SR 0.451.43.

[3] Federal Act of 1 July 1966 on the Protection of Nature and Cultural Heritage (Natur- und Heimatschutzgesetz, NHG), SR 451; Federal Act of 20 June 1986 on Hunting and the Protection of Wild Mammals and Birds (Jagdgesetz, JSG), SR 922.0; Federal Act of 21 June 1991 on Fishing (Bundesgesetz über die Fischerei, BGF), SR 923.0; Federal Act of 29 April 1998 on Agriculture (Landwirtschaftsgesetz, LwG), SR 910.1; Federal Act of 4 October 1991 on Forest (Waldgesetz, WaG), SR 921.0; Federal Act on 24 January 1991 on the Protection of Waters (Gewässerschutzgesetz, GSchG), SR 814.20.

› On 13 January 2010, the Federal Council passed the Ordinance on the Protection of Dry Meadows and Pastures of National Importance[4] which regulates the implementation of the corresponding Federal Inventory.

However, for a number of species, protected areas are not sufficient to ensure their conservation in Switzerland. They require special measures, defined in the context of specific action plans. A list of priority species, for which Switzerland bears particular responsibility, was published in 2011 (» FOEN 2011b). This will be supplemented in 2011 by a general species protection strategy.

Switzerland's lynx and beaver populations grew in recent years, and the wolf has reappeared. The increasing presence of these three protected species leads to conflicts and tensions with livestock farmers and hunters. To facilitate the regulation of the populations of protected predators, the Federal Council commissioned the revision of the Hunting Ordinance.[5]

The revision of the Waters Protection Act,[6] which was passed by parliament on 11 December 2009 and entered into force in early 2011, permits the remediation of ecosystems so that they can fulfil all of their natural functions again (» Chapter 9). These measures will primarily benefit biodiversity in the watercourses and in bank areas. However, the population will also profit indirectly from them (recreation and tourism).

Ecological compensation areas[7] and the promotion of their quality and connectivity constitute important tools for the conservation of biodiversity in agricultural areas (» Chapter 6).

Many genetic resources used in Switzerland originate from other countries. The Convention on Biological Diversity grants the signatory states sovereign rights over their genetic resources. The parties to the Convention have committed to sharing the benefits arising from the use of genetic resources and the associated traditional knowledge in a fair and equitable way. The establishment of an international legal order is intended to facilitate access to genetic resources and, at the same time, the equitable sharing of the benefits arising from the use of genetic resources and the associated traditional knowledge.

In order to guarantee that Switzerland can also avail of the benefits provided by biodiversity, parliament has mandated the Federal Council to develop a National Biodiversity Strategy. It is due to be presented to parliament in early 2012. •

Internet links

www.bafu.admin.ch/state-biodiversity

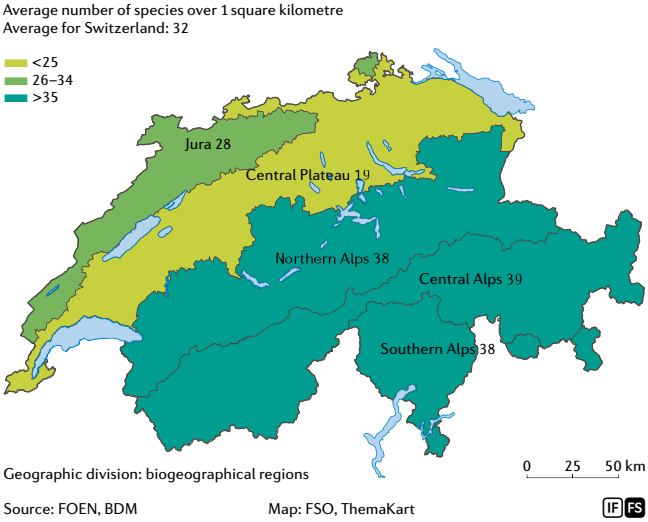
www.biodiversitymonitoring.ch

www.vogelwarte.ch

Regional comparison: species diversity by region

The map shows the average number of butterfly species found in sample areas of 1 km². In the Central Plateau, this number is only half that found in the Alps. The average number of species for Switzerland is 32.

M12.1 Butterfly diversity, survey period 2005–2009



Geographic division: biogeographical regions

Source: FOEN, BDM Map: FSO, ThemaKart IF FS

[4] Ordinance of 13 January 2010 on the Protection of Dry Meadows and Pastures of National Importance (Trockenwiesenverordnung, TwwV), SR 451.37.

[5] Ordinance of 29 February 1988 on Hunting and the Protection of Wild Mammals and Birds (Jagdverordnung, JSV), SR 922.01.

[6] Federal Act of 24 January 1991 on the Protection of Waters (Gewässerschutzgesetz, GSchG), SR 814.20.

[7] Ordinance of 4 April 2001 on the Regional Promotion of the Quality and Connectivity of Ecological Compensation Areas in Agriculture (Öko-Qualitätsverordnung, ÖQV), SR 910.14.

13. Forests

Forests provide protection against natural hazards, are a habitat for countless plants and animals and a popular recreational location for people. Forest soils act as an important water filter and wood is a versatile raw material. Forests store carbon and the harvesting of wood increment is ecologically sound. Switzerland's forest area increased by nearly 5 % between 1995 and 2006. Excessive nitrogen inputs pose a problem for the forest.

Context

According to the Swiss Federal Forest Act,[1] forests should fulfil the following three important functions: protection, welfare and production. Forests provide protection against natural hazards like avalanches and rockfall, they also provide a habitat for numerous species and play an important role in the lives of people as a location for leisure and recreation. Forest soils act as a water filter and the wood harvested in forests can be put to a wide variety of uses. In addition, forests produce oxygen and store the greenhouse gas carbon dioxide (CO_2) in the form of carbon (sink effect) (» G13.1). Conflicts can arise between the different functions of forests and the environmental services they provide.

The Swiss forest covers an area of almost 1.3 million ha, which represents 31 % of the country's territory. Forest area increased by 4.9 % between 1995 and 2006 (» M13.1). The main cause for this is the reclamation of unused agricultural areas and Alpine pastures by forests (» WSL 2010).

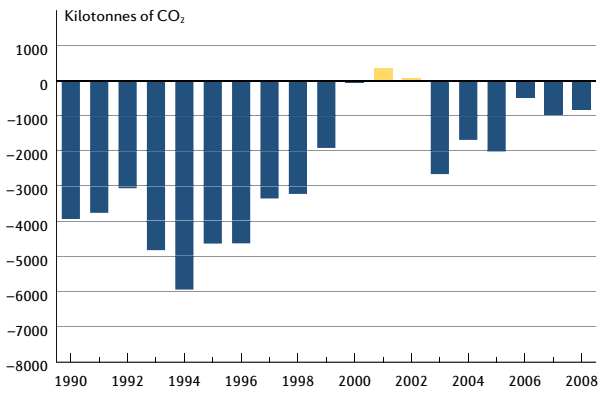
Public demands on the functions of the forest have shown a tendency to increase in recent years. Forests offer space for leisure and recreation which is appreciated and used intensively by the population. The forests are of crucial importance for biodiversity. Thus, around 20,000 plant, animal and fungal species – that is about 50 % of the known species in Switzerland – rely on the forest for their survival. The number of species under threat is generally lower than in other ecosystems. However, for some organism groups, many forest species are on the Red List, in particular beetles that live in dead wood, fungi, lichens and amphibians, and heat and light-loving orchids, butterflies and reptiles. The situation of birds is more positive. The Swiss Bird Index (SBI®)[2] has recorded a slightly upward trend for the 57 bird species that breed in the forest. This is probably due to the expansion of forest area and the general increase in the volume of dead wood.

Pollutants harm the forests directly through inputs from the air and indirectly through accumulation in the soil. Ozone pollution causes damage to leaves and needles while nitrogen causes the acidification of forest soil and results in an imbalance in the nutrient supply of the trees. Nitrogen emissions from agricultural fertilisers (primarily farm manure but also mineral fertilisers) and combustion processes (e.g. motorised transport) is introduced into the forest by the wind. As various studies have shown, nitrogen inputs are too high in 95 % of Switzerland's forests (» Federal Council 2009d). Due to climate warming and the ongoing and gradual changes associated with it, extreme weather events, for example heavy storms and summer heat waves, are likely to increase in future (» Chapter 8). Finally, a greater risk of biotic impacts may also be expected as a result of the introduction of non-indigenous species (» Chapter 12).

Impacts

The forest is under chronic stress as a result of soil acidification and air pollution and is, therefore, more vulnerable to periods of drought, storms, diseases and pests like bark beetle. The undesirable input of nutrients from the air causes trees to grow in height more rapidly without forming »

G13.1 Net carbon sink effect of forests



Source: FOEN

[1] Federal Act of 4 October 1991 on Forest (Waldgesetz, WaG), SR 921.0.
[2] www.vogelwarte.ch » Research » Population trends

› correspondingly deep roots. This reduces the stability of forests. Climate change also affects the forests ecosystem and impacts on the growth of the individual tree species: the forest communities change and the forest line shifts to higher altitudes. Although forests and tree species can adapt naturally to changing local conditions over generations of trees, this capacity for adaptation is under severe pressure due to the rapidity with which climate change is taking place. Moreover, the increase in summer heat waves that may be expected in the future will lead to drier forest soils and thus to more forest fires (» OCCC 2007). Polluted forests cannot always fulfil their function as a ground water filter adequately. The forest structure in many locations does not provide optimum conditions for the conservation of biodiversity. Thus, in many forests, the deadwood, on which thousands of species depend for survival, is insufficient in terms of both quantity and ecological quality.

Measures

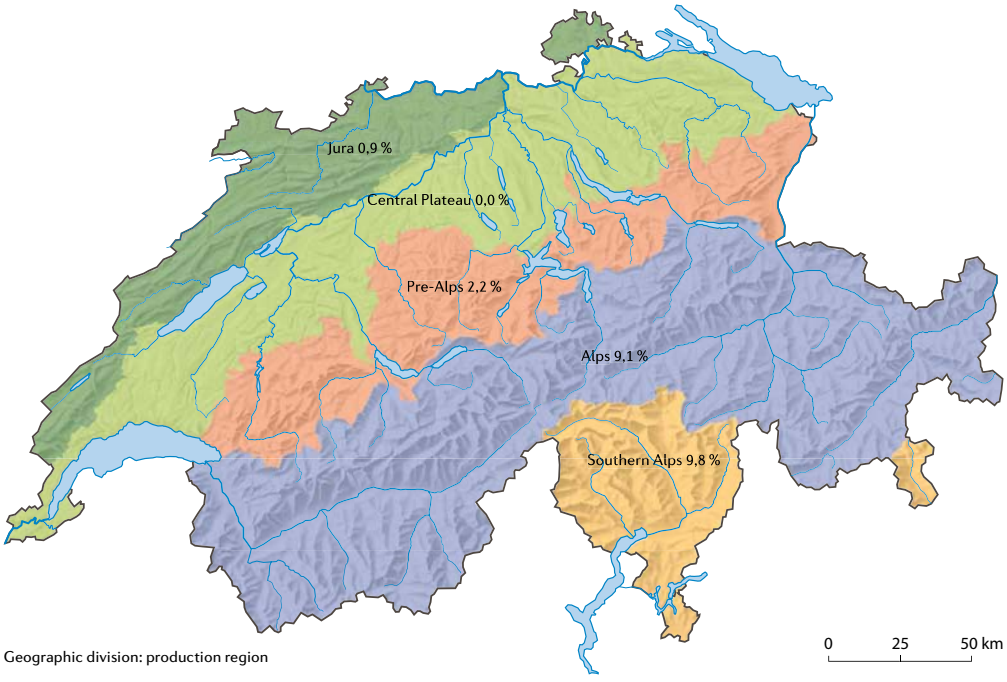
The most important measure for the conservation of the forest in terms of its area and spatial distribution is the prohibition of clearcutting by law.[3] In terms of area, the forests in the Jura and Alpine regions (Pre-Alps, Alps and Southern Alps) are not under threat today, whereas those in the Central Plateau are under severe pressure. To stabilise the state of the forest, the emissions of nitrogen oxides and ammonia should be reduced at their sources. Three measures are intended to enhance the ecological function of the forest and its contribution to the conservation of biodiversity: first, near-natural forest management will be practised everywhere as standard; second, part of the forest will be left to evolve naturally again (in forest reserves and islands of old growth); and, third, targeted interventions will be made in order to upgrade particular habitats and favour priority species. Ecologically valuable forms of forest cultivation require regular maintenance or extensive management to ensure that the special habitats they provide for flora and fauna are conserved. Examples here include the wooded pastures found in the Jura region and the chestnut groves of the Southern Alps.

[3] Federal Act of 4 October 1991 on Forest (Waldgesetz, WaG), SR 921.0, Article 5.

Regional comparison: forest area development

The development of forest area varies from region to region: clear increases in forest area may be observed in the Alps, particularly in the Southern Alps. As opposed to this, forest area in the Central Plateau has remained unchanged.

M13.1 Increase in forest area between the survey periods 1993–1995 and 2004–2006



Geographic division: production region

Source: WSL, NFI3

Map: FSO, ThemaKart

IF FS

Dealing with climate change requires flexible strategies. The focus is on near-natural forest management and the conservation and creation of varied forests that are suited to local conditions. The research programme "Forests and Climate Change" should provide the knowledge necessary to overcome the wide-ranging challenges that arise in this area.

Based on environmental programme agreements between the federal authorities and the cantons, federal funding is made available for the maintenance of protective forests, the promotion of biodiversity and the improvement of the efficiency of the forestry sector on an outcome-oriented basis.

One of the measures implemented for the conservation of biodiversity is the creation of forest reserves (» G19). Switzerland currently has over 800 forest reserves which account for 3.2 % of forest area – this will have risen to 5 % by 2012 and the federal authorities and cantons aim to achieve a further increase to at least 10 % by 2030. The harvesting of wood is severely restricted or prohibited in these forest reserves. •

Internet links

www.bafu.admin.ch/state-forest

www.bafu.admin.ch/state-timber

www.statistics.admin.ch » Topics » Agriculture, forestry

www.lfi.ch

UN International Year of Forests

To mark the International Year of Forests in 2011, the United Nations is shining a spotlight on the global importance of forests. The main topics being highlighted are the conservation of forest area and long-term forest management. The Swiss government is availing of this opportunity to raise public awareness of important forest policy issues: forest management combined with wood harvesting should contribute to the reduction of CO_2 and hence to the stabilisation of the climate. At the same time, Swiss forests must continue to provide the services required of them by society – even under altered climate conditions.

Sustainable wood harvesting

Sustainable wood harvesting means that the combined volume of harvested and dead trees does not exceed forest increment in the long term. Furthermore, wood stocks in certain forest sites can be reduced in order to maintain or improve forest stability and for ecological reasons. The forestry and wood sectors are important employers, particularly in peripheral regions. The people employed there are responsible for wood harvesting and processing and also make an important contribution to maintaining the landscape and biotopes.

The standing volume of living trees in Switzerland is 405 million m³, which corresponds to 364 m³/ha. The increase in standing volume between 1995 and 2006 was 14 million m³, of which 4 million m³ is acccounted for by the increase in forest area. The regional variances in this increase are striking and arise from differences in harvesting intensities and the effects of storm Lothar (1999) and the 2003 drought with the ensuing bark beetle infestation (» WSL 2010).

Wood is a renewable raw material. Its use, e.g. in the construction of houses, is particularly advantageous from an ecological perspective because carbon is stored in the wood. As long as the volume of wood that is incinerated or dies does not exceed that which accrues through growth, its use for energy generation is climate neutral as the new wood is formed from CO_2 absorbed from the atmosphere. Hence the replacement of fossil fuels with wood contributes to climate protection. The use of this resource should be organised more on a cascade basis in the future: i.e. wood should be used first for sawnwood and derived wood products and, finally, for energy generation.

The federal authorities support innovative projects in the area of wood processing and recycling through the Wood Action Plan (Aktionsplan Holz) and the SwissEnergy programme, the fund for the promotion of research on forests and wood, and the Swiss National Forest Programme for the optimisation of the value of the resource wood.

14. Natural risks

The scale of damage caused by natural hazards displays an upward trend. Moreover, extreme events are likely to occur more frequently in the future due to climate change. However, with the help of targeted measures, the damage caused by natural hazards can be prevented or, at least, limited. Switzerland spends almost CHF 3 billion annually on natural hazard prevention.

Context

As a mountainous country with considerable differences in altitude over a small area, Switzerland is particularly vulnerable to the different types of natural hazards. Together with the federal authorities, the cantons have the task of protecting human life and major material assets against natural hazards. The flood events of 2005 (in 13 cantons) and 2007 (Aargau, Solothurn, Basel-Landschaft, Bern, Jura, Fribourg and Vaud) prompted comprehensive political action in the area of natural hazards (» FOEN/WSL 2008; G14.1).

There is no such thing as absolute protection against natural hazards, and the damage they cause is on the increase. The main reasons for this are twofold. First, susceptibility to damage is increasing due to the general expansion of settlement areas and the associated rise in the value of potentially damaged assets. Second, while the vulnerability of infrastructure has become greater, spatial planning has not always been adapted to integrate natural hazards. Extreme hazard events (e.g. floods or debris flows) may have increased in intensity as a consequence of climate change (» Chapter 8). Experts assume that this trend will intensify further in the future. Taking all of the protective measures already implemented into account, in monetary terms, the residual risk posed by natural hazards in Switzerland adds up to CHF 1.8 billion per year (» FOCP 2003).

Switzerland is a country with moderate earthquake activity and a seismic hazard classified as "average" (» SED 2006). The areas considered as particularly at risk from earthquakes in Switzerland are Valais, the Basel region, Central Switzerland, the Engadine and the St. Gallen Rhine Valley. Due to the country's dense population and extensive material assets, earthquakes pose the greatest damage potential of all natural hazards in Switzerland. From a long-term perspective, the expected loss caused by earthquakes in Switzerland is comparable to that associated with floods.

The reinsurance companies estimate that if an earthquake of magnitude 6.9 on the Richter scale, as occurred in Basel in 1356, were to arise in Switzerland today, it would claim a few thousand lives and cause damage totalling between CHF 50 and 100 billion (» Swiss Re 2000).

Impacts

The scale of the damage caused by natural disasters displays an upward trend. The annual expected losses associated with natural disasters total around CHF 350 million.[1] The cost of damage caused in individual years may exceed this sum appreciably. For example, the 2005 flood claimed six lives and caused material damage totalling CHF 3 billion (» DETEC 2008).

Around CHF 2.9 billion or 0.6 % of gross domestic product (GDP) is spent on hazard prevention each year.[2] Of this spending, 59 % comes from private sources and the rest from the public purse. Most of the money is spent on flood protection and storm protection. 45 % is spent on prevention, 37 % on insurance, 14 % on response preparedness and 4 % on the development of hazard information bases (» PLANAT 2007).

Measures

Protection against natural hazards in Switzerland is based on the strategy of integrative risk management. This involves the coordination of the following measures: the preparedness against hazard events (prevention and preparation), the response to problems that arise during hazard events (alerting, intervention and provisional repair) and recovery after events (definitive repair and reconstruction).

Responsibility for providing protection against natural hazards is shared by the federal and cantonal authorities. Based on the new system of financial equalisation and the division of tasks between the Confederation and the cantons, preventive measures against natural hazards (protective forest, protective structures and hazard information bases) are subsidised in the framework of performance-oriented four-year programme agreements between the federal authorities and the cantons.

[1] Basis: loss amounts 1972–2009.
[2] Basis: average for the years 2000–2005.

Planning, technical and biological protective measures: The adaptation of land-use to risks posed by natural hazards is particularly important. For this reason, the cantons are required to compile hazard maps by the end of 2011 (» G25). These maps subdivide an area into four sections characterised by residual, slight, average and substantial hazard levels. Thanks to the hazard maps, it is now known where and to what extent human life and major assets are at risk from natural hazards in Switzerland. Approximately 70 % of the necessary maps had been completed by the end of 2010.

Because many bank protection structures and dikes are showing signs of wear and tear, urgent remediation projects are due to be carried out on numerous major watercourses in the coming decades (» Chapter 9).

Mountain forests protect countless settlements and transport routes against avalanches, rockfall, landslides and debris flows, hence the long-term conservation of the tree stands in these forests is important. The project "Sustainability and Success Monitoring in Protective Forests" (NaiS) developed quality standards for mountain forest maintenance in close cooperation with research, the administration and forestry practitioners (» SAEFL 2005c; Chapter 13).

Organisational measures: Based on the Federal Council's mandate for the Optimisation of Warning and Alerting (OWARNA) various measures have been undertaken to improve the cooperation between the participating federal authorities in the area of hazard warning and alerting (e.g. improvement of discharge forecasts and the development of monitoring networks) (» Swiss Confederation 2010).

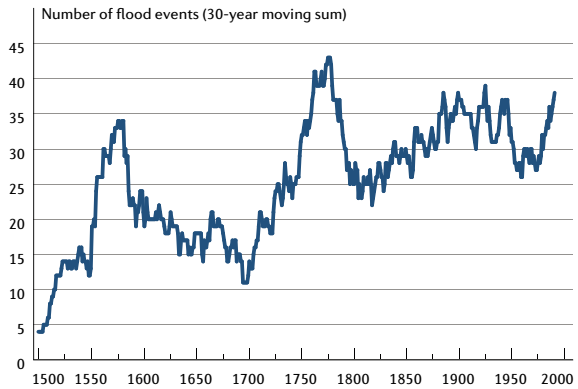
The Steering Committee Intervention against Natural Hazards (LAINAT) was established in 2008. This committee is a joint body involving the federal agencies responsible for protection against natural hazards and is charged with coordinating the measures necessary for protection against natural hazards. These measures include:

Single Official Voice: Official alerts and reports must be identifiable as the output of the federal agencies responsible for natural hazards (official voice). This establishes the requirement that the population be able to protect itself on an individual level against natural hazards by adopting suitable measures and that the risk of inappropriate behaviour and, hence also, of damage to human life and material assets, thus be reduced. The content of alerts issued to the population must coincide with the alerts issued to the federal, cantonal and communal intervention bodies (single voice) and be disseminated quickly and comprehensively through all suitable media. The Single Official Voice project was authorised by the Federal Council on 18 August 2010 with the revision of the Alerting Ordinance[3] and the Radio and Television Ordinance,[4] and entered into force on 1 January 2011.

[3] Ordinance of 5 December 2003 on the Warning, Alerting and Communication of Instructions to the Population (Alarmierungsverordnung, AV), SR 520.12.

[4] Radio and Television Ordinance of 9 March 2007 (Radio- und Fernsehverordnung, RTVV), SR 784.401.

G14.1 Floods: total for 14 Swiss catchments



Source: Schmocker-Fackel and Naef 2010

Common Information Platform for Natural Hazards (GIN): GIN has been operational since 1 March 2010. Through GIN, MeteoSwiss, the FOEN and the Institute for Snow and Avalanche Research (SLF) provide the natural hazard authorities at federal, cantonal and communal levels with detailed information about storms, floods, forest fires and avalanches to enable them to respond to natural hazard events (current data, models, bulletins, forecasts etc.).

Earthquake mitigation: The main aim of the federal authorities' earthquake mitigation programme consists in the protection of human life and material assets against the effects of earthquakes. This involves the implementation of structural and organisational measures and the promotion of earthquake mitigation among the cantons, communes and the population in general through the provision of information, technological expertise and instruments. In 2009, the DETEC was commissioned to intensify the promotion of earthquake mitigation in cooperation with the relevant institutions and to develop a dedicated internet platform (» Federal Council 2009e). •

Internet links

www.bafu.admin.ch/state-naturalhazards

www.bafu.admin.ch/state-earthquakes

www.gin-info.ch

www.wsl.ch

www.naz.ch

www.meteoswiss.admin.ch » Danger

15. Risk of major chemical and biological accidents

In 2009, 2,600 facilities and 12,000 km of transport routes were covered by the Major Accidents Ordinance on account of their hazard potential. The release of hazardous substances or organisms can have serious impacts on people and the environment. The owners of such facilities are obliged to take all appropriate and feasible measures to limit these effects and minimise the risk of major accidents.

Context

Major accidents can arise through the operation of facilities with chemical and biological hazard potentials and in the transportation of hazardous substances. Following the major fire in a chemicals warehouse in Schweizerhalle in 1986, the Major Accidents Ordinance[1] was passed to protect people and the environment against the severe damage caused by such events. According to the Ordinance, major accidents are extraordinary events that arise in facilities or on transport routes and also cause significant impacts outside the facility site or transport route in question.

A facility is only subject to the Major Accidents Ordinance if a minimum volume (quantity threshold) of at least one hazardous substance may be present there for operational reasons. The quantity threshold is defined on the basis of the toxicity of the substance to humans or the environment and its fire or explosion characteristics. Facilities that work with microorganisms are subject to the Major Accidents Ordinance if the activities carried out there are classified as being in the higher risk classes in accordance with the Containment Ordinance.[2] Transport routes are subject to the Major Accidents Ordinance if they are used for the transportation of hazardous goods.

In 2009, around 2,600 facilities, 4,000 km of railway lines, 7,850 km of roads and 20 km of the Rhine in Switzerland were subject to the Major Accidents Ordinance. 230 of these facilities have the potential to cause very serious damage in the event of a major accident and therefore had to submit a risk assessment to the authorities (» M15.1).

Impacts

The release of hazardous substances or organisms during major accidents can have very serious consequences for humans and the environment, e.g. fatalities, injuries, diseases, serious impacts on surface waters, the groundwater or the soil. Caustic and volatile chemical substances can damage the respiratory tract. Hazardous organisms include, for example, tuberculosis, anthrax and avian influenza pathogens, and the foot-and-mouth-disease viruses that can arise in biungulates.

Measures

The Major Accidents Ordinance obliges the owners of facilities to take all appropriate measures to reduce the risk of an accident that are both available in terms of the latest safety technology and economically viable. These include measures that reduce the hazard potential, prevent major accidents and limit their impacts.

Responsibility for the implementation of preventive safety measures lies with the owners of the facilities. Hence, major accident prevention builds on this personal responsibility in accordance with the Environmental Protection Act. Personal responsibility means that the necessary measures must be taken without their implementation being ordered by the authorities. The cantonal and, in part, federal authorities monitor the compliance by facilities with the requirements of the Major Accidents Ordinance through a control and assessment procedure.

The variety of the facilities and the need to be prepared for rare events and consequences necessitate intensive intercantonal and international cooperation. •

Internet links

www.bafu.admin.ch/state-majoraccidents

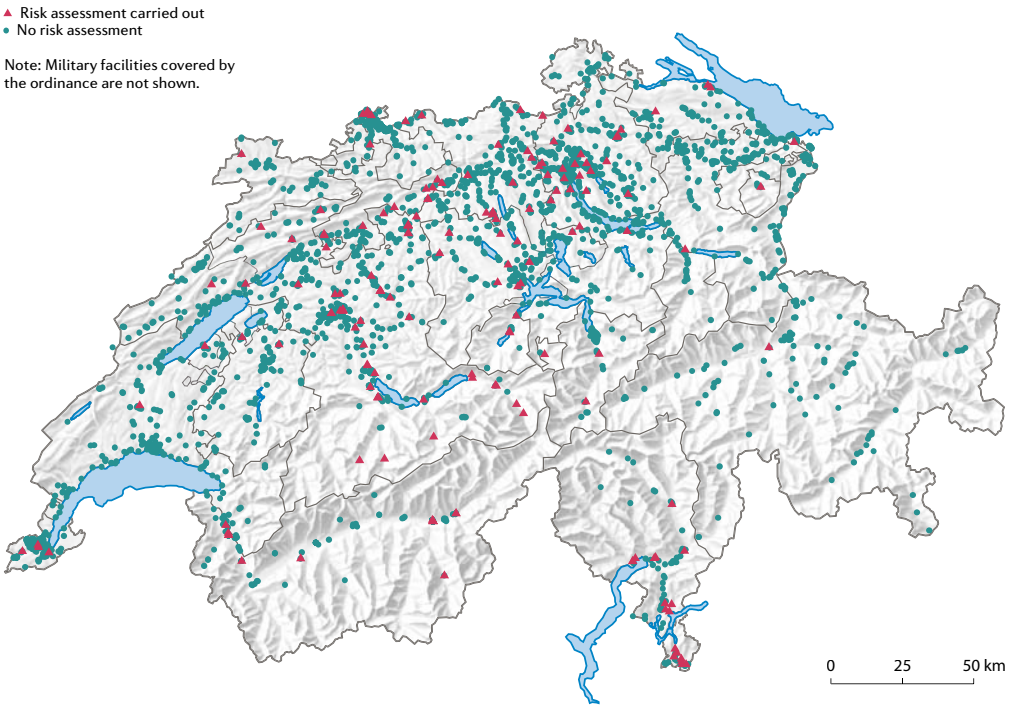
www.bafu.admin.ch/state-biosafety

[1] Ordinance of 27 February 1991 on Protection against Major Accidents (Störfallverordnung, StFV), SR 814.012.
[2] Ordinance of 25 August 1999 on the Contained Use of Organisms (Einschliessungsverordnung, ESV), SR 814.912.

Regional comparison: facilities with a chemical or biological hazard potential

Facilities that could cause serious damage in the event of a major accident are obliged by the authorities to submit a risk assessment; these account for around 9 % of the facilities covered by the Major Accidents Ordinance.

M15.1 Facilities with a chemical hazard potential covered by the Major Accidents Ordinance, 2009



Source: FOEN

Map: FSO, ThemaKart

IF FS

16. Noise and vibrations

Around 1.3 million people are affected by excessive noise levels during the day in Switzerland. The main source of this noise is road traffic. Noise affects people both psychologically and physically. The economic damage caused by noise due to losses in property value and health impacts totals over CHF 1 billion per year. Around 40,000 people are exposed to excessive vibrations.

Context

Based on the noise impact thresholds defined in the Noise Abatement Ordinance (NAO),[1] a total of around 1.3 million people in Switzerland are affected by excessive noise during the day and around 955,000 at night. If the recommendations of the World Health Organization (WHO) are applied, the number of affected people increases to almost 4 million by day and around 3.1 million at night (» FOEN 2009j). Road traffic is the greatest source of noise (» G16.1). However, rail and air traffic also generate noise. People are also disturbed by the noise emitted by industrial plants, civil and military shooting ranges, building sites, neighbours and leisure activities (e.g. noisy public events).

Road traffic noise has increased in the past 20 years. Although vehicle engines have become less noisy, the weight of vehicles has increased and this, combined with the wider tyres, gives rise to louder tyre rolling noise. Above all, however, traffic volume has increased markedly (» Chapter 3). During the day, 1.2 million people are exposed to excessive levels of road traffic noise; the corresponding figure for night time is 700,000. Rail traffic also generates noise that causes considerable disturbance to 70,000 people by day and as many as twice that number at night. Excessive aircraft noise affects 65,000 people by day and 95,000 people at night (» G16.1).[2] Cities and urban agglomerations are particularly severely affected by noise pollution (» G27).

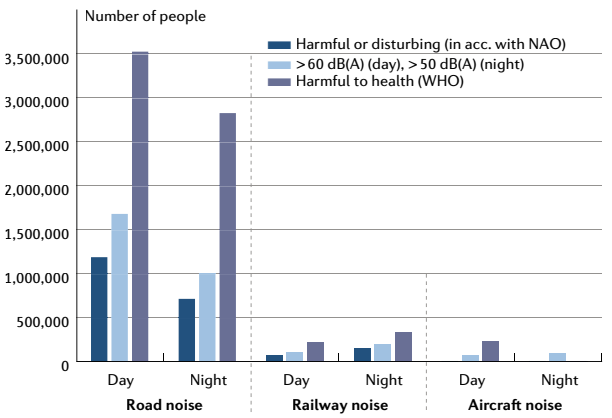
Impacts

Noise is not just disturbing, it can also cause illness. The possible health consequences of noise include hearing loss, cardiovascular problems and raised blood pressure. Other effects are stress, agitation, tension and depression. These effects are accompanied by impacts in the area of social interaction, for example aggression. The commonly held view that "people get used to noise" is incorrect; we react

[1] Noise Abatement Ordinance of 15 December 1986 (Lärmschutzverordnung, LSV), SR 814.41.

[2] For technical reasons, the calculations were carried out on the basis of the impact thresholds in residential areas, i.e. for >60 dB(A) during the day and >50 dB(A) at night.

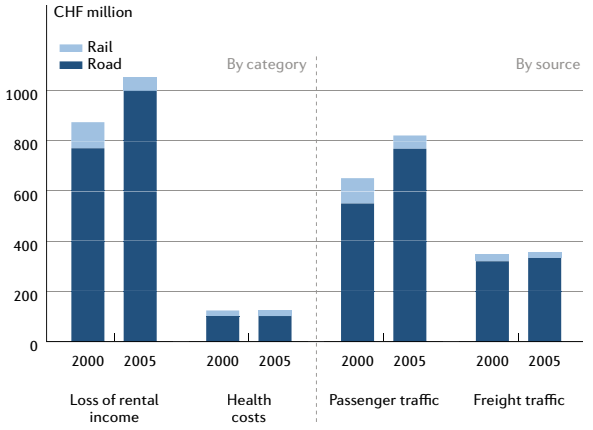
G16.1 Number of people exposed to noise pollution according to different threshold values and types of noise, 2009



Source: FOEN

IF M

G16.2 External costs of traffic noise



Source: ARE

IF E

unconsciously to noise and it can cause the release of stress hormones. Children react particularly sensitively to chronically high levels of noise. According to projections, 335 life years are lost annually by the Swiss population due to noise pollution (» ARE/FOEN 2008).

Even if a sleeping person is not woken by noise at night, physical reactions to noise, for example a raised heartbeat, can be observed. Disturbed sleep is responsible for a range of health problems and generally reduces the well-being of those affected. The risk groups here include children, the sick and the elderly. Because they need more sleep than adults and recover less quickly from lack of sleep, children are particularly negatively affected by nocturnal noise. Elderly people are more sensitive to noise disturbance because their sleep is lighter (» WHO 2009).

Noise pollution is reflected in health costs, rental income losses and reduced property prices: properties subject to noise impacts yield lower rental income. The external costs of road and rail traffic noise for 2005 were estimated at over CHF 1 billion (» ARE 2008; G16.2). Noise also leads to changes in the composition of the local population in affected areas. Those who can afford to do so move to a quieter neighbourhood.

Measures

The key pieces of legislation underpinning noise abatement measures are the Environmental Protection Act (EPA)[3] and the Noise Abatement Ordinance (NAO). The aim of the legislation is to protect the population against harmful and disturbing noise. It requires that, irrespective of its intensity, noise be limited as much as possible on a preventive basis, for example through the use of the latest available noise-reduction technology. If the noise exposure limits cannot be complied with in this way, other measures must be taken, for example the construction of noise barriers and highway lids and the implementation of traffic calming measures (» G16.3). If the noise generated by roads, railways and other public infrastructure cannot be reduced below the applicable exposure limit despite the implementation of all appropriate measures, soundproof windows must be installed in the buildings of those affected by the noise. However, this is an alternative measure that only provides protection when people are in the buildings in question.

Up to now, the main focus of the implementation of the the EPA and NAO requirements has been on the definition of exposure limits, structural noise protection measures and the installation of soundproof windows. These measures remain central to noise abatement.

The range of noise abatement measures implemented is also to be developed further. The main focus here is on the use of low-noise technologies at source. For example, the fitting of vehicles with low-noise tyres considerably reduces tyre-rolling noise. Railway carriages with disc brake axles cause just one tenth of the noise generated by rolling stock fitted with cast-iron block brakes. Such measures are most effective at limiting noise because, unlike noise barriers, for example, they provide extensive protection over a wide area. Technical measures on roads or railway lines can also greatly reduce noise. It has been possible to achieve a perceptible reduction in the level of noise pollution in the centres of towns and cities through the use of low-noise road surfaces, for example. Additional protection can be provided through the installation of noise absorbers on railway tracks.

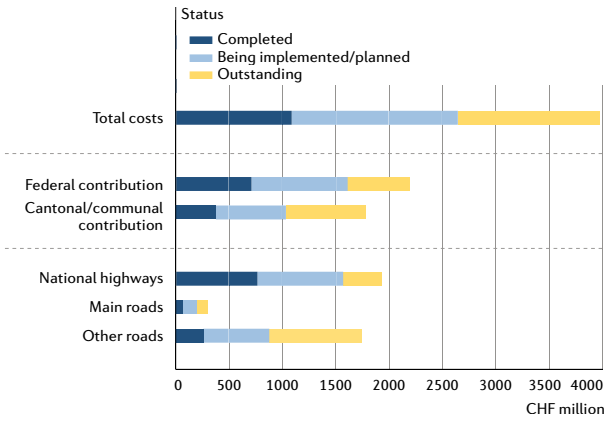
In addition to these measures, incentive systems are being developed and, in some cases, already in use. Airports are already charging noise-related takeoff and landing fees. Route prices on the railways are differentiated according to the noise emissions generated by the rolling stock. Such approaches aim to make quieter technologies more attractive economically by giving them a market advantage. •

What is noise?

When a sound is perceived as unpleasant and disturbing, it is described as noise. The decibel (dB) is the physical unit used to measure sound pressure or noise. The decibel is a logarithmic unit of measure. This means that a 10 dB increase corresponds to the doubling of the perceived volume. Because the human ear is not equally sensitive to all frequencies, the physically measured values in each frequency are adjusted to reflect how they are perceived by the human auditory system. As the volume of most noise sources varies considerably over time, they are averaged out over a certain period of time in order to assess the level of disturbance they cause.

[3] Federal Act of 7 October 1983 on the Protection of the Environment (Umweltschutzgesetz, USG), SR 814.01.

G16.3 Road traffic noise: cost of remedial measures
(Status: end of 2008)



Source: FOEN

IF E

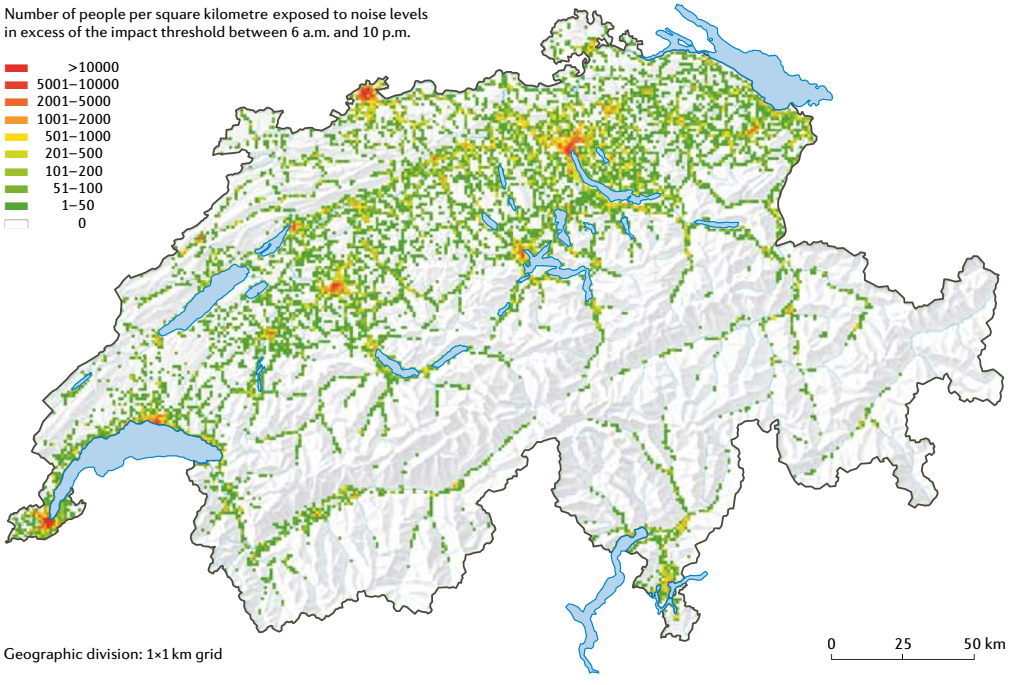
Vibrations

Vibrations, which also include structure-borne noise, also come within the scope of the EPA. For example, a railway can generate vibrations that affect nearby buildings. The vibrations are transmitted to a building through the subsoil and the building co-vibrates as a result. The propagation of the vibrations in the building is determined by the nature of the vibrations and, especially, the dynamic characteristics of the building. Vibrations are often stronger on the upper floors of a building. People perceive them in the building interior through physical contact with the building shell and through their sense of hearing. The structure of the building transmits the vibrations to the surrounding air as structure-borne noise which is perceived as a dull rumbling sound. An ordinance regulating vibrations, similar to that which already exists for noise abatement, has yet to be introduced. The reason for this is the complexity of the phenomenon which extends from the description of the propagation, impact, perception and sensation of vibrations to the implementation of preventive or remedial measures, which are considerably more expensive today than noise abatement measures. Furthermore, far fewer people are affected by vibrations than by noise. It is estimated that 40,000 people are currently exposed to excessive vibration levels. Of these, 30,000 are affected by railway vibrations (» FOEN/FOT/SBB 2003). Industrial and commercial plants are the second most common source, followed by building sites and roads.

› **Internet link**
www.bafu.admin.ch/state-noise

Regional comparison: road traffic noise (exposed people)
The map shows the number of people per km² exposed to road traffic noise at home. The threshold values are 60 dB(A) during the day and 50 dB(A) at night. The map clearly demonstrates that exposure to traffic noise is greatest in urban agglomerations.

M16.1 People exposed to road traffic noise, 2009



Geographic division: 1×1 km grid

Source: FOEN

Map: FSO, ThemaKart

IF M

17. Health

A high concentration of particulate matter in the air causes numerous respiratory diseases and cardiovascular problems. Ozone, noise and radiation also have impacts on human health. Based on current scientific knowledge, it may be assumed that climate change will give rise to other environment-related health problems.

Context

The pollution of the air with particulate matter (PM10) and ozone, noise, some forms of radiation and the climate all have an impact on human health.

Outdoor air: In terms of the outdoor air, the pollutants particulate matter and ozone are, together with pollen, relevant to health. Elevated particulate matter concentrations are found in the air today, particularly in close proximity to very busy roads and in towns and cities. High temperatures and good weather conditions cause increased ozone concentrations in summer (» Chapter 7). Air pollution also intensifies the allergic potential of pollen.

Noise: Many people are exposed to noise both at home and in the workplace. Noise levels are also rising due to the increase in traffic (» Chapter 16). However, traffic is not the only source of noise. Noise from shooting ranges, industrial plants and neighbourhood activities (restaurants, discos, festivals) can also cause disturbance. The temporal span of noise pollution has also expanded in recent years into the night. Noise is also an increasing source of disturbance in recreational areas.

Climate change: Heat waves are likely to become more frequent in Switzerland as a result of climate change. Heat waves have a negative impact on the population's well-being, and pose a threat to the health of the elderly, chronically ill, young children and people who require care. The distribution of animals, plants and microorganisms will also change following climate change, and undesired species – for example carriers of infectious diseases (Asian tiger mosquito) and plants with a high allergenic potential (Ambrosia) – could spread in Switzerland. The risk of the spread of infectious diseases, which are transmitted in food and water, also rises with increasing temperatures (» Chapter 8).

Ionising radiation, for example gamma radiation and x-rays, has sufficient energy to alter the basic units of living organisms, i.e. atoms and molecules. Radon, a radioactive gas that occurs naturally in the ground, is the most dangerous carcinogenic agent in the residential setting. Radon is responsible for 60 % of the average radiation exposure of the Swiss population, although the level of exposure varies considerably from region to region (» FOPH 2010). The emissions of ionising radiation generated by Switzerland's nuclear power plants do not contribute appreciably to background radiation levels.

Non-ionising radiation: Electrical installations, power lines and antennas for mobile telecommunications emit non-ionising radiation. In particular, the number of mobile telecommunications antennas has increased markedly in recent years (» G9). Due to the depletion of the ozone layer, there has also been a slight rise in level of natural ultraviolet (UV) radiation from the sun in recent years (» Walker 2009).

Impacts

Environmental factors have an impact on human health (» Perritaz 2010). The intensity of the impact depends on the nature of the pollution and the individual affected: everyone does not have the same reaction to environmental effects.

Outside air: Air pollution, especially particulate matter, can cause respiratory and cardiovascular disease. An estimated 3,000 to 4,000 premature deaths – including 250 deaths from lung cancer – are caused by air pollution every year in Switzerland (» ARE/FOEN 2008). High ozone concentrations can cause irritation of the mucous membranes and inflammations of the respiratory tract which impair lung function and reduce general physical capacity. Between 15 % and 20 % of the Swiss population suffer from pollen allergies (» Müller et al. 2000).

Noise: Noise has impacts on health that can be both psychological (e.g. discomfort, stress, communication and sleep disorders) and physical (e.g. hearing impairment, high blood pressure) in nature.

Ionising radiation: Between 200 and 300 people die each year in Switzerland from lung cancer caused by radon exposure (» FOPH 2010).

Non-ionising radiation: People in Switzerland are not generally exposed to radiation levels in excess of the internationally agreed impact thresholds; this means that they are protected against the scientifically proven short-term »

› effects. However, based on current scientific knowledge, it is unclear as to whether and to what extent the everyday exposure to non-ionising radiation is detrimental to health in the long term. What is clear, however, is that UV radiation can cause skin cancer. The incidence of malignant skin cancer (melanoma) has been increasing in Switzerland for around 50 years (» VSKR 2007). However, this is less the result of the slight increase in the intensity of UV radiation than of the changes in leisure behaviour featuring more frequent sun-bathing and beach holidays (» FOPH 2003).

Measures

According to the Environmental Protection Act (EPA)[1] and the Ordinance on Air Pollution Control,[2] pollutant emissions must be reduced primarily at source using the best available technology. In order to protect the public, in particular vulnerable groups such as children and the infirm, as effectively as possible from the impacts of air pollution, the ambient air quality standards set down in the Ordinance on Air Pollution Control must be complied with.

The implementation of effective measures at source is also the key to the sustained improvement of indoor air quality. In areas at risk from high radon levels, the radon concentration in buildings must be measured and reduced if necessary.

With regard to noise abatement, as with the measures implemented to counteract air pollution in accordance with the EPA and the Noise Abatement Ordinance,[3] noise must be primarily reduced at source using the best available technology. If this is not possible, the propagation of the noise must be prevented and soundproof windows must only be installed in the affected buildings as a last resort.

The limits defined by the Ordinance on Protection against Non-Ionising Radiation[4] on the emission of radiation from mobile telecommunications antennas or new power lines in locations such as homes, schools, hospitals and playgrounds are considerably stricter than the limits applied internationally. Based on the precautionary principle enacted in the EPA, this should maintain long-term exposure as low as possible and hence also minimise the risk of eventual health impacts that are unknown today. •

Internet links

www.statistik.admin.ch » Themen » Gesundheit (f g)

www.bafu.admin.ch/state-electrosmog

www.foph.admin.ch

www.obsan.admin.ch

www.sapaldia.net

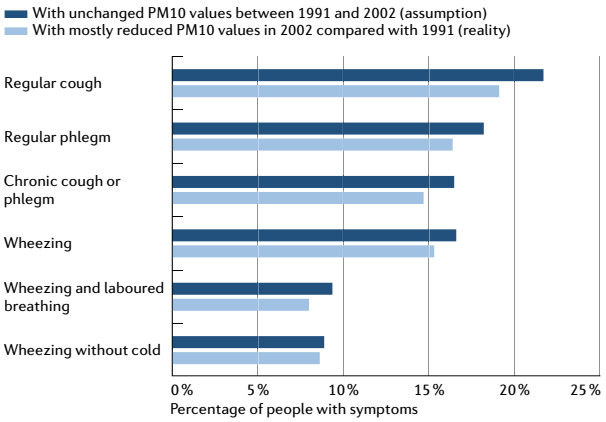
www.meteoswiss.admin.ch » Weather » Health

[1] Federal Act of 7 October 1983 on the Protection of the Environment (Umweltschutzgesetz, USG), SR 814.01.
[2] Ordinance of 16 December 1985 on Air Pollution Control (Luftreinhalte-Verordnung, LRV), SR 814.318.142.1.
[3] Noise Abatement Ordinance of 15 December 1986 (Lärmschutz-verordnung, LSV), SR 814.41.
[4] Ordinance on Protection against Non-Ionising Radiation (Verordnung über den Schutz vor nichtionisierender Strahlung, NISV) of 23 December 1999, SR 814.710.

The SAPALDIA study – air pollution and health

Air pollution, especially particulate matter concentration, has a clear influence on pulmonary function and on the cardiovascular system. This is one of the key findings of the SAPALDIA cohort study. As part of this study, 10,000 and 8,000 people in Switzerland were surveyed and examined in 1991 and 2002 respectively. Their residential locations were also recorded and the corresponding ambient air quality measured. One of the study's many findings was that the closer people live to busy roads, the greater the risk they face of adverse health effects (» Bayer-Oglesby et al. 2006). The levels of air pollution in Switzerland declined in the period 1991 to 2002. The study was able to prove that people's health improved as a result; for example the age-related decline in lung function decelerates when there is less particulate matter in the air (» Downs et al. 2007) and people are less prone to respiratory problems (» Schindler et al. 2009; G17.1).

G17.1 Respiratory symptoms with unchanged and reduced particulate matter (PM10) exposure, 1991–2002



Source: Schindler et al. 2009

III. Switzerland in the international context

The first two parts of this environmental report concentrated on the state and development of the environment in Switzerland. However, it is also important to consider the situation in Switzerland within the international context, as environmental problems rarely halt at international borders.

The first chapter of this part of the report identifies the most pressing global environmental problems and discusses Switzerland's commitment to their resolution. The main multilateral environmental agreements that have been ratified by Switzerland are presented in a table. In the second chapter Switzerland is compared with other European countries. The environmental indicators presented here were selected on a pragmatic basis as the data available for Switzerland are not always directly comparable with those collected in the EU Member States. The latter were largely taken from the databases of the Statistical Office of the European Communities (EUROSTAT), the European Environment Agency (EUA) and the Organisation for Economic Co-operation and Development (OECD), which are accessible online.

18. Global environmental problems and Switzerland's commitment

Many environmental problems are global in nature, for example climate change and the loss of biodiversity. The resolution of global environmental problems requires international cooperation and commitment in the context of international organisations and multilateral environmental agreements. Switzerland is very active in the area of international environmental policy, and views it as one of the five priority areas of Swiss international relations.

The United Nations Environment Programme (UNEP) has been producing regular reports on the state of the global environment since 1997. The current UNEP report, GEO-4 (» UNEP 2007), which was published in 2007 and involved the work of some 1,400 expert authors and reviewers, identified an unprecedented level of change in the environment at global and regional levels. The problematic areas highlighted by the report include climate change, the loss of biodiversity, hazardous chemicals and waste, the ozone layer, and water and air pollution.

Switzerland is involved in combatting these problems in the areas of international environmental governance, finance, the relationship between the environment and development, on the one hand, and between environment and trade, on the other. It also supports the greater consideration of environmental issues in the context of economic processes (green economy). Switzerland's cooperation with the European Union (EU) in the area of the environment is also gaining in importance. Most Swiss and EU environmental legislation is now harmonised and Switzerland has been a member of the European Environment Agency (EEA) since April 2006.

Through its commitment to environmental issues at international level, Switzerland not only contributes to the protection and sustainable use of the global environment, it also represents its own interests: environmental pollution does not come to a halt at national borders, pollutants reach Switzerland, for example, through regional and global airborne transport and through their accumulation in the food chain and in products.

Climate change

The global temperature increased by an average of 0.74 °C over the course of the last century. It is highly likely that this warming is due to human activities. The effects of climate change can already be observed: glaciers are melting faster, the availability of water is declining, food security is diminishing, sea levels are rising, habitats are shifting and the habitat quality of sensitive ecosystems is deteriorating. According to the estimates of the Intergovernmental Panel on Climate Change (IPCC), a further increase in temperature of between 1.8 and 4.0 °C may be expected by the end of this century. Hence, more frequent and intensive heat waves, storms, floods and periods of drought can also be expected (» Chapter 8).

The United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol form the basis of Switzerland's commitment to climate protection. Switzerland supports the intensification of the current climate regime and the involvement in this regime of the newly industrialised countries and their main generators of emissions like China, India and Brazil along with the already industrialised states.

Biodiversity

The majority of all of the animal and plant species that have been surveyed globally are in decline – both in terms of their distribution and their frequency. According to the International Union for Conservation of Nature (IUCN), over 16,000 species are threatened with extinction. The ecosystems that accommodate these species also display major changes. Whereas forest area in temperate zones increased by 30,000 km² annually between 1990 and 2005, deforestation in the tropics increased by 130,000 km² annually over the same period. Fishing catch yields have declined enormously both in the seas and inland waters – mainly as a result of overfishing. This development has a negative impact on both the food supply and biodiversity (» Chapter 12).

The aim of markedly reducing the loss of biodiversity at global, regional and national levels by 2010 was not achieved by the 190-plus parties to the Convention on Biological Diversity (CBD), which include Switzerland. The aim of the CBD is to conserve biodiversity, to ensure the sustainable use of its components and to promote the fair »

› and equitable sharing of the benefits that arise from it. Switzerland views the acceptance of legally binding international regulations in this regard as a matter of priority. The better protection of forests at international level in the context of various international organisations, such as the United Nations Forum on Forests (UNFF), the Food and Agriculture Organization (FAO) and the International Tropical Timber Organization (ITTO), is also a particular concern of Switzerland.

Chemicals and waste

Chemicals are of crucial importance to human prosperity, however they also pose risks to the environment and human health. A huge number of hazardous chemicals are spread globally through the air, water, food chain, the trade in products and in the form of waste (» Chapters 4 and 5). Because these substances do not stop at national borders, neither the benefits nor risks associated with chemicals and waste are bound to one place. Hence, the effective protection of humans and the environment and the fair distribution of the associated benefits and risks require international coordination and cooperation.

There are several important agreements and instruments at global level that protect humans and the environment against hazardous pollutants and waste. A new global convention for the regulation of the use of mercury has been in negotiation since June 2010 and is due to be passed in 2013. Switzerland is pursuing the objective of developing a comprehensive, coherent, effective and efficient international chemicals and waste regime. To achieve this, the existing system should be developed further, gaps should be filled, the cooperation and coordination between the different instruments intensified and the financing of their implementation guaranteed. The improvement of the protection provided to developing countries against hazardous waste and the development of new initiatives in the area of electronic waste are also matters of high priority.

Ozone layer

In 2006, the hole in the ozone layer over the Antarctic reached its biggest dimensions since measurements were first taken. This phenomenon involves the depletion of the ozone layer which provides protection against UV radiation and starts at an altitude of around 10,000 m. The depletion of the ozone layer is caused by chemical compounds such as chlorofluorocarbons (CFCs) (» Part I; Ozone layer).

The emission of ozone-damaging substances has declined appreciably over the past 20 years: by 2004, emissions had declined by 80 % as compared with 1990 levels. This internationally coordinated reduction was made possible by the Vienna Convention for the Protection of the Ozone Layer of 1985 and the signing of the Montreal Protocol two years later. In order to support developing countries in their efforts to abandon the use of ozone-depleting substances within the legal time limits, a multilateral ozone fund was established, to which Switzerland contributes. Due to the long dwell time of ozone-depleting substances in the atmosphere, the World Meteorological Organization (WMO) predicts that the ozone layer will not be restored to its pre-1980 state until after 2060.

Forests and water

The per-capita availability of fresh water is declining globally. In addition, polluted water is the main cause of environment-related diseases and fatalities. According to the United Nations (UN), by 2025, 1.8 billion people will be living in countries or regions affected by water shortages (» UN Water 2007). The quantitative and qualitative decline in surface waters and groundwater affects the ecosystems and the services they provide (» Chapter 9). Conversely, the hydrological cycle is also negatively influenced by the deterioration in the quality of ecosystems, for example the reduction in forest cover. The decline of the forests reduces species diversity, can cause natural disasters and contributes to climate change.

To ensure a sufficient water supply for people, the water cycle must be considered in its entirety. Consequently, Switzerland is committed to the protection of ecosystems like forests which play a central role in the filtration and storage of water and in the regulation of fluctuations in precipitation. This contributes not only to the improved supply of drinking and process water, but also to the protection against flooding. The guaranteeing of the multifunctionality of the forests also contributes to the conservation of the soil and biodiversity, to the sequestration of CO_2 and to the maintenance of recreational space (» Chapter 13). Therefore Switzerland supports international regulations and instruments that promote the protection and sustainable harvesting of forests.

Air

While the quality of the air in certain cities has been improved substantially, the situation in many areas remains unsatisfactory. The large-scale transportation of air pollutants can cause damage to human health and ecosystems in regions located far away from the source of their emission (» Chapter 7).

Switzerland's main aim with regard to the improvement of air quality is the reduction of secondary pollutants (ozone, particulate matter and nitrogen compounds) in the pan-European area. This is to be achieved through the UNECE Convention on Long-range Transboundary Air Pollution, which was passed in Geneva in 1979, and its eight protocols. In addition, Switzerland also actively supports the tightening of the Gothenburg Protocol of 1999 which defines binding regulations for the reduction of pollutant emissions after 2010 and prescribes the technical measures for stationary and mobile sources that will help to achieve this. •

The main multilateral environmental agreements ratified by Switzerland

Climate

- *United Nations Framework Convention on Climate Change of 9 May 1992 (with annexes), SR 0.814.01.*
- *Kyoto Protocol to the United Nations Framework Convention on Climate Change of 11 December 1997 (with annexes), SR 0.814.011.*

Biodiversity

- *Convention on Wetlands of International Importance especially as Waterfowl Habitat of 2 February 1971 (Ramsar Convention), SR 0.451.45.*
- *Convention on International Trade in Endangered Species of Wild Flora and Fauna of 3 March 1973 (with appendices I–IV) (CITES), SR 0.453.*
- *Convention on the Conservation of Migratory Species of Wild Animals of 23 June 1979 (Bonn Convention) (with appendices), SR 0.451.46.*
- *Convention on Biological Diversity of 5 June 1992 (with appendices), SR 0.451.43.*
- *Cartagena Protocol on Biosafety to the Convention on Biological Diversity of 29 January 2000 (with annexes), SR 0.451.431.*

Chemicals and waste

- *Vienna Convention for the Protection of the Ozone Layer of 22 March 1985 (with annexes), SR 0.814.02.*
- *Montreal Protocol on Substances that Deplete the Ozone Layer of 16 September 1987 (with annexes), SR 0.814.021.*
- *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal of 22 March (with annexes), SR 0.814.05.*
- *Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade of 10 September 1998 (PIC Convention) (with annexes), SR 0.916.21.*
- *Stockholm Convention on Persistent Organic Pollutants (POP Convention) (with annexes), SR 0.814.03.*

Desertification

- *United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, particularly in Africa, of 17 June 1994 (with annexes), SR 0.451.1.*

Treaties concluded under the auspices of the UNECE

- *Convention on Long-Range Transboundary Air Pollution of 13 November 1979 (Geneva), SR 0.814.32.*
- *Convention on Environmental Impact Assessment in a Transboundary Context of 25 February 1991 (with appendices) (Espoo), SR 0.814.06.*
- *Convention on the Protection and Use of Transboundary Watercourses and International Lakes of 17 March 1992 (with annexes) (Helsinki), SR 0.814.20.*
- *Convention on the Transboundary Effects of Industrial Accidents of 17 March 1992 (with annexes) (Helsinki), SR 0.814.04.*

Internet links

www.bafu.admin.ch/international-affairs

www.bafu.admin.ch/state-ozonelayer

www.eea.europa.eu

www.unep.org

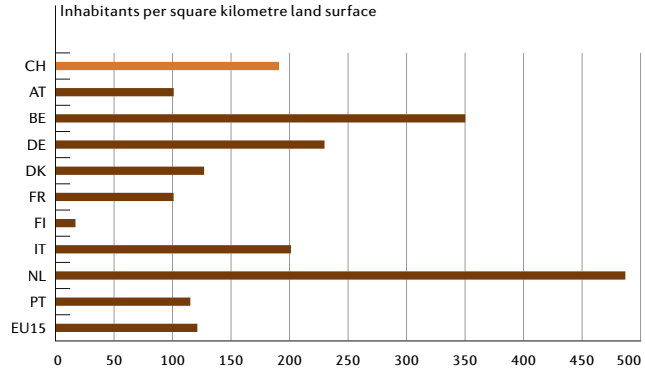
www.oecd.org

19. Comparison with some European countries

Population and economy

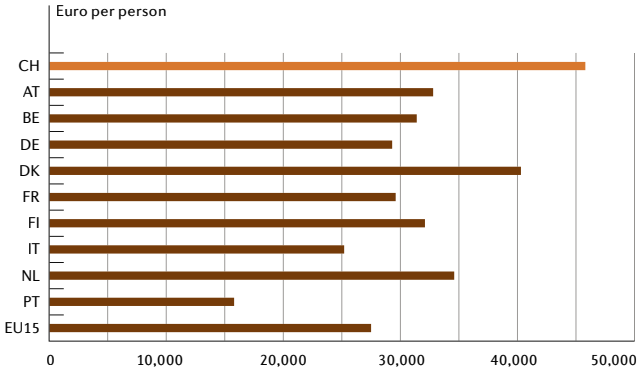
Europe's settlement areas are among the most densely populated and economically developed in the world. Their dynamic economic activity and high level of prosperity are reflected in the intensive use of natural resources such as food, water, energy and industrial raw materials.

GIII.1 Population density, 2007/2008



Source: Eurostat

GIII.2 Gross domestic product (GDP), 2009



Source: Eurostat

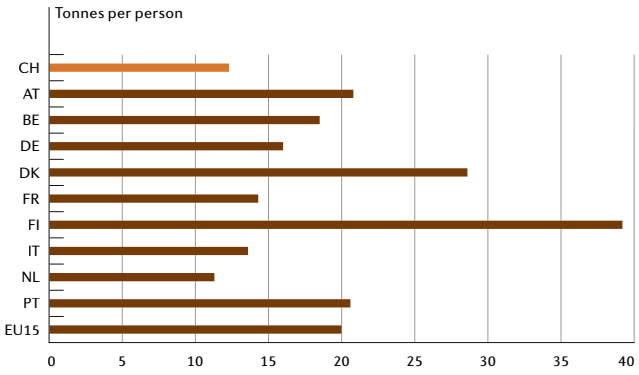
Resources and material flows

Material requirements in both Switzerland and the EU have increased in recent decades. Today, considerably more resources are used and pollutants emitted throughout Europe than the ecosystems can provide or break down in the long term. The objective of decoupling resource use from economic development (lower material turnover with increasing economic performance) has not yet been achieved either in Switzerland or the EU.

A growing proportion of the materials used by the economy and society originate from areas outside of Europe. Hence, the environmental impacts arising from the extraction and processing of these materials are shifting outside the continent. At the same time, dependence on imports is growing. A major increase in imports of finished products, in particular, can be observed in Switzerland since the early 1990s.

GIII.3 Domestic material consumption (DMC), 2007

(» Chapter 1)



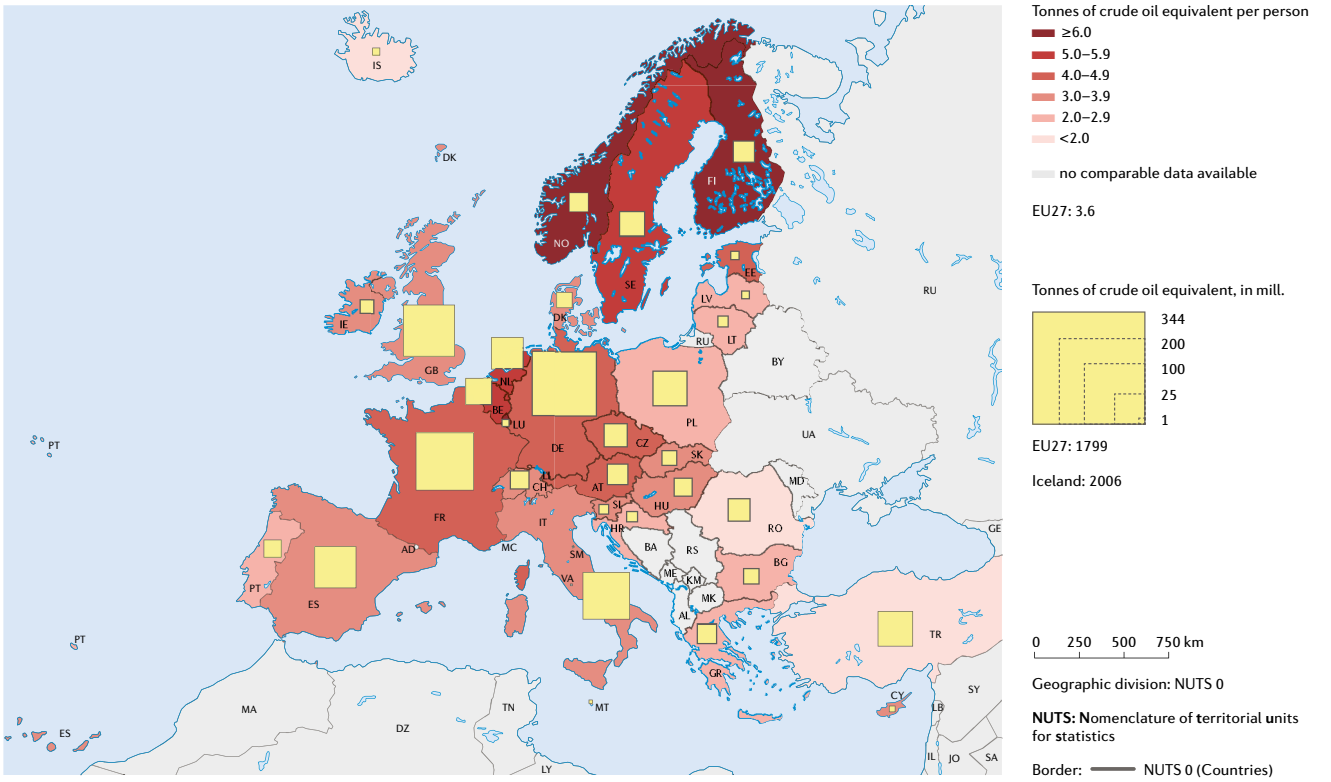
Sources: FSO; Eurostat

Energy

Energy intensity (ratio of energy consumption to economic performance expressed as gross domestic product, [GDP]) has declined considerably in both the EU and Switzerland since the 1990s: i.e. GDP has increased more than energy consumption. The decrease in energy intensity in the EU is strongly influenced by developments in the new (Eastern European) Member States where obsolete and inefficient structures are gradually being replaced.

In 2008, the share of final energy consumption in the EU accounted for by renewable energies was 10.3 % (» EC 2010). The share of electricity generation accounted for by hydropower is on a downward trend in both the EU and Switzerland. In contrast, the share of "new" renewable energies (biomass, wind, solar power) has increased appreciably in the EU and accounts for up to 20 % in individual countries. In comparison, this share is very small in Switzerland.

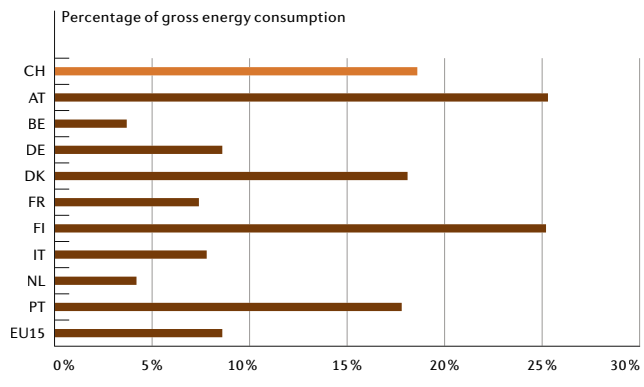
MIII.1 Gross energy consumption, 2008



Source: Eurostat

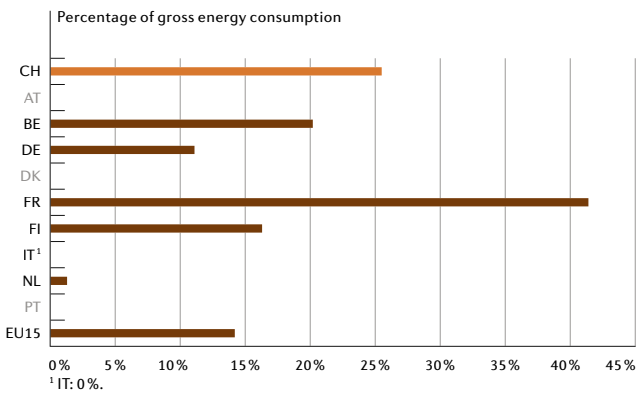
Map: FSO, ThemaKart

GIII.4 Renewable energy, 2008 (» Chapter 2)



Source: Eurostat

GIII.5 Nuclear power, 2008 (» Chapter 2)



¹ IT: 0 %.

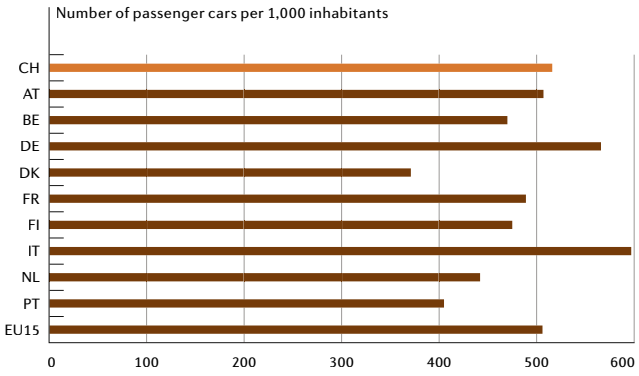
Source: Eurostat

Transport and mobility

Transport is the biggest final energy consumer in both Switzerland and the EU. The constant increase in mobility over the past two decades has cancelled out the savings obtained from the more energy-efficient and less polluting engines and drives. The transport sector is the main source of both air pollutants and CO_2 emissions and, within the transport sector, road transport consumes most energy. This makes it the main source of transport-related environmental impacts. The highest growth rates in terms of energy consumption and environmental impacts can be observed, however, in the aviation sector.

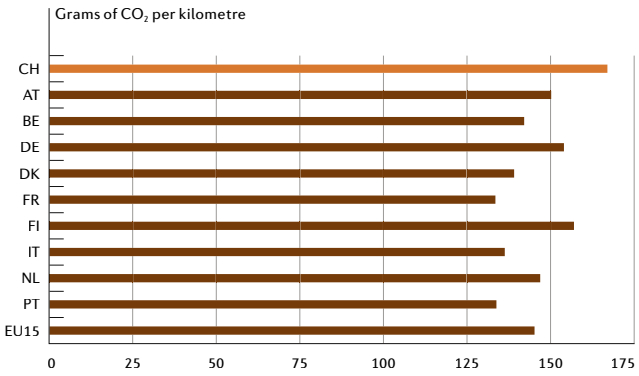
At 61 %, the proportion of goods transported by road in Switzerland in 2008 was markedly lower than the corresponding figure for the EU27 (average: 77 %). Whereas this figure has remained stable in the Western European countries (EU15) and Switzerland since the year 2000, it grew noticeably in the Eastern European Member States (EU12), at the cost of rail transport.

GIII.6 Passenger cars, 2006 (» Chapter 3)



Source: Eurostat

GIII.7 Average CO_2 emissions from new passenger cars, 2009 (» Chapter 3)



Sources: European Commission; SFOE

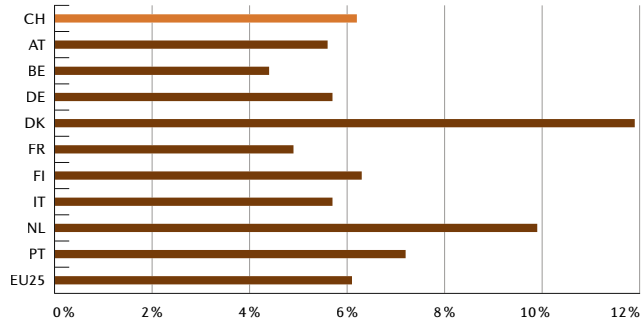
Production and consumption

The provision of services and the production, use and disposal of goods generate environmental impacts. The overall level of these impacts is influenced by the nature and scale of production and consumption, on the one hand, and by demographic development, economic growth, prosperity levels and the importance of the industry or service sector, on the other.

The proportion of waste that is recycled has generally increased throughout Europe since 1990. The landfilling of untreated municipal solid waste is now prohibited in Switzerland. A similar trend is emerging in the EU, albeit with a delay.

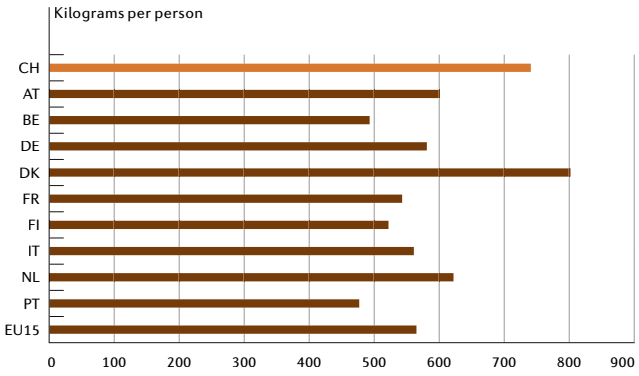
Up to now, efforts to reduce production-related and consumption-related environmental impacts in both Switzerland and the EU were focused on the management and recycling of waste. Efforts are now increasingly targeting the other phases in the life cycles of consumer goods with the aim of improving the sustainability of production and consumption.

GIII.8 Environmental tax revenues as a share of total revenues from taxes and social contributions, 2008 (» Chapter 5)



Source: Eurostat

GIII.9 Municipal solid waste, 2008 (» Chapter 5)



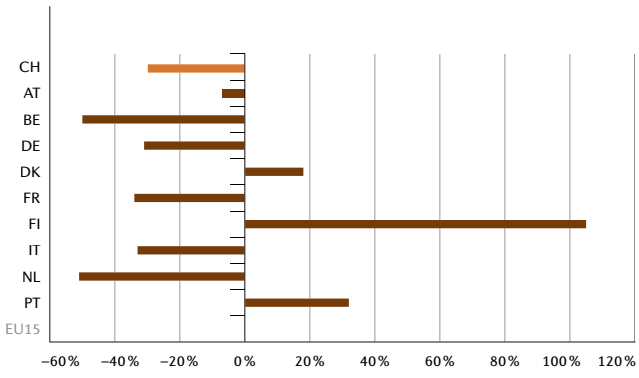
Source: Eurostat

Air quality

The situation with regard to the development of air quality in Switzerland and the rest of Europe is very similar. Although considerable differences exist from one country to the next, thanks to the implementation of air pollution control measures, overall, the emissions of various air pollutants have declined markedly in recent decades. For example, the problem of acid rain was largely alleviated through the imposition of stringent restrictions on emissions of sulphur dioxide from combustion systems and engines.

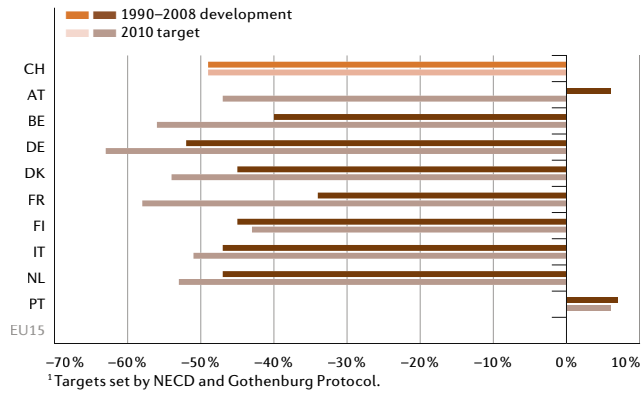
On the other hand, the frequent and sometimes massive exceedances of the ambient air quality standards for nitrogen dioxide (NO_2), ozone (O_3) and particulate matter (PM10, PM2.5) continue to arise. Both Switzerland and the EU have revised their legislation on air pollution control and introduced measures to reduce the negative impacts of air pollution on human health, agriculture and ecosystems.

GIII.10 Development of particulate matter (PM10) emissions from 1990 to 2008 (» Chapter 7)



Source: EEA

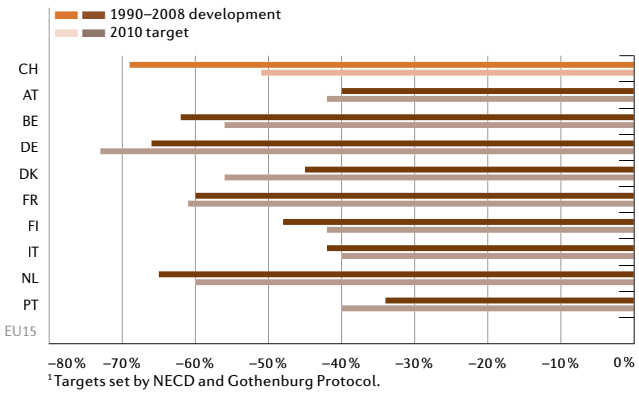
GIII.11 Reduction of NO_X emissions from 1990 to 2008 compared to targets for 2010[1] (» Chapter 7)



[1] Targets set by NECD and Gothenburg Protocol.

Soure: EEA

GIII.12 Reduction of NMVOC emissions from 1990 to 2008 compared with targets for 2010[1] (» Chapter 7)



[1] Targets set by NECD and Gothenburg Protocol.

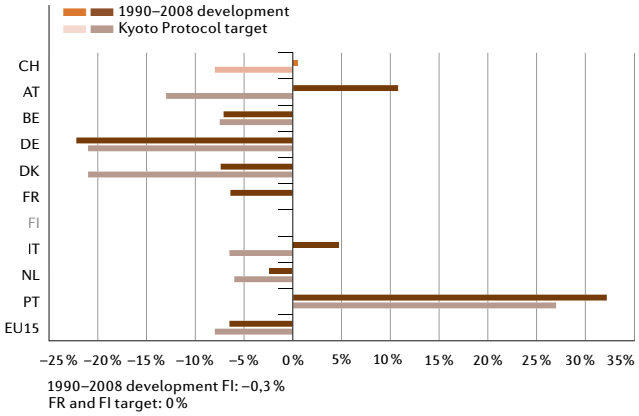
Source: EEA

Climate change

The constant increase in the concentrations of greenhouse gases in the atmosphere due to human activities is the main factor responsible for the observed warming of the global climate. Whereas Switzerland's greenhouse gas emissions remained more or less constant between 1990 (the base year of the Kyoto Protocol) and 2009, the corresponding emissions decreased over the same period by 6.9 % in the western part of the EU (EU15) and by a good 14 % in the overall EU area. The abandonment of the use of fossil fuels (in particular coal) in countries like Great Britain and Germany and the promotion of renewable energies made a major contribution to the reduction of emissions in the EU15 area.

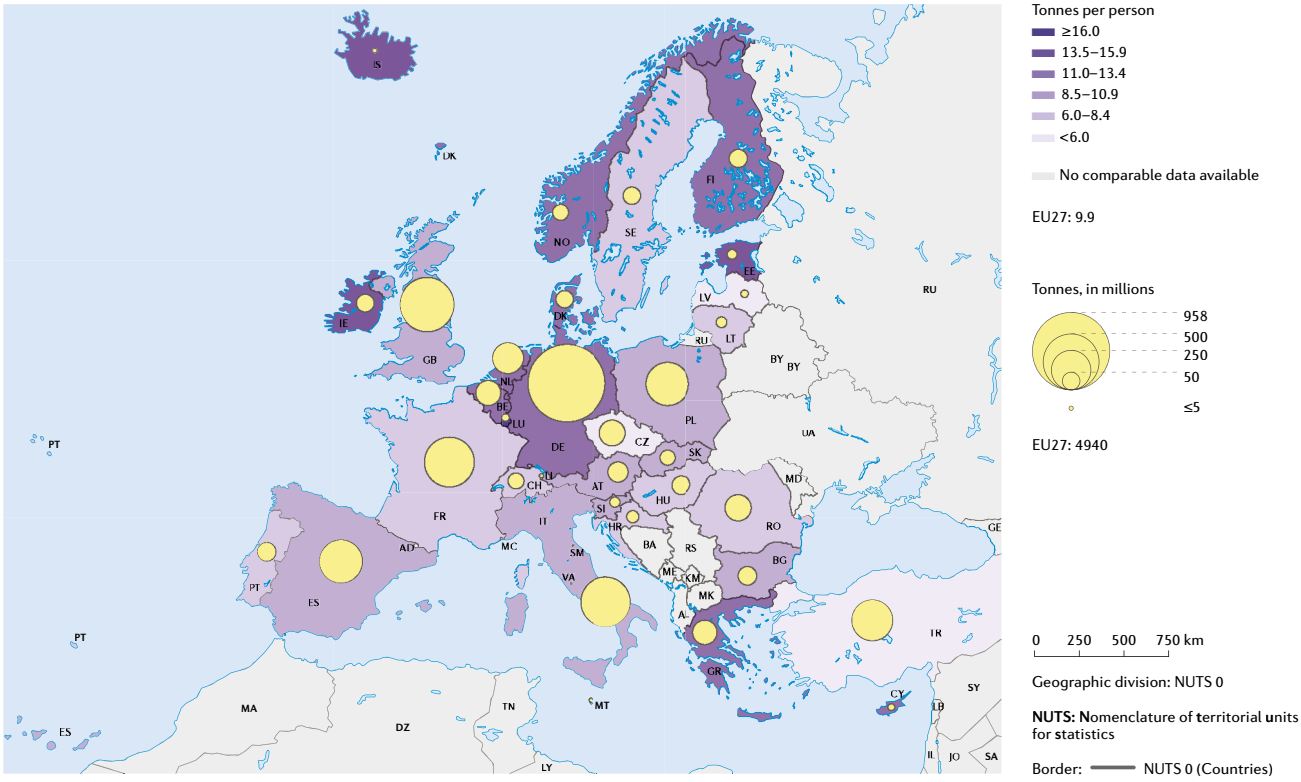
Due to Switzerland's traditionally less CO_2-intensive energy supply and the relatively minor importance of the industrial sector, per capita greenhouse gas emissions there are considerably lower than the average level in Western European countries. However, Switzerland's level of "grey" emissions, i.e. emissions generated abroad, is relatively high.

GIII.13 Development of greenhouse gas emissions between the Kyoto Protocol base year and 2008 (» Chapter 8)



Source: EEA

MIII.2 Greenhouse gas emissions in CO_2 equivalents, 2008



Source: EEA

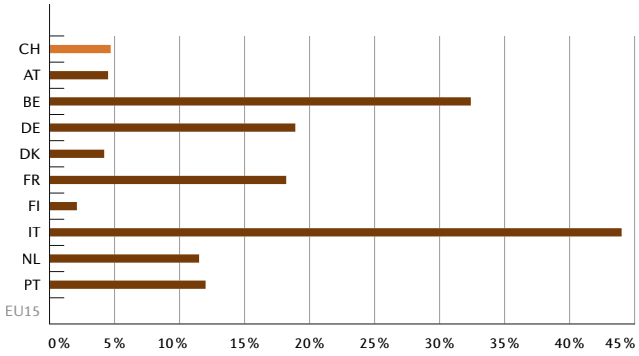
Map: FSO, ThemaKart

Waters

The quality of drinking water in Europe has reached a generally high level. However considerable deficits still exist in the area of wastewater treatment – particularly in Eastern and South-Eastern Europe. The problem of micropollutants, e.g. metals, chemicals and pharmaceuticals, in watercourses and in the groundwater, poses a challenge both in Switzerland and the EU. Inputs of nitrates into watercourses and water bodies in intensively farmed areas also remains an unresolved problem throughout Europe.

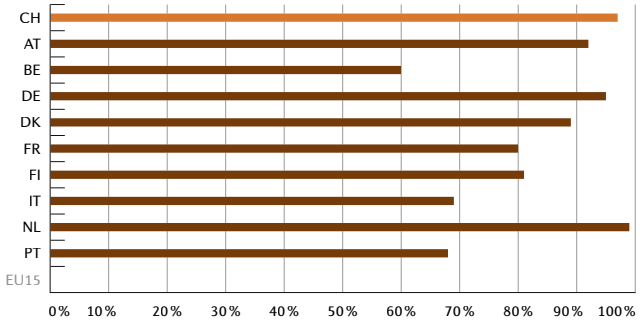
Water scarcity and competition for the resource water is likely to increase in parts of Europe – particularly Southern European countries – due to the changing climate conditions. Thanks to the high volumes of precipitation in the Alpine region, the situation in Switzerland is comparatively positive in this regard.

GIII.14 Water abstractions as a percentage of annually available water resources (most recent data available) (» Chapter 9)



Source: OECD

GIII.15 Percentage of the population connected to a water treatment plant (most recent data available) (» Chapter 9)



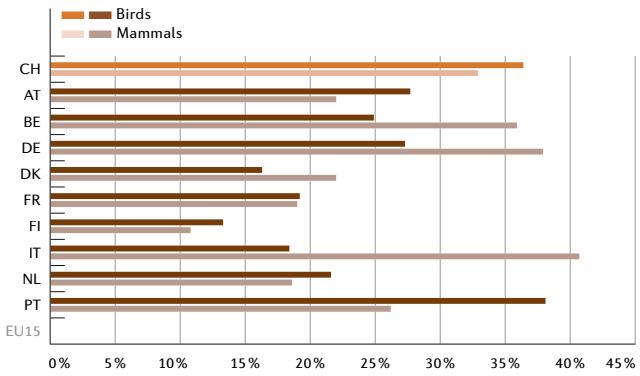
Source: Eurostat

Biodiversity

Due to gaps in the data, it is difficult to compare the status of biodiversity in the EU and Switzerland. The available information indicates, however, that, despite the establishment of new conservation sites – in particular the Natura 2000 network sites – and the implementation of biodiversity protection programmes, the variety of species and habitats is declining.

Although the decline of birds, which have been comparatively well surveyed, could be largely halted in the EU over the past 10 to 15 years, a similar trend cannot be observed for the equally well surveyed butterfly species. This can probably be explained by the continuing intensification of agriculture and the loss of suitable habitats. The fact that the proportion of intensively harvested forests is smaller in Switzerland than in large parts of the EU is an advantage for biodiversity in Switzerland.

GIII.16 Number of endangered species as a percentage of total known species (most recent data available) (» Chapter 12)



Source: OECD

Landscape development and land-use

Settlement area is increasing in both the EU and Switzerland, principally at the expense of agricultural land. As a matter of fact, at 7 %, the percentage of settlement area in Switzerland is considerably higher than in all of the EU area (4 %). The growing specialisation of land use can be observed throughout Europe: agricultural land is subject to increasingly intensive use or agricultural activity is being abandoned and forests are growing on previously farmed land.

The reorientation of agricultural policy has resulted in the management of an increasing share of agricultural land being subject to ecological requirements or being carried out in accordance with organic farming principles. The share of organically farmed land varies considerably throughout Europe. At 11 %, the percentage of organically farmed land in Switzerland is above the average for the EU where, in 2008, 4.5 % of agricultural land was farmed in accordance with organic criteria.

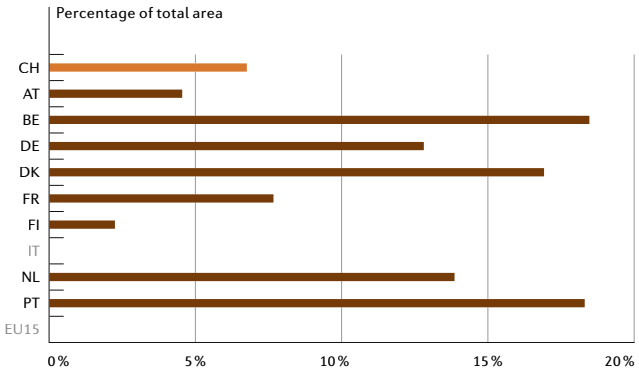
Internet links

ec.europa.eu/eurostat

www.eea.europa.eu

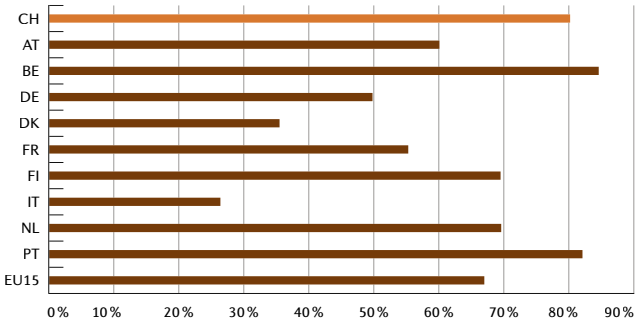
www.oecd.org

GIII.17 Settlement area, 1995/2000 (» Chapter 11)



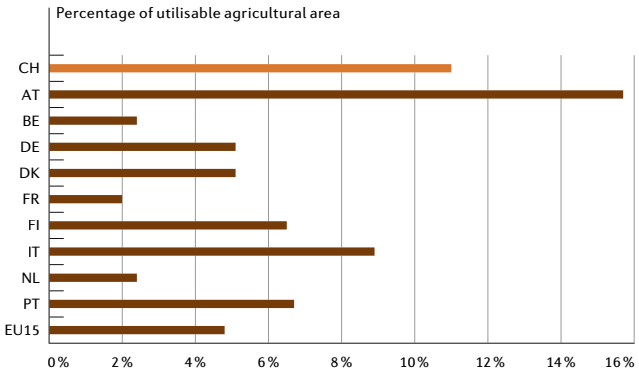
Source: Eurostat

GIII.18 Wood harvest as a percentage of annual forest increment, 2000/2005 (» Chapter 13)



Source: Eurostat

GIII.19 Organic farming, 2007 (» Chapter 6)



Source: Eurostat

IV. Annexes

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Abbreviations

ARE	Federal Office for Spatial Development (since 2000)
ART	Research Station Agroscope Reckenholz-Tänikon
BDM	Swiss Biodiversity Monitoring Programme
BLN	Federal Inventory of Landscapes and Natural Monuments of National Importance
BRP	Bundesamt für Raumplanung (ARE since 2000)
BWG	Federal Office for Water and Geology (FOEN since 2006)
CRF	Foundation for the management of the Cost-covering Remuneration for Feed-in to the electricity grid
DETEC	Department of the Environment, Transport, Energy and Communications
EAWAG	Swiss Federal Institute of Aquatic Science and Technology
EC	European Commission
EEA	European Environment Agency
EMPA	Swiss Federal Laboratories for Materials Science and Technology
ENDK	Conference of Cantonal Directors of Energy
ENFK	Conference of Cantonal Energy Authorities
ERKAS	Risk register established pursuant to the Major Accidents Ordinance
EU	European Union
EUROSTAT	Statistical Office of the European Communities
FAO	Food and Agriculture Organization
FDHA	Federal Department of Home Affairs
FEDRO	Federal Roads Office
FFA	Federal Finance Administration
FOAG	Federal Office for Agriculture
FOCA	Federal Office of Civil Aviation
FOCP	Federal Office for Civil Protection
FOEN	Federal Office for the Environment (since 2006)
FOPH	Federal Office of Public Health
FOSPO	Federal Office of Sport
FOT	Federal Office of Transport
FSC	Forest Stewardship Council
FSO	Federal Statistical Office
GEF	Global Environment Facility
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature and Natural Resources
LABES	Swiss Landscape Monitoring Network
METEOSWISS	Federal Office of Meteorology and Climatology
NABEL	National Air Pollution Monitoring Network
NABO	Swiss Soil Monitoring Network
NADUF	National River Monitoring and Survey Programme
NAMEA	National Accounting Matrix including Environmental Accounts
NECD	National Emissions Ceilings Directive
NAQUA	National Groundwater Monitoring Network
NFI	Swiss National Forest Inventory

OCCC	Organe consultatif sur les changements climatiques (Advisory Body on Climate Change)
OECD	Organisation for Economic Co-operation and Development
OFCOM	Federal Office of Communications
OPET	Federal Office for Professional Education and Technology
SAEFL	Swiss Agency for the Environment, Forests and Landscape (FOEN since 2006)
SBB	Swiss Federal Railways
SDC	Swiss Agency for Development and Cooperation
SED	Swiss Seismological Service
SFOE	Swiss Federal Office of Energy
SLF	Institute for Snow and Avalanche Research
STV	Swiss Tourism Association
SVGW	Swiss gas and water industry federation
TA-SWISS	Centre for Technology Assessement
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFF	United Nations Forum on Forests
VSKR	Swiss Association of Cancer Registries
WHO	World Health Organisation
WMO	World Meteorological Organization
WSL	Swiss Federal Institute for Forest, Snow and Landscape Research
WTO	World Trade Organization

Glossary

Alien organism Non-native animal (neozoon) or plant (neophyton) species introduced intentionally or unintentionally by humans after 1492. An alien organism is defined as invasive if it reproduces intensively and spreads at the expense of other organisms.

Ambient air quality standard Maximum atmospheric concentration for a specific pollutant adopted as enforceable by a regulatory authority.

Biodiversity see Biological diversity

Biogenic Of biological or organic origin; formed by life processes or living organisms.

Biological diversity Diversity and variability of living organisms and of ecological structures, encompassing three levels: species diversity (animal, plant, fungal and bacterial species), habitat diversity (ecosystems such as forests and surface waters) and the genetic diversity found within species (e.g. subspecies, varieties and breeds).

Biosphere The entirety of the Earth's ecosystems, including organisms and their habitats. It includes all compartments of the atmosphere, hydrosphere and lithosphere where there is life.

Carbon sink Through photosynthesis, trees remove CO_2 from the air, converting it and storing it for extended periods in wood. The sink effect – the balance of carbon stored and released by biomass – is influenced by agricultural and silvicultural activities and can contribute to offsetting CO_2 emissions.

Certificates see Emission certificates

CO_2-equivalent Unit describing how much global warming a given type and amount of greenhouse gas may cause, using the functionally equivalent amount or concentration of carbon dioxide (CO_2) as the reference. Greenhouse gas emissions other than CO_2 (CH_4, N_2O, HFCs, PFCs and SF_6) are converted into CO_2-equivalents according to their global warming potential (GWP) to ensure better comparability. One kilogramme of CH_4 corresponds to 21 kg CO_2, and one kilogramme of N_2O is equivalent to 310 kg CO_2.

Combustible A material that, on input of energy and in the presence of oxygen (oxidant), reacts chemically with the oxygen and thereby releases heat.

Constant terms Prices reflecting real values, i.e. adjusted to inflation by applying a reference value. Synonyms: inflation-adjusted, real terms.

Contaminated site Polluted site of a facility, an accident or a landfill that has been proven to cause harmful or noxious impacts on the environment or for which there is a risk that such impacts may arise.

Crude oil equivalent (also known as crude oil unit) Unit of mass used to carry out comparative calculations based on different energy sources (e.g. total energy consumption). A tonne of crude oil is equal to 0.041868 terajoules.

Deadwood Dead trees or components of trees. Deadwood is a characteristic feature of natural forests. It provides a habitat and food source for numerous organisms and is an important component of the forest ecosystem.

Decoupling Arises if the growth of the economy is more rapid than growth in resource consumption or environmental pressure. Decoupling is relative if resource consumption or emissions remain constant or grow more slowly than the economy. If resource consumption or emissions drop and the economy grows nonetheless, decoupling is absolute. In this case, with regard to the specific field of materials consumption, reference is also made to a dematerialisation of the economy.

Economic sector One of the three main subdivions of the economy:
- Primary sector: agriculture, forestry and fisheries;
- Secondary sector: industry and construction;
- Tertiary sector: services.

Ecosystem Network of interactions between a community of organisms (biocoenosis) and its environment (biotope). The latter is characterised by geological, pedological and atmospheric conditions. Components of an ecosystem form a network of interdependencies that enable life to be maintained and developed.

Efficiency Measures the value added per unit of resource consumption or environmental impact. For instance, material efficiency corresponds to the amount of Swiss francs generated per kilogramme of material consumed. Opposite of intensity.

Emission The release of pollutants, noise, radiation and similar phenomena from natural sources or by man into the environment.

Emission certificates Emission credits generated through emission reduction projects in developing countries and other industrialised states or economies in transition. Emission credits can be traded in the emissions trading system, a market-based climate policy instrument. This enables the reduction of greenhouse gas emissions wherever this can be done most effectively.

Endocrine disruptor Substance that influences the hormone balance of organisms.

Energy carrier Any substance from which energy can be generated, be it directly or after conversion. A fossil energy carrier is a primary energy carrier formed from organic substances in the soil (mineral oil, natural gas, various hydrocarbons, coal etc.).

Exotic organism see Alien organism

External costs Costs incurred in production or consumption processes that are not borne by the generator.

Final energy The energy procured or produced by consumers in order to receive a certain utility, such as electricity for light or petrol for mobility. Final energy refers to the final link in the trading chain.

Flow regime Typical discharge pattern of a watercourse repeated over the course of the seasons.

Forest sink see Carbon sink

Fossil energy carrier see Energy carrier

GDP (gross domestic product) Measure of the performance of a national economy over the course of a year. GDP measures the value of goods and services produced in the country, provided they are not consumed in the production of other goods and services – in other words the so-called value added. GDP is calculated using either current terms or constant (i.e. real) terms for a given year. With constant terms, real economic development over time is represented without the influence of price changes.

Genetic diversity see Biological diversity

GMO (genetically modified organism) Organism (animal, plant, fungus, microorganism) whose genetic material has been modified in a way that does not occur in nature by crossing or natural recombination.

Greenhouse effect The greenhouse effect is a natural phenomenon. It is caused by various gases in the atmosphere (water vapour, carbon dioxide, methane, nitrous oxide etc.) that reflect a part of the heat radiation emanating from Earth back again. An increased concentration of such greenhouse gases leads to a rise in the warming effect.

Greenhouse gas Gaseous substance in the air that contributes to the greenhouse effect and can be either natural or anthropogenic (caused by human activity) in origin. The Kyoto Protocol regulates the following greenhouse gases or groups of gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). HFCs are used mainly as substitutes for chlorofluorocarbons (CFCs) – the latter, which are also greenhouse gases, are responsible for stratospheric ozone depletion and are regulated by the Montreal Protocol.

Gross energy National energy statistics are concerned primarily with total energy consumption within the boundaries of the country, including the conversion losses arising within those boundaries. This gross consumption comprises the primary energy produced within the country, the input/output balance of foreign trade in the various energy carriers, and the changes in stocks.

Guideline value Pollution level above which, according to the state of scientific knowledge or practical experience, long-term soil fertility is no longer assured. The Federal Council can set guideline values and remediation levels, for instance to assess soil pollution.

Hazardous waste Waste whose environmentally sound disposal requires special technical and organisational measures because of its composition and chemical-physical or biological properties.

Heating fuel see Combustible

Hydropeaking (surge and flow) More or less regular alternation between two different flow regimes. Surge refers to the artificially increased discharge of water in a watercourse during the operation of hydroelectric turbines to satisfy peak demand. Surges are punctuated by low-water phases during periods of low demand, i.e. usually at night and weekends.

Impact threshold see limit value

Intensity A measure of the resource consumption or environmental impact per unit of value added. For instance, energy intensity corresponds to the quantity of energy consumed per unit of gross domestic product (GDP) (in Swiss francs). Opposite of efficiency.

Invasive species see Alien organism

Land-use statistics Acting on behalf of the Federal Council, the Federal Statistical Office (FSO) has produced a simplified picture of land use and land cover every twelve years since the 1980s, thus capturing the imprint of society on the landscape. To date, two nationwide surveys have been published, the first (1979/85) based on aerial photos taken from 1979 (Western Switzerland) to 1985, and the second (1992/97) on aerial photos taken from 1992 to 1997. The third, which will cover the period from 2004 to 2009, began in 2005 and will be available by 2013 at the earliest, however, interim findings are published periodically on the FSO website (www.statistik.admin.ch » Themen » Raum, Umwelt » Bodennutzung, -bedeckung [f g]).

Limit value Threshold which applies when assessing the exposure to harmful or noxious impacts of air pollution, noise, vibrations and radiation. It takes account of the impact of the ambient level on categories of people who are particularly sensitive, such as children, sick people, elderly people and pregnant women.

Motor fuel Mixture of combustible hydrocarbons in liquid or gaseous form that, when combined with air, drives an internal combustion engine.

NMVOCs (non-methane volatile organic compounds) A group including numerous organic substances used as solvents in paints, varnishes and adhesives, in cleaning agents or as propellants in spray cans. They are precursors to the formation of ozone, summer smog and PM10.

Noise exposure limit Limit specified in the Noise Abatement Ordinance in accordance with the noise characteristics, the time of day and the sensitivity to noise of the buildings and areas to be protected. There are three types of exposure limits:

- The impact threshold is the limit above which noise is regarded as harmful and a nuisance.
- The planning value is 5 dB(A) lower than the impact threshhold and applies to new facilities; it is designed to prevent a noise level rising to the point where it becomes a nuisance.
- The alert threshold is 5 to 15 dB(A) higher than the impact threshold; if it is exceeded, remedial action is considered to be urgently required.

Permafrost Permanently frozen subsoil found where the climate is comparatively cold, either in high latitudes (polar regions) or at high altitudes.

Person-kilometres Total of kilometres travelled annually by the persons conveyed.

PIC (Prior Informed Consent for Certain Hazardous Chemicals and Pesticides) Prior Informed Consent for Certain Hazardous Chemicals and Pesticides: the Rotterdam Convention defines information and reporting obligations for the trade in particularly hazardous chemicals and pesticides. The Convention obliges the Parties to inform other countries about any bans and use restrictions they adopt and to report exports of the relevant substances to importing countries.

PM2.5 (Particulate Matter <2.5 µm) Dust particles with a diameter of less than 2.5 micrometres.

PM10 (Particulate Matter <10 µm) Dust particles with a diameter of less than 10 micrometres.

POPs (persistent organic pollutants) Toxic and extremely poorly degradable chemical substances that spread on their release via the air and water and through the food chain, and can pose a threat to human health and the environment a long way from the location of their release. POPs are considered carcinogenic, they can cause hormonal imbalances and reproductive dysfunctions.

Polluter-pays principle Principle according to which all costs (including the external costs) should be borne by the polluter.

Primary energy Energy that occurs in nature and has not yet been subjected to any conversion process, regardless of whether it can be utilised directly in this form or not. Examples: hydropower, wood, coal, crude oil, natural gas etc. For statistical purposes, it also includes the heat generated in nuclear reactors and the energy extracted from municipal and industrial wastes.

Ratification Confirmation of the signature at the bottom of a document, by which an agreement with another state is concluded. Generally, depositing the instrument of ratification constitutes the definitive validation of an international treaty.

Real terms see Constant terms

Red Lists Lists of endangered plant or animal species for whose survival urgent action is required. There are red lists for animals, ferns and flowering plants, mosses, lichens and fungi. The species are classed in different categories depending upon their threat status.

Renewable energies Collective term for energy sources that do not rely on finite raw materials and are available for an unlimited period on a human timescale. They include the use of hydropower, solar energy, ambient heat, biomass, wind energy, the renewable fractions of solid wastes, and the energy extracted from sewage treatment plants.

Smog Contraction of "smoke" and "fog" referring to a mixture of air-polluting, gaseous, liquid and solid components that usually forms over urban areas under weather conditions in which air exchange is restricted. When there is smog, sunlight appears diffuse and seems to come through a cloud of fog.

Species diversity see Biological diversity

Stemwood The stem or trunk of a tree is its main axis extending from the surface of the soil to the crown. Hence stemwood is the wood that grows overground excluding the branches but including the bark.

Stratosphere Layer in the Earth's atmosphere at an altitude of approx. 15 to 50 km, characterised by an elevated concentration of ozone (ozone layer) in its central part.

Surge see Hydropeaking (surge and flow)

Tonne-kilometre A measure of freight traffic, corresponding to the conveyance of one tonne over one kilometre.

Troposphere Lowest layer of the atmosphere between the Earth's surface and the stratosphere. Almost all weather activity occurs in the troposphere.

UAA (Utilisable agricultural area) Area used for crop production, excluding summer pastures and woods.

UV (ultraviolet radiation) Invisible, short-wave electromagnetic radiation with wave lengths between 100 and 400 nanometres. Three UV categories are distinguished on the basis of wave length: UVC (100–280 nm), UVB (280–315 nm) and UVA (315–400 nm). The shorter the wave length, the more energy-rich the radiation. While UVC radiation is absorbed by the ozone layer, UVA and UVB radiation reach Earth's surface.

Value added Value created as part of a production process by a unit or branch of the economy. It is measured by comparing the value of goods and services produced less the value of intermediate consumption (excluding salaries) used to produce them. Value added is a gross figure because it is calculated without subtracting the value of fixed capital consumed during production. After adjustment (for taxes, subsidies etc.), the sum of the gross value added corresponds to the GDP (gross domestic product).

VOC see NMVOCs

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