



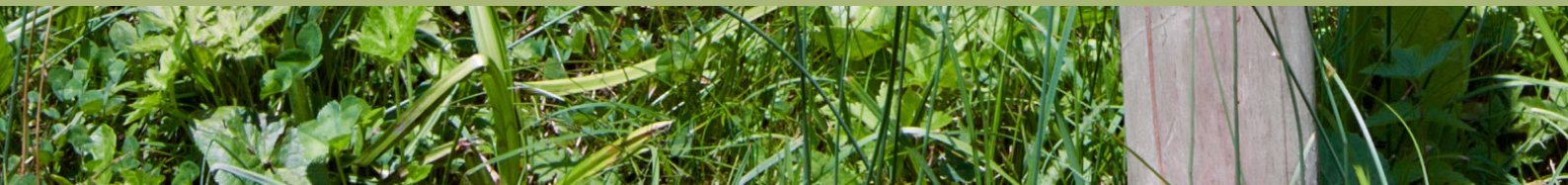
# Environment Switzerland 2013



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Swiss Confederation

Federal Office for the Environment FOEN



## Link types

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[Link to a chart \(» G6.1 ...](#)

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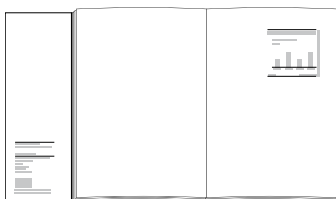
The pictograms combine information on state and trend

positive

neutral

negative

impossible to evaluate



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# **Environment Switzerland 2013**

Published by  
the Federal Office for the Environment FOEN  
Bern 2013

**Published by**

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

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**Source to be referenced**

FOEN (ed.), Environment Switzerland 2013, Bern 2013, 86 pages.  
Copying of this work for non-commercial purposes is authorised  
as long as the source is given.

**Writing completed on**

20 December 2012

**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](mailto:verkauf.zivil@bbl.admin.ch), [www.bundespublikationen.admin.ch](http://www.bundespublikationen.admin.ch)

**Order numbers**

810.400.081eng (English), 810.400.081f (French),  
810.400.081d (German), 810.400.081i (Italian)

**PDF file**

[www.bafu.admin.ch/ud-1070-e](http://www.bafu.admin.ch/ud-1070-e)

**Price**

CHF 8.– (incl. VAT)

**ISBN**

978-3-905782-88-2 (e), 978-3-905782-86-8 (f),  
978-3-905782-85-1 (d), 978-3-905782-87-5 (i)

**Language versions**

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

**Print run**

1,000 in English, 1,300 in French, 3,600 in German, 500 in Italian

**Paper**

Recystar, 100 % recycled paper

**Cover**

Cover photo: Bee hives at Hongrin (Vaud) queen breeding station,  
Yannic Bartolozzi

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**Acknowledgement**

The publisher 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 earth is a limited planet with a multitude of finite resources that do not regenerate on a human timescale. However, the human race is currently acting as though it had a second planet in reserve. This finding, which is presented in the new chapter of this report entitled “Global Megatrends”, also applies to Switzerland. It is only possible to reduce the pressure on natural resources by decoupling economic growth from environmental pollution. At international level, the efforts to achieve this are subsumed under the concept of the green economy. The Federal Council is tackling this issue through the Green Economy Action Plan and its indirect counterproposal to the popular initiative for a green economy.

Happily, the environmental impacts on the air and surface waters have declined considerably in recent decades. However, since the turn of the millennium, this success story has reached a standstill in some sectors as new substances are being produced that can cause new environmental impacts. These developments – for example in the area of nanotechnology – must be monitored closely and their eventual impacts should be minimised and eventually eliminated at source through product design. The upgrade of wastewater treatment plants to include an additional processing stage that can also prevent endocrine disrupters and other micro-pollutants from entering surface waters is currently being examined. Further efforts to reduce greenhouse gas emissions are needed throughout the world and in Switzerland, particularly in the transport sector.

Environmental policy incorporates all policy fields today. This is evident in the case of biodiversity, a field in which considerable action is still required. The pressure on animals, plants and ecosystems continues unabated. The Federal Council’s new Agricultural Policy 2014–2017 represents a welcome step in the direction of better compensation for agricultural services provided in the interest of biodiversity. The Swiss Biodiversity Strategy is another policy tool now available in this sector. In the medium term, the provision of sufficient lands of adequate ecological quality is crucial to the conservation of biodiversity.

This report by the Federal Office for the Environment uses data provided by its own sections and departments and by other federal authorities, in particular the Swiss Federal Statistical Office, which no longer acts as co-publisher of the report. A comprehensive and forward-looking environmental policy relies on good base data. In this spirit of furthering transparency in environmental matters, I wish you an informative and enjoyable read.



Bruno Oberle, Director  
Federal Office for the Environment

## Overview

The report “Environment Switzerland 2013” provides an overview of the current state of the environment in our country. It assesses the measures implemented by the federal authorities to improve the quality of the environment and identifies areas in which further action is required. It also presents the progress achieved in Switzerland in the global context.

Three important developments (known as “global megatrends”) are currently influencing the state of the environment worldwide: the progressive overuse of natural resources, the increasing pollution of the environment and the intensifying impacts of climate change. The consequences of these developments are also noticeable in Switzerland.

Swiss environmental policy has achieved many successes since the 1980s and reduced the pollution of the environment by certain contaminants. As a result, the country’s air quality has improved considerably over the past 25 years. The quality of surface waters and groundwater is also generally good today. The contamination of the soil by heavy metals, for example lead and cadmium, is generally declining and the first country-wide evaluation of the register of contaminated sites presents a positive picture: overall, there are fewer contaminated sites in Switzerland than was previously assumed (38,000 as opposed to the estimated 50,000) and the programme for the rehabilitation of contaminated sites is on target.

However, most of this progress, for example in relation to air and water quality, was achieved before the year 2000 and there has been little change since then. Ambient concentrations of certain pollutants (particulate matter, ozone, nitrogen oxides, ammonia) still regularly exceed the prescribed limit values. A large number of chemical substances (e.g. drugs, personal care products, plant protection products) are not filtered out by wastewater treatment plants and cause damage to ecosystems in the form of micropollutants.

Since the mid-1980s, more resources are used globally than are replaced through regeneration. Switzerland consumes over twice the volume of resources that can be sustainably provided by the earth. To meet its requirements for production and consumption, our country imports increasing volumes of raw materials, e.g. fuels and metals, feed and food. Over half of the environmental impacts generated through our domestic consumption arise abroad. In response to this problem, the Federal Council passed the Green Economy Action Plan in March 2013. The measures proposed in this plan shall contribute to fostering approaches to economic activity and consumption that conserve resources.

The pressure on Switzerland’s own natural resources is also high: the pressure on surface waters and landscape is growing through high energy consumption, increasing mobility and the constant expansion of settlement and transport areas. Soil continues to be sealed at a worrying rate. This is mainly reflected in the unsatisfactory state of biodiversity. To ensure the long-term conservation of biodiversity, the Federal Council passed the Swiss Biodiversity Strategy in April 2012. The federal authorities will develop an action plan by mid-2014 which will substantiate the strategy’s objectives. An important milestone has also been reached in the area of water protection: the revised Waters Protection Act contains provisions for the restoration of rivers and lakes so that they can fulfil their natural functions again and contribute to the conservation and promotion of biodiversity. The cantons must complete their strategic plans for the rehabilitation of watercourses and reduction of the negative impacts of hydropower production by the end of 2014. The first projects are already being implemented. However, Switzerland’s decision to withdraw from nuclear power and the associated expansion of hydropower production make the simultaneous task of conserving or re-establishing natural habitats and landscapes a challenging one.

Switzerland could be particularly severely affected by changes in the climate: according to new climate scenarios, an unchecked rise in global greenhouse gas emissions could increase temperatures here by over 6 °C as compared with pre-industrial times by the end of the 21<sup>st</sup> century. Despite the efforts made at international level, it has not been possible to stem the rise in greenhouse gas emissions up to now. Considerable action is also required in this area in Switzerland, particularly in relation to transport. Although the country has succeeded in reducing CO<sub>2</sub> emissions from heating fuels as compared with 1990 levels, transport-related emissions have continued to increase. Hence, the country's domestically and internationally defined emission-reduction targets could only be achieved through the purchase of emissions certificates for climate protection projects abroad. In the revised CO<sub>2</sub> Act, which came into force on 1 January 2013, Switzerland has set itself the goal of reducing its domestic greenhouse gas emissions by at least 20 % by 2020, as compared with 1990 levels. At the same time, the federal authorities shall also coordinate new measures for adaptation to climate change. The first part of the national strategy for adaptation to climate change was passed by the Federal Council in March 2012. The strategy shall be substantiated in a national action plan by the end of 2013.



# Introduction

The purpose of the Environment Switzerland reports is to provide clear and accessible information about the state of the environment and the associated trends as required by Swiss law (Federal Constitution, Environmental Protection Act and 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 2013” 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 eighth 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 with an interest 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, 2009 and 2011 reports which, in turn, were based on the standardised European DPSIR model.<sup>1</sup> 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

Where possible, the information provided in the graphics is evaluated using smileys. They indicate the state of the environment and the associated trends for each topic. Thus, the main findings of the report can be identified at a glance. The assessment of the diagrams was carried out by the relevant experts, based on their knowledge of the topic in question. If politically defined target or limit values exist, these formed the basis for the assessment. Additional information explaining the assessments presented in the diagrams is provided on the internet ([www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)).

The diagrams presented in the report are generally based on the data available up to the end of 2012.

<sup>1</sup> 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 and defined 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 summary presentation provides a rapid overview of the status of the environment and of the effectiveness of the measures taken to date. Under the heading “Action required” 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 topics.

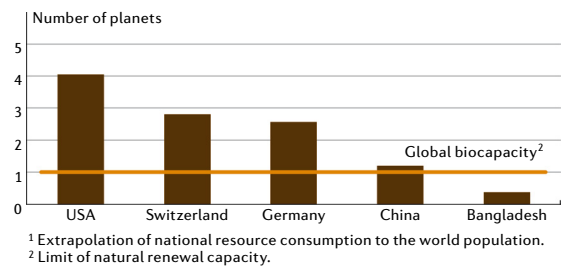
The topics addressed in this section are: Natural resources – Biotechnology – Chemicals – Ozone layer – Waste – Air – Climate – Water – Soil – Landscape – Biodiversity – Forests – Natural hazards – Major accident risks – Noise – Electromog – International cooperation.

## Natural resources

Switzerland has a vital interest in the long-term availability of non-renewable resources and in the global conservation of the regenerative capacity of nature. The consumption of resources in Switzerland is far in excess of the level that can be sustained by nature. To meet its requirements in terms of natural resources for production and consumption, Switzerland is heavily reliant on raw materials from abroad. The extraction, harvesting and processing operations required to produce the large volumes of animal feed, foodstuffs, fuels, metals and other materials imported into Switzerland pollute the soil, water and air and harm biodiversity and landscapes in the countries of origin. Considerably more than half of the environmental impacts arising from Swiss consumption occur abroad. Measures that promote a more sparing use of resources, an increased use of renewable energies and the closure of material cycles (e.g. through the recovery of reusable materials from waste) contribute to a more sustainable approach to scarce raw materials and the protection of human livelihoods.

**Action required** The country must intensify its efforts for the sustainable management and use of raw materials and natural resources, such as fertile soil and biodiversity. The term “green economy” refers to an economic approach which factors in the scarcity of finite resources and the regeneration capacity of renewable resources, and seeks to improve resource

## G1 Exploitation of natural resources per capita<sup>1</sup>, 2008



Source: Footprintnetwork

State

Trend

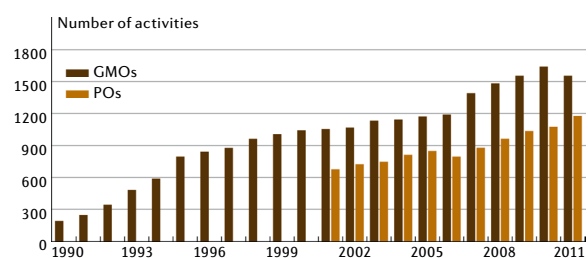
efficiency. As a result, overall economic performance and wellbeing will be enhanced. The Green Economy Action Plan of March 2013 contains measures which should help to bring the consumption of natural resources down to a sustainable level, thus preserving the livelihood of the present and future generations. Economic actors – both companies and consumers – need a meaningful, reliable basis for decision-making, as well as conditions that remain predictable in the long term and take better account of the environmental impacts and limited availability of natural resources.

## Biotechnology

The work carried out in research and industry increasingly involves pathogenic, genetically modified and alien organisms. Based on the risks they pose to human life and the environment, such activities are subject to reporting or licensing requirements. In 2008 the scope of the associated ordinance was extended to cover the release of alien organisms. Since then four applications have been submitted for release experiments involving invasive alien plants, and one for the release of a small alien invertebrate for pest control. No experimental releases of genetically modified organisms (GMO) have been carried out since 2011. The federal authorities commenced work on the development of a monitoring system in 2012 which will make it possible to establish whether genetically modified plants are present in the environment.

**Action required** The GMO moratorium of 2005, which prohibits the cultivation of genetically modified organisms in the agricultural sector, was extended up to 2017 by Parliament in December 2012. The administration has been mandated to develop a regulation by the end of 2017 which will show how GM agriculture and GM-free agriculture can co-exist. It shall also examine

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



Source: FOEN

State

Trend

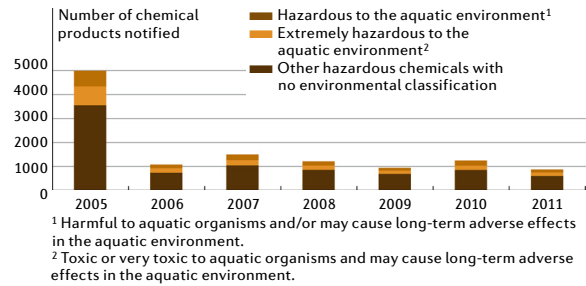
whether the designation of genetic-technology-free areas would be appropriate.

## Chemicals

The European Union (EU) has completely revised its chemicals law since 2007 and is thus setting new standards for chemical safety in Europe. The REACH Regulation concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals came into force the same year. The provisions for plant protection and biocidal products were also updated through comprehensive changes to the Regulation on the placing of plant protection products on the market in 2011 and to the Regulation concerning the making available on the market and use of biocidal products in 2012. To guarantee a level playing field in terms of health and environmental protection and to facilitate access to the European market for the chemical products of Swiss companies, Switzerland adopted key provisions from EU law into its national chemicals law. For example, in the case of particularly hazardous substances that are subject to authorisation in the EU, it adopted equivalent restrictions in its Ordinance on Chemical Risk Reduction. The federal authorities adapted the new rules for the classification and labelling of chemicals in the Chemicals Ordinance and defined binding transitional periods for their application. With regard to nanotechnology, considerable gaps currently exist in the knowledge of this field. Risks to health and the environment can arise from the production, use and disposal of nanomaterials and products manufactured from them. To enable the early recognition and control of these problems, the Federal Council's Action Plan "Synthetic Nanomaterials" contains provisions for a series of studies. These include, for example, the development of methodological and scientific bases (supplementation of OECD Test Guidelines, clarification of toxicological and ecotoxicological mechanisms of action, risk assessments), guidelines, and enforcement aids for self-monitoring by industry.

**Action required** The complete adoption of the REACH provisions by Switzerland would improve the level of protection afforded to human life and the environment and further reduce the associated costs and the administrative burdens for the Swiss industry. The conclusion of a chemicals agreement with the EU is a priority. The ongoing methodological and scientific studies for the implementation of the Action Plan "Synthetic Nanomaterials" shall continue until 2014. These studies will form the basis for the formulation of legal provisions for and risk assessment of nanomaterials.

### G3 Number of newly notified chemical products and their hazard classification



Source: FOEN

State

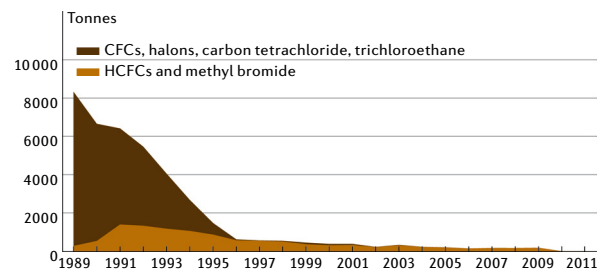
Trend

## Ozone layer

The ozone layer in the stratosphere protects living organisms from the damage caused by ultraviolet (UV) radiation. The manufacture and consumption of the main substances that damage the ozone layer have been prohibited by the Montreal Protocol since 1996 in industrialised countries and since 2010 in developing countries. Apart from a few controlled exceptions, Switzerland gradually banned these substances until their complete phase-out in 1995. Under the Protocol, the last group of substances, namely HCFCs, are to be completely phased out at the latest in 2030 in industrialised countries and in 2040 in developing countries. Switzerland will already ban them in 2015. Emissions of the four main groups of ozone-depleting substances have shown a marked decrease since 1990. However, because these substances are highly stable and linger in the atmosphere for a long time, the ozone layer, e.g. over Central Europe, is still around 5 % thinner than in 1980, and the UV radiation on the earth's surface is elevated. The depletion of the ozone layer over the Antarctic can exceed 60 % in the winter season; this is called the ozone hole. The ozone concentration over the Arctic can also decrease markedly, e.g. by up to 30 % in very cold winters like that of 2010/2011. The holes that form in the ozone layer as a result can extend far south – occasionally as far as Switzerland. The complete recovery of the ozone layer should take several more decades.

**Action required** Several thousand tonnes of ozone-depleting substances are still being used in Switzerland, e.g. in air-conditioning and refrigeration systems, fire-extinguishing systems, and in the foams used for thermal insulation. Additional efforts are required to ensure that these substances are destroyed as completely as possible during disposal of the associated systems and of building waste. In parallel, it must be ensured that the replacement substances used in upgraded or new devices do not act as strong greenhouse gases.

## G4 Imports of ozone-depleting substances

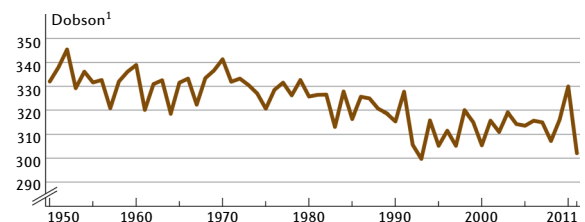


Source: FOEN

State 😊

Trend 😊

## G5 Ozone layer over Switzerland



<sup>1</sup> 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 were concentrated in a column of air on the ground, 330 DU would represent a 3.3-mm-thick ozone layer.

Source: METEOSWISS

State 😞

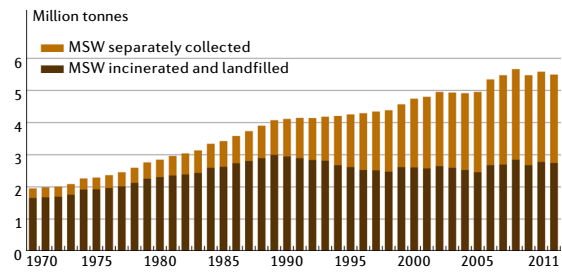
Trend 😞

## Waste

Due to population growth and increasing prosperity, the volume of municipal solid waste (MSW) generated in Switzerland has increased continuously over the past 40 years. In 2011, a total of 5.48 million tonnes or 689 kg per person of MSW were generated. As compared with a peak of 443 kg per capita in 1989, the proportion of non-recycled waste decreased to 344 kg. This waste is incinerated in an environmentally friendly way in the country's 29 waste incineration plants. The electricity and heat generated in the process cover approximately 2 % of Switzerland's energy consumption. Today, a good half of household waste is collected separately and recycled. Since 1990, the proportion of waste recycled has more than doubled. Around 1.8 million tonnes of hazardous waste is produced annually. This waste undergoes special processing, is disposed of domestically or exported and treated abroad in accordance with the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Despite the increasing volumes of waste, overall, there has been a strong decline in environmental pollution arising from waste management. Hence, the focus is now shifting to the environmentally friendly production and use of consumer goods. The polluter-pays principle has proven effective in the financing of waste management.

**Action required** To prevent a further increase in the total volume of waste generated and reduce the aggregate environmental impact of the production and consumption of goods, environmental factors should be given greater consideration in product design (eco-design and increased material efficiency). This favours a more sparing use or facilitates the recovery of non-renewable raw materials.

### G6 Municipal solid waste

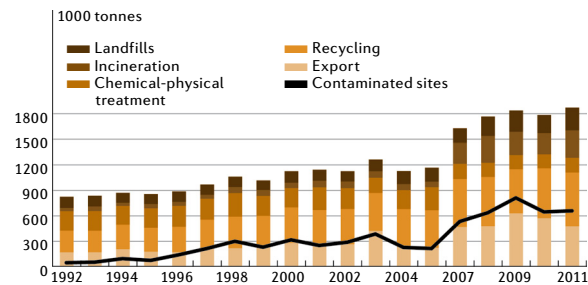


Source: FOEN

State 😞

Trend 😊

### G7 Disposal of hazardous waste in Switzerland



Source: FOEN

State 😊

Trend 😊

## Air

Air quality in Switzerland has improved substantially over the past 25 years. For example, sulphur dioxide emissions declined by over 80 %, and those of lead in particulate matter by over 90 %. However, the high concentrations of particulate matter (PM<sub>10</sub>), ozone (O<sub>3</sub>), nitrogen oxides (NO<sub>x</sub>) and ammonia (NH<sub>3</sub>) continue to cause damage to health and the natural ecosystems. In its current state, the air is responsible for between 3,000 and 4,000 premature deaths annually, 39,000 cases of acute bronchitis in children and health costs totalling approximately CHF 5.1 billion. Soil and groundwater quality are impaired by acidification, forests are becoming more unstable and the biodiversity of naturally nutrient-poor ecosystems like mires and Alpine heaths is suffering. The main causes of problematic pollution are motorised transport, agriculture and industry.

**Action required** To attain the objectives enshrined in the Air Pollution Control Strategy, which was updated in 2009, and reduce the emissions of nitrogen oxides, ammonia, particulate matter and volatile organic compounds (VOCs), Switzerland must consistently promote and use the best available techniques in motor vehicles and in agricultural and industrial installations. Examples of such technologies include particle filters for diesel engines, processes to remove NO<sub>x</sub> from exhaust fumes, and wood-fired heating systems with reduced particulate matter emissions. A systematic review of the options available for all main sources of emissions must be carried out. Considerable need for action exists in the area of ammonia emissions from agriculture. Measures for its reduction are planned, for example, in the context of the Agricultural Policy for 2014–2017. In relation to transboundary air pollution, Switzerland also supports the adoption of binding reduction targets at international level.

### G8 Exceedance of the ambient air quality standards of the Air Pollution Control Ordinance (OAPC), 2012

Ambient air quality standards

☺ Complied with ☹ Slightly/occasionally exceeded ☹ Considerably/frequently exceeded

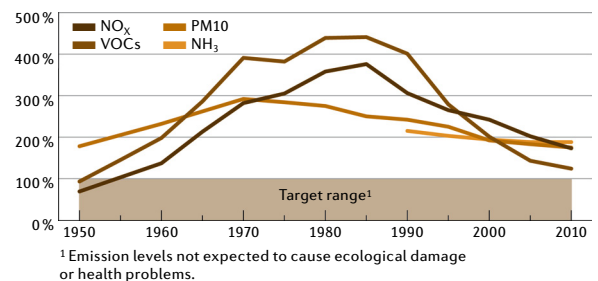
	Urban	Suburban	Rural
Nitrogen dioxide (NO <sub>2</sub> )	☹	☹	☺
Particulate matter (PM <sub>10</sub> )	☹	☹	☹
Ozone (O <sub>3</sub> )	☹	☹	☹

Source: FOEN

State ☹

Trend ☺

### G9 Air pollutant emissions



Source: FOEN

State ☹

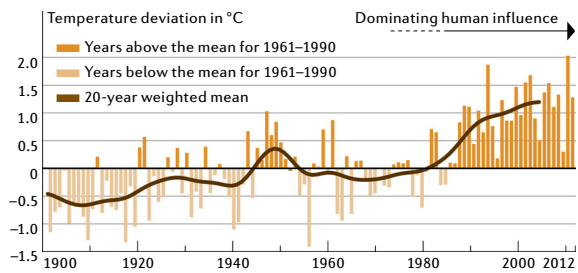
Trend ☺

## Climate

Temperatures in the past few years – in particular the record year of 2011 – are completely in line with the above-average values recorded in the recent past, both globally and in Switzerland. If global greenhouse gas emissions continue to increase unabated, according to new climate scenarios for the end of the 21<sup>st</sup> century, average temperatures in Switzerland could rise by over 6 °C as compared with values for the preindustrial period. This development would have far-reaching consequences for agriculture, forestry, winter tourism and hydropower production, for example, and would present various new risks to human health. Since 1990, Switzerland's greenhouse gas emissions have levelled off at between 50 and 54 million tonnes of CO<sub>2</sub> equivalents per year, or 6 to 8 tonnes per capita. When the emissions generated by imported goods are taken into account, this figure is 12 to 13 tonnes per capita. In accordance with its international commitment (Kyoto Protocol), Switzerland was supposed to achieve a reduction of 8 % in greenhouse gas emissions averaged over the period 2008–2012, compared with the level recorded for 1990. It can only reach this target by purchasing emissions certificates from climate protection projects abroad. The target set by the national CO<sub>2</sub> Act (10 % reduction in CO<sub>2</sub> emissions) for the period 2008 to 2012 cannot be achieved either without the purchase of additional foreign emission certificates. Although the country's overall CO<sub>2</sub> emissions have shown a slight decline since 1990 due to the marked reduction in the consumption of heating fuels, the CO<sub>2</sub> emissions generated by transport have risen considerably since 1990. The average temperature on earth has increased by around 0.7 °C over the past 50 years. To prevent the dangerous impairment of the climate system, global warming must be limited to a 2 °C increase as compared with the preindustrial period. This means that global emissions must be reduced by between 50 % and 85 % by 2050. Because it has not been possible to halt the rise in globally emitted greenhouse gases up to now, remaining within this limit poses an increasingly difficult challenge. The outcome of the 2011 UN climate change conference in Durban (South Africa) gives some reason for hope: it was decided there that a new global climate protection agreement shall be negotiated by 2015. This agreement shall contain binding emissions reduction targets for all states from 2020.

**Action required** The approach adopted with the revision of the CO<sub>2</sub> Act (at least 20 % reduction in domestic greenhouse gas emissions by 2020 as compared with 1990 levels) must be pursued consistently. Particular efforts to reduce transport-related emissions are required. The first steps towards the implementation of the national adaptation strategy must be initiated at the same time. This will enable the timely limitation of the damage arising from the impacts of climate change.

**G10 Annual mean temperature in Switzerland**  
Deviation from mean for 1961–1990



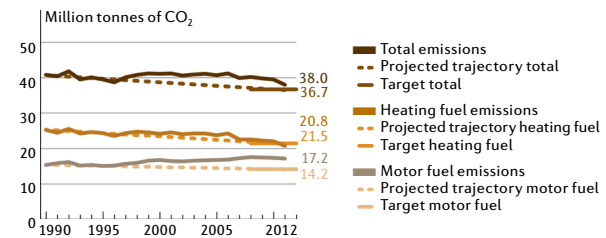
Source: MeteoSwiss

State

Trend

**G11 CO<sub>2</sub> emissions from heating and motor fuel consumption**  
Deviation of emissions from the projected trajectory based on the CO<sub>2</sub> Act

Deviation of emissions from the projected trajectory based on the CO<sub>2</sub> Act



Source: FOEN

State

Trend



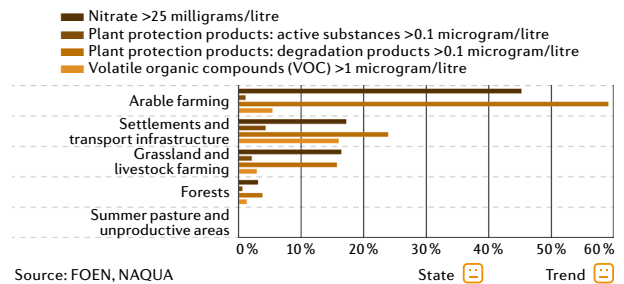
## Water

Despite the generally good quality of the groundwater, the legally required limit values for nitrate and plant protection products are not complied with throughout Switzerland. The main source of this pollution is agriculture. Thanks to wastewater treatment, the water quality in rivers and lakes has shown a marked improvement in recent decades. 97 % of the Swiss population is now connected to central wastewater treatment plants (WTP). As a result, there has been a strong decline in the contamination of waters by nutrients and pollutants. However, micropollutants such as endocrine disruptors continue to pass through the WTPs. Micropollutants have a negative impact on ecosystems and, even in minute concentrations, can make water unsuitable for use as drinking water. The ecological condition of one quarter of Switzerland's rivers and streams and numerous lakeshores, particularly on the Central Plateau, is poor due to the presence of hydraulic engineering structures and artificial obstacles. The operation of hydropower plants in many locations disrupts the natural function of water bodies and watercourses due to insufficient residual flows, the abrupt alteration of water surges and low flow phases (hydropreaking), restricted bed load transport and poor fish passability. The temperature of many rivers and streams has risen, in part as a result of the discharge of heated wastewater. This trend is likely to intensify due to the influence of climate change. The living conditions of aquatic organisms are likely to deteriorate as a result.

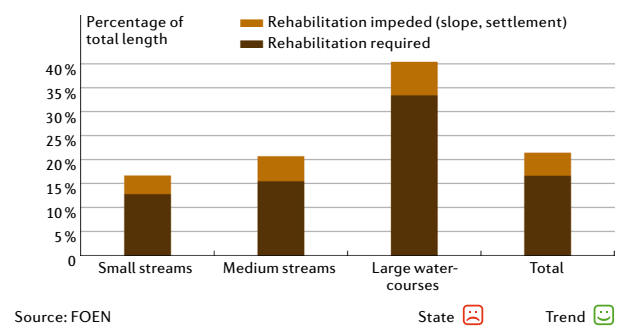
**Action required** The excessive concentrations of nitrate in many groundwater bodies must be further reduced through specific rehabilitation projects. To this end, agricultural activities must be adapted to the site in which they are carried out. In addition, the federal authorities are examining the introduction of a risk minimisation programme for plant protection products to enable the implementation of additional measures, for example in the area of user support. Micropollutants must be reduced through the addition of extra treatment stages in WTPs. Parliament has mandated the Federal Council to develop a polluter-pays financing system. The cantons must complete their strategic planning for the rehabilitation of watercourses and reduction of the negative impacts of hydropower production by the end of 2014. The first projects are already being carried out. However, the interest expressed by the cantons in rehabilitation projects exceeds the available finance. Switzerland's decision to phase out nuclear power and the associated proposed expansion of hydropower make the task of conserving and restoring near-natural habitats and landscapes a very challenging one.

### G12 Groundwater quality: monitoring sites with excessive concentrations of nitrate and artificial organic substances, 2011

Based on the main land use



### G13 Need for rehabilitation of watercourses, 2009



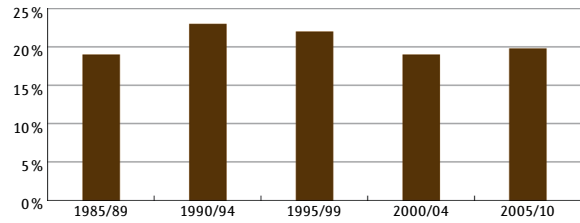
## Soil

The changes in land use in Switzerland continue: on average, almost 1 m<sup>2</sup> of agricultural land is lost every second, mainly to make way for transport infrastructure and settlements. Between 1983 and 2007, the proportion of sealed land increased by around 34 %. The chemical contamination of top soil is extensive. However, thanks to various measures, inputs of pollutants like lead, cadmium, copper and zinc have decreased. Nonetheless, individual uses of the soil continue to result in an increase in certain contaminants, in particular copper and zinc. Today, around 38,000 sites are registered as polluted by waste. Over 6,000 of these have already been surveyed and the measures to be taken defined. It is expected that 3,500 of these are contaminated sites requiring remediation. Remediation has already been carried out in over 700 cases.

**Action required** Unlike the EU, Switzerland does not have an integrated strategy for the sustainable management of soil. Such a strategy would have to guarantee that soil functions remain unimpaired in the long term or are capable of being restored if necessary. It would also have to guarantee that settlement development is consistently restricted to areas in which soil has largely already lost its other functions. With regard

## G14 Contamination of soils with heavy metals

Percentage of 97 monitoring sites with at least one measurement above the guide value for lead, copper, cadmium or zinc



Sources: FOEN; FOAG; ART

State

Trend

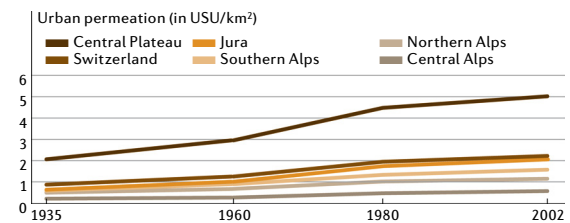
to polluted sites, the surveying of all sites in need of investigation shall be completed by 2015. Contaminated sites that pose an acute threat shall be remediated by 2017. Remediation measures for all other contaminated sites must be initiated by 2025 at the latest. The federal authorities provide funding of around CHF 40 million annually for the remediation of contaminated sites.

## Landscape

In its variety, beauty and uniqueness, the landscape is a valuable asset for society: it generates identity, influences well-being, characterises tourism destinations and provides habitats for flora and fauna. Varied and beautiful landscapes are important location factors and contribute hugely to the attractiveness of Switzerland. However, many landscapes are under pressure and declining in quality. Due to settlement and infrastructure development and the intensification of agriculture, they are becoming monotonous and impoverished in terms of natural spaces and cultural-historical testimonies. Landscape fragmentation and urban sprawl have increased markedly in the past 70 years. Productive agricultural land, open spaces and local recreational areas are being lost as a result of this development. The federal authorities support the preservation of the character of landscapes through corresponding management. It is planned to conserve and promote the qualities and services of the landscape for recreation and spatial identification purposes. The particularly valuable landscapes of the UNESCO World Heritage sites, the mire landscapes, the objects recorded in the Federal Inventory of Landscapes and Natural Monuments of National Importance (ILNM) and the Swiss parks have an important contribution to make here.

**Action required** Due to the continued pressure from land use and the considerable public interest in issues

## G15 Urban sprawl<sup>1</sup>



<sup>1</sup> The extent of urban sprawl, which is measured in "urban sprawl units (USU) per km<sup>2</sup>", 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

State

Trend

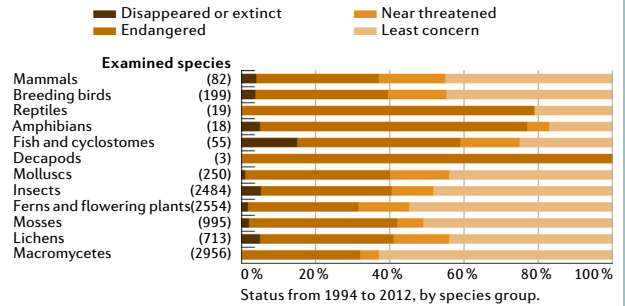
concerning the landscape, the federal authorities are intensifying the country's integrated landscape policy: they support the coherence of all spatially relevant policies, organise their own activities in a way that is compatible with the interests of the landscape, promote particularly valuable landscapes like mires, landscape inventory areas and parks of national importance, and guarantee the continued provision of landscape services, e.g. recreation and location quality. In terms of regulated landscapes, the impact of the ILNM must be improved so that the objects listed in the inventory retain their character and are upgraded. To this end, implementation of the inventory in the context of the spatially relevant sectoral policies shall be furthered. The Ordinance on the ILNM is currently being revised.

**Biodiversity**

Over the past century valuable habitats in Switzerland have suffered a stark decline. Since 1900, 36 % of the country's alluvial sites, 82 % of its mires and 95 % of dry meadows and pastures have been lost. According to the Red Lists, 36 % of the surveyed species, of fauna, flora and fungi are threatened. Little is known about the genetic diversity of wild species, and the genetic diversity of some important cultivated plant and livestock species is under threat. Biodiversity has come under pressure from changes in land use and water management, urban sprawl, soil sealing and the development of transport infrastructure, the spread of alien invasive animal and plant species, and the erection of hydroengineering structures. Poor biodiversity poses a threat to the services provided by ecosystems, for example the supply of drinking water, the mitigation of the effects of flood events following intensive precipitation, the provision of genetic resources for research, agriculture, nutrition and health, and the promotion of a good quality of life for humans.

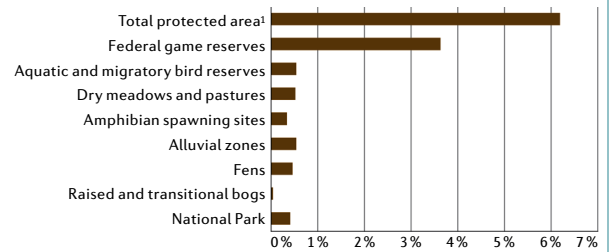
**Action required** With the Swiss Biodiversity Strategy (SBS), which was passed by the Federal Council in April 2012, the federal authorities aim to achieve a more sustainable use of biodiversity throughout Switzerland and guarantee the country's ecological infrastructure. This should provide sufficient space for the remaining near-natural habitats and improve their interconnection. Species whose populations cannot be guaranteed without special measures shall be specially targeted. Moreover, better use shall be made of the potential for biodiversity in settlement areas. Having passed the SBS, the Federal Council set a 24-month deadline for the development of an action plan. This will contain concrete measures for the implementation of the strategy's ten goals.

**G16 Extinct, endangered, near threatened and least concern species, per group**



Source: FOEN State Trend

**G17 Protected areas in Switzerland, 2010**



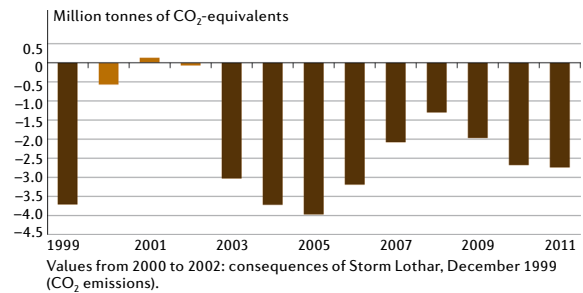
<sup>1</sup> Percentage of land area without overlaps. Source: FOEN State Trend

## Forest

Forests cover 31.8 % of the territory of Switzerland. In the five-year period from 2007 to 2011, forest area increased by around 300 km<sup>2</sup> or 1.8 %. This increase arose in the Alpine region where forest encroached on marginal agricultural lands and Alpine pastures that are no longer farmed. From 2007 to 2011, standing volume also increased further, i.e. by around 2 % throughout Switzerland. Accordingly, the forest acts as a CO<sub>2</sub> sink and contributes to the mitigation of climate change. The only region in which a further decline in standing volume was recorded was the Central Plateau. The services provided by forests (biodiversity, drinking-water supply, regeneration) are threatened, however, by high nitrogen inputs, which exceed the critical limit values in 95 % of forest area. The culprits here are ammonia from agriculture and combustion gases, which mainly originate from traffic.

**Action required** The Forest Policy 2020, which was passed by the Federal Council in 2011, states that better use should be made of the potential offered by sustainably harvested wood in Switzerland. This has not been the case in the Alpine region up to now. The protective function of forests must be guaranteed, and targeted improvements shall be made to biodiversity in areas in which deficits exist. Hence the proportion of forest reserves must be increased from the current 5 % to 8 % by 2020. Sufficient deadwood shall be available in all regions of Switzerland. The forest will be fundamentally conserved in its area and distribution (prohibition of deforestation). The effects of climate change shall be minimised through suitably adapted management and maintenance. The increased use of wood shall make a greater contribution to the reduction of CO<sub>2</sub> emissions (sink effect of wood used in construction) and substitution of fossil fuels.

**G18 Net carbon sink effect of forests**  
According to the Kyoto Protocol



Source: FOEN

State

Trend

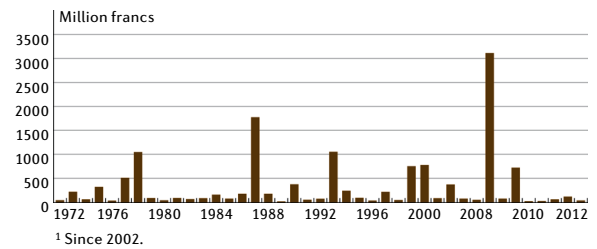
### Natural hazards

There has been a marked increase in the number of flood events in Switzerland since the 1970s. Between 1972 and 2011, the average annual cost of the damage caused by floods, debris flows, landslides and rockfall processes was CHF 340 million per year. Due to the increasingly intensive use of settlement areas and progressive climate change, it may be assumed that the damage caused by natural hazards will continue to increase. Hence, in addition to technical and biological-engineering measures, the consideration of such hazards in the context of spatial planning activities is becoming more important. Hazard maps provide the basis for regulations on the use of such areas and for the implementation of measures for the protection of individual structures. The maps will be finalised for all cantons by the end of 2013. The experiences of recent years have shown that it is also still necessary to improve the organisational aspects of hazard event management – e.g. the use of alerting systems.

**Action required** The knowledge gained from the hazard maps must be rapidly incorporated into the cantonal structure plans and communal land-use plans. Old hazard protection structures must be refurbished so that the control of processes can be guaranteed in the case of extreme hazard events (excess load). The hazard maps must be adapted periodically to reflect the latest knowledge status (hazard event analyses, climate change). In the area of warning and alerting, the co-operation between the federal authorities, cantons and communes shall be further intensified. The improvement of measurement and forecasting systems for storms and water hazards is particularly important at federal level. At communal level, the priority is the development of emergency plans and the training of natural hazard advisors. The risk-appropriate extension and maintenance of safety infrastructure, both technical (protective structures) and biological (protective forest), is also extremely important.

### G19 Damage caused by floods, landslides, debris flows and rockfall processes<sup>1</sup>

Data adjusted for inflation (base year 2012)

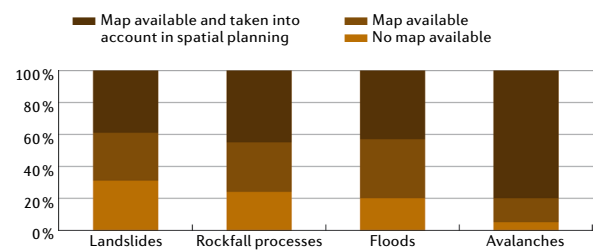


Sources: FOEN; WSL/SLF

State

Trend

### G20 Status of natural hazard mapping<sup>1</sup> at 1.1.2012



<sup>1</sup> Percentage of total Swiss land area mapped according to hazard type.

Source: FOEN

State

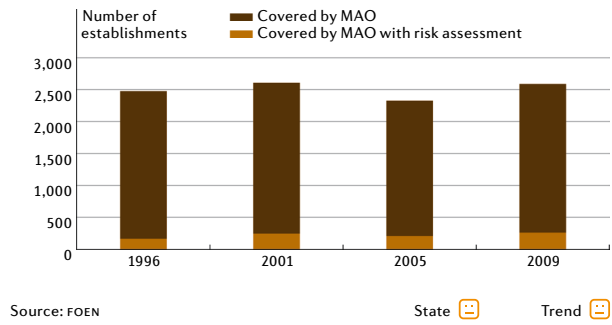
Trend

### Major accident risks

Establishments that deal with certain volumes of dangerous chemicals or with organisms that can cause harm to health and the environment, e.g. pathogens, pose a risk of major chemical or biological accidents. Other sources of risk include the transport of hazardous goods by road, rail and water. Since the beginning of 2013, around 2,200 km of high-pressure gas pipelines and 250 km of oil pipelines are also subject to the Major Accidents Ordinance. The owners of such installations are personally responsible for ensuring that all possible, state-of-the-art and financially viable, safety measures are taken to avoid major accidents. The relevant authorities assess the risks posed by the installations, and regularly monitor the implementation of the associated measures. Around 9% of establishments must submit and regularly update a risk report as a major accident can have very serious impacts for the population and the environment.

**Action required** Due to the increasing settlement density in Switzerland, it is essential that the coordination of spatial planning and major accidents prevention be improved. To ensure that such risks do not increase, a new article (coordination with structure and land-use plans) was added to the Major Accidents Ordinance at the beginning of 2013. If this article and the corresponding planning guide published by the

### G21 Establishments covered by the Major Accidents Ordinance (MAO)



Source: FOEN State Trend

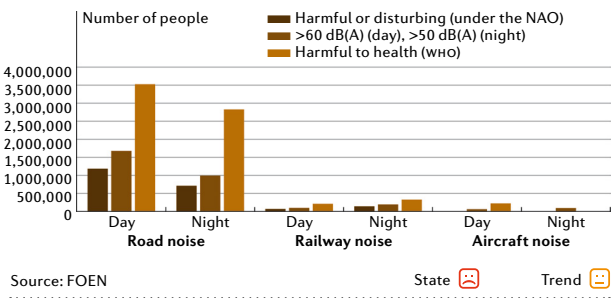
federal authorities are taken into account in the cantonal structure and land-use plans, settlements can develop further without undue risk to the population.

### Noise

Approximately 1.3 million people in Switzerland are exposed to excessive noise levels during the day and 930,000 at night. The main source of this noise pollution is traffic. The associated decline in property values and the health impacts caused by disturbance, sleep disorders, cardio-vascular problems and other diseases generate considerable costs. External costs of around CHF 1.26 billion per year are caused by road traffic noise; the corresponding figure for railway noise is around CHF 85 million. Because people with higher incomes avoid living in noisy neighbourhoods, noise also results in the social segregation of entire residential areas.

**Action required** More must be done in future to eliminate noise directly at source. Examples of such measures include: spatial planning measures, the use of low-noise tyres, low-noise road surfaces, an adapted transport regime and optimised driving behaviour. Previously, the focus was on noise abatement measures, such as noise barriers, whose effect is limited to a specific location and only affects the propagation of the sound. The federal authorities would like to further promote the reduction of noise at source by creating incentives. Railway companies already pay track access charges for their freight cars based on the level of

### G22 Number of people exposed to noise pollution by threshold value and type of noise, 2009



Source: FOEN State Trend

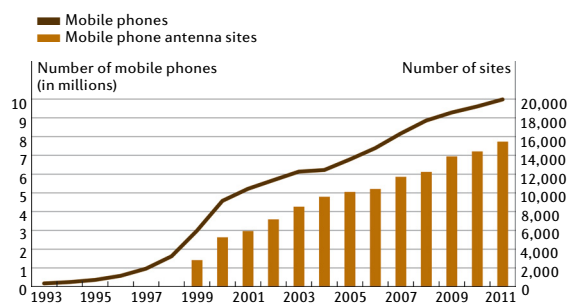
noise they generate. A model based on noise-dependent compensation payments is also currently being examined. This would oblige the emitters of noise to pay compensation to property owners for losses in value arising from noise pollution.

### Electrosmog

Everyday life is increasingly pervaded by the wireless applications of modern information and communication technologies. The receiving devices used by these applications rely on transmitters which generate non-ionising radiation (electrosmog). Radiation exposure is also rising with the growing number of radio applications and increasing data transfer rates. Electrosmog is also emitted by high-voltage power lines, transformer stations and household electrical appliances. The federal authorities implemented measures for the protection of the population against electrosmog by defining impact and installation limit values. The findings of the national research programme “Non-Ionizing Radiation – Environment and Health” (NRP 57), which was completed in 2011, support this approach: even if clear proof of the health risks arising from everyday exposure is lacking, the biological effects of electrosmog measured in the laboratory justify the adoption of strict installation limit values as practised up to now.

**Action required** The specification of installation limit values for places where people spend time regularly and for extended periods has proven effective and must be retained. Gaps in the knowledge about the long-term effects of non-ionising radiation must be filled through long-term studies. A monitoring system

### G23 Mobile telecommunications in Switzerland



Source: OFCOM

State  Trend

that records the population's exposure to electrosmog is required as a basis for this research.

### International cooperation

The conservation of life-sustaining natural resources is one of Switzerland's five foreign policy objectives. Switzerland has ratified numerous international conventions and plays an active role in most of the international organisations involved in environmental issues and sustainable development. The topics to which it is particularly committed include climate change, the protection of biodiversity, the management of water and forest resources, and the management of chemicals and waste. As part of the activities for the promotion of the green economy (in particular in the context of the Organisation for Economic Co-operation and Development OECD and the United Nations Environment Programme UNEP), Switzerland supports the improvement of resource efficiency and advocates a trade system that promotes sustainable patterns of consumption and production. Another important field of activity is its relations with the European Union (EU). Switzerland has been a member of the European Environment Agency (EEA) since 2006.

**Action required** The international environmental regime is in need of reform. Many environment-relevant decisions are made by influential organisations that do not primarily pursue environmental objectives (World Trade Organisation, WTO, World Bank, United

Nations Development Programme, UNDP). The lack of coordination between these organisations and the environmental institutions diminishes the effect of the international environmental protection activities. Hence, UNEP should assume a more prominent role in relation to other organisations. The strengthening of UNEP was decided at the Rio+20 conference through a resolution to open up the governing council to all Member States of the United Nations, and the formulation at regular intervals of an environmental strategy for the United Nations by UNEP. However, further reforms are necessary. The financing of measures for the efficient implementation of the environmental agreements in developing countries is a crucial challenge. This is carried out through both bilateral and multinational channels (e.g. Global Environmental Facility, GEF, Green Climate Fund). The developed countries stated in 2010 that they are willing to make USD 100 billion available annually from 2020 for measures in the area of climate protection. Important financing requirements also arise in the areas of biodiversity and the management of dangerous chemicals. The federal authorities would also like to improve the integration and standing of environmental issues in the context of Switzerland's bilateral relations with the EU.

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## II. State of the environment

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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 analyses. 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 trends, and the measures initiated.

The following topics are examined: Natural resources – Private sector and production – Households and consumption – Energy – Transport and mobility – Agriculture – Air quality – Climate change – Water – Soil – Landscape – Biodiversity – Forests – Natural hazards – Risk of major chemical and biological accidents – Noise – Electrosmog – Health.



# 1. Natural resources

The amount of raw materials and other natural resources consumed by Switzerland to meet its requirements is far in excess of the level that can be sustained by nature. The country is also heavily reliant on raw materials from abroad. A sustainable approach to natural resources necessitates more efficient resource use and the closure of material cycles whenever possible.

## Context

Human beings consume non-renewable resources on a vast scale and many renewable resources are being depleted faster than they can regenerate. Global forest area is shrinking, a large proportion of the world's fish stocks are overfished or at risk of overfishing, and the number of plant and animal species is decreasing (» WWF 2012).

The ecological footprint<sup>1</sup> is the measure used to demonstrate the scale on which human beings consume natural resources and produce greenhouse gases. The corresponding demand is measured against nature's regenerative capacity (» FSO 2006). If more natural resources are consumed than are regenerated on an ongoing basis, the ecological footprint is greater than one planet. Thus, if the global population consumed resources to the same extent as the Swiss population, it would require considerably more than twice the average amount of resources which the earth can sustainably provide per capita (» G1). Hence Switzerland uses up the capital of other countries whose resources it consumes. Indeed, it is only by importing nat-

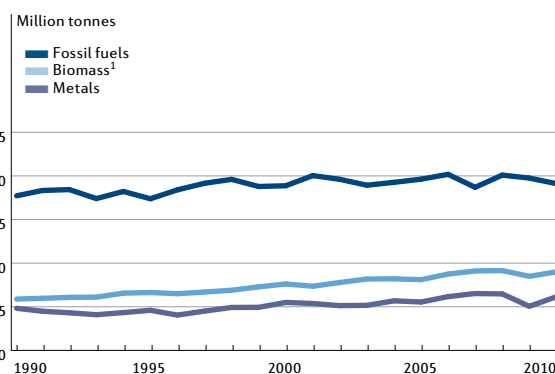
ural resources from abroad that Switzerland can maintain its very high level of consumption without drastically over-exploiting its own natural capital.

A comprehensive analysis of the environmental impact caused by Switzerland revealed that around 60% of the total environmental impact arising from Swiss consumption occurs abroad (» FOEN 2011a). Many raw materials and semi-finished products used in manufacturing and increasing numbers of finished products are being imported into Switzerland (» FSO 2012a). The environment in other countries is polluted by the mining and extraction of raw materials, their processing and by the transportation of products made from them, e.g. through energy and water consumption, through pollutant emissions and through interventions in natural ecosystems. Imports of the categories of materials that are most damaging to the environment (fossil fuels, metals, biomass) have been increasing for 20 years (» G1.1). The production of imported animal feed and foodstuffs (biomass) alone is responsible for one sixth of the total environmental impact caused by Switzerland (» FOEN 2011a).

Extensive use is also made of Switzerland's own natural resources: the pressure on watercourses, water bodies and the landscape is rising due to the high levels of energy »

<sup>1</sup> [www.footprintnetwork.org](http://www.footprintnetwork.org); Important environmental sectors that are not taken into account by the ecological footprint include, for example, the impacts of nuclear power and damage to health caused by air pollutants like particulate matter and NO<sub>x</sub>.

**G1.1 Imports of selected categories of materials**

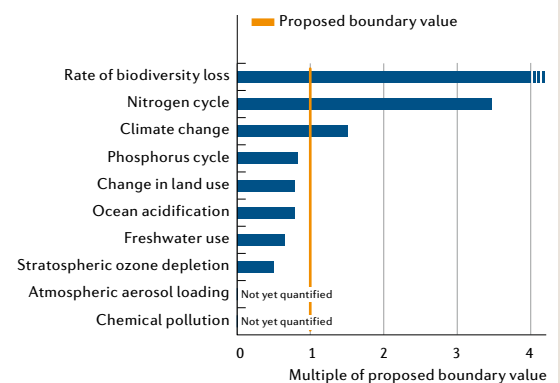


<sup>1</sup> Food and animal feed, wood, organic textiles, etc.

Source: FSO

State Trend

**G1.2 Boundaries of global natural systems, 2009**  
Current status as compared with the planetary boundary



Source: Rockström et al. 2009

State Trend

## Rare metals

Sectors like the Swiss mechanical and electrical engineering industries and the metals industry require metals like chrome, cobalt, lithium and platinum, the global availability of which is very limited. The complete closure of materials cycles is very important for such materials. Therefore, recycling systems and waste recovery plants effectively become production sites for secondary raw materials.

Sorting and separating technologies for discarded electronic devices and the recovery of metals from incineration plant slag help to ensure that scarce raw materials remain available for future use. This also reduces the major environmental impacts associated with the mining and extraction of these metals.

Because the rare metals are finely dispersed in waste, their recovery presents a technical challenge. Hence, the

federal authorities are actively involved in finding answers to the numerous questions that remain unanswered in relation to the development of efficient recycling technologies and the establishment of suitable collection infrastructure.

- › consumption, and soil sealing is progressing rapidly due to the constant increase in settlement and transport areas.

## Impacts

Since the mid-1980s, more natural resources are being used globally than are being replenished through regeneration. Hence, the natural capital for supplying the earth's population is shrinking steadily: groundwater levels are sinking, soils are being leached and sealed, forests and fish stocks are being decimated, and greenhouse gases are accumulating in the atmosphere. Vital resources will only be available to everyone in the long term if the environmental impact caused by the consumption of energy and goods decreases.

According to a study published in 2009, the earth's current level of resource consumption in three areas already exceeds the regenerative limits of natural systems (› Rockström et al. 2009): biodiversity loss, greenhouse gas emissions and nitrogen inputs into soils and water (› Chapter 19; G1.2). However, the closing of the ozone hole shows that rapid, resolute and coordinated action can solve global environmental problems. The use of ozone-depleting substances has been gradually prohibited since the late 1980s. As a result, the earth's protective ozone layer has stabilised and should have regenerated fully within the next few decades (› G5).

The reduction of resource consumption and the search for renewable alternatives to finite raw materials are a matter of global interest and are also of interest for Switzerland. On the one hand, the concern is to guarantee the numerous services provided to human well-being by intact ecosystems (› Chapter 18). It should be taken into consideration here that the intensive use of renewable resources can endanger other important ecosystem services. On the other hand, the existing dependence on raw materials of central importance for the economy and society should be reduced where possible. Examples of such raw materials include petroleum, which is an important basic substance for the energy supply and the chemical industry, phosphorous as an indispensable agricultural nutrient, and the rare metals (› Box "Rare metals").

## Measures

In March 2013, the Federal Council approved the Green Economy Action Plan. This plan aims to bring about an economic approach which factors in the scarcity of finite resources and the regeneration capacity of renewable resources, and seeks to improve resource efficiency. As a result, overall economic performance and wellbeing will be enhanced. The Green Economy Action Plan contains measures in the four priority areas consumption, production, waste and raw materials. It also states objectives and defines performance measurement, information policy and reporting obligations (› FOEN 2013a).

To facilitate progress in the sustainable use of natural resources at international level also, the federal authorities, together with other private and public institutions, support corresponding endeavours. These include, for example, programmes for the promotion of sustainable patterns of consumption and production (the United Nations Environment Programme's [UNEP] ten-year framework of programmes on sustainable consumption and production patterns, which was passed at the Rio+20 conference). Switzerland also supports the prioritisation of the liberalisation of markets for goods and services that enable the protective and efficient use of natural resources in the context of the World Trade Organisation (WTO). It also advocates the resolution of contradictions between global environmental and trade regulations. •

## Internet links

[www.bafu.admin.ch/state-resources](http://www.bafu.admin.ch/state-resources)

[www.statistik.admin.ch](http://www.statistik.admin.ch) » Topics » Territory and environment  
 » Environmental accounting (f, g)

[www.footprintnetwork.org](http://www.footprintnetwork.org)

[www.sdc.admin.ch/water](http://www.sdc.admin.ch/water)

## Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

## 2. Private sector and production

Environmental pollution in Switzerland as a production location is on a downward trend compared to economic production. At the same time, however, environmental damage arising in other countries as a result of Swiss consumption is on the increase. It is aimed to reduce resource consumption to a naturally sustainable level through the adoption of the green economy model.

### Context

Compared to many other countries, Switzerland as a production location generates relatively little domestic environmental pollution. The services sector, which employs almost three quarters of the workforce, is a dominant force in the country's economy, and Switzerland lacks highly polluting activities, such as heavy industry, fossil-fuel power plants and large-scale mining operations. However, besides imports of raw materials and semi-finished products, increasing volumes of finished products are being imported into Switzerland from abroad (» FSO 2012a).

The environmental impacts generated by domestic economic activity have not developed uniformly in recent decades. Although the Swiss economy's energy consumption has increased slightly since 1990, this increase is less pronounced when compared with economic development (» SFOE 2012a). The CO<sub>2</sub> emissions generated by economic activity have remained practically static since 1990 (» FOEN 2012a). Hence, in these two areas there has been a relative decoupling of economic development and environmental impacts. However, their absolute decoupling – that is a sustained decline in pollution despite ongoing growth – is not yet on the horizon. In the area of freight transport,

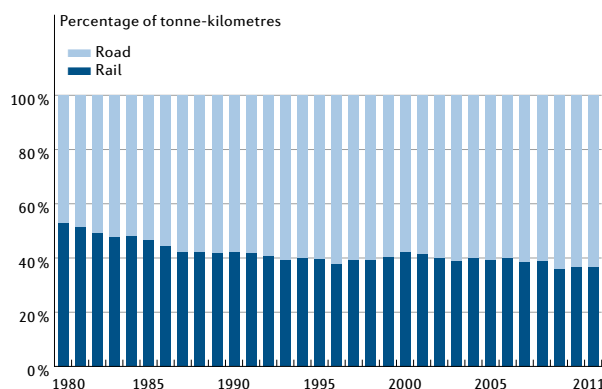
more goods are still transported by road than by rail and the trend is upward. Road transport is a major source of air pollutants, greenhouse gas emissions and noise. Whereas in 1980, 53 % of haulage capacity was provided by rail, by 2011, this figure had declined to 36 % (» G2.1). Over the same period, the total volume of goods transported almost doubled and thus grew at a faster pace than the economy over the past 20 years.

Ecological products and services are assuming an increasingly prominent role in the Swiss economy. Sales of resource-efficient and environmentally-friendly products and services in the areas of food production, construction, energy supply, water management, mobility, biotechnology and waste management, recycling, and environmental technology, in the narrow sense, grew by 6.3 % annually from 2001 to 2009 (» WWF 2011). This is clearly higher than the overall growth rate of the economy of 2.8 % (absolute and at current prices) (» FSO 2012b).

### Impacts

The manufacture of goods and provision of services consume resources and have impacts on the air, soil, water and biodiversity. Thanks to the efforts of the affected »

**G2.1 Modal split in freight transport**

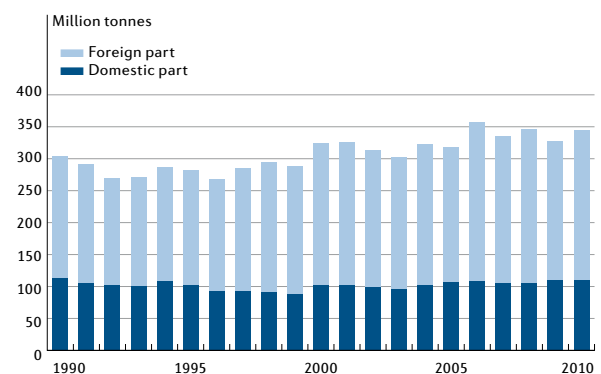


Source: FSO

State

Trend

**G2.2 Material requirement of the Swiss economy<sup>1</sup>**



<sup>1</sup> Total material requirement (TMR) of the Swiss economy, excluding water and air.

Source: FSO

State

Trend

## The role of Switzerland in international commodities trading

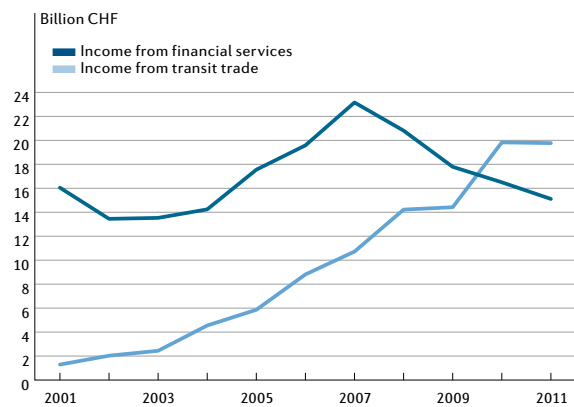
Switzerland is one of the world's biggest locations for commodities trading, in particular the trade in ores, metals and petroleum, and in agricultural products like grain and coffee. Thousands of experts in trading and finance are employed by the sector, in particular in the commodities trading centres of Geneva and Zug. The importance of commodities trading for the Swiss economy is growing rapidly: for example, in terms of turnover, the transit trade, which consists almost exclusively of commodities trading, has overtaken bank financial services in Switzerland (» G2.3). In 2011 the sales proceeds from transit trade totalled CHF 763 billion. This is far in excess of the Swiss gross domestic product of roughly CHF 560 billion (» SNB 2012).

The commodities sector has a major influence on global environmental pollution and, hence also, on the well-being of the populations in countries that are rich in commodities. As an importer and location of numerous important trading companies, Switzerland shares responsibility for the way in which raw materials are extracted, processed and marketed. For this reason, it is increasingly

committed to the international initiatives in this area. For example, Switzerland is one of the co-founders of the Kimberley Process against the trade in conflict diamonds. It is also a member of the Executive Board and a major sponsor of the Extractive Industry Transparency Initiative (EITI), the aim

of which is to ensure the maintenance of strict transparency standards in the mining and extraction sector. These standards should contribute to ensuring that the income from raw materials extraction is put to greater public-interest use in the countries of origin.

### G2.3 Income from transit trade compared with income from financial services



Source: SNB

State  Trend

› sectors (e.g. investments in more efficient machinery) and state regulations (e.g. introduction of limit values), the emissions of most pollutants have declined in Switzerland. However, considerable need for action exists in relation to the impacts of energy consumption and transport (greenhouse gas emissions, particulate matter, noise and pollutant contamination by freight transport) and of agriculture (impact on biodiversity, ammonia, nitrate and nitrous oxide emissions, soil compaction and erosion).

The importation of ever-increasing volumes of goods also gives rise to increasingly resource-intensive production processes abroad. Resource consumption due to the production and transport of imported goods for Switzerland is rising in the exporting countries. Imported products can be associated with very severe environmental impacts, for example when sensitive ecosystems like tropical forests are affected (» Chapter 19). There is no domestic fossil fuel and metal extraction in Switzerland. These particular goods, however, are source of particularly widespread environmental impacts during extraction and processing abroad (» G2.2).

## Measures

To improve the framework for the green economy, in March 2013, the Federal Council approved the Green Economy Action Plan (» FOEN 2013a). This should make it possible to reduce resource consumption to a naturally sustainable level and simultaneously strengthen Switzerland's economic performance. The Cleantech Masterplan, among other mechanisms, is intended to provide new impulses for greater resource efficiency and renewable energies (» OPET 2011). In addition, the good reputation of Swiss quality shall be developed and the opportunity availed of to position the "Swiss" brand at international level as a guarantee of resource-efficient and environmentally-friendly technologies, products and services.

New approaches in product design are assuming increasing importance with respect to the reduction of environmental impacts and achievement of greater resource efficiency by business. Material and energy consumption and costs can be reduced and repair and recycling capacity improved through innovative product design. To enable better use of the existing savings potential in the energy

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## Nanotechnology – the opportunities and risks

Nanotechnology is one of the most innovative areas of the chemicals industry. It facilitates the more environmentally sound design of existing products and services. For example, a special characteristic of titanium oxide particles enables them to break down dirt and smells when exposed to light. This makes them an interesting option for use in paints, varnishes and plaster for self-cleaning facades, and reduces the need of chemicals for cleaning purposes. The electronics industry also avails of the special properties of nanomaterials: depending on their arrangement, carbon nanotubes can act as insulators, semi-con-

ductors or metallic conductors. In addition to the scope they offer for the development of new products, they can also be used to substitute rare and, in some cases, toxic metals.

However, the use of nanomaterials is also associated with certain risks. Various studies have shown that due to their small size nanoparticles can enter the body with the inhaled air, access the blood via the lungs, travel around the body and penetrate other organs. Hence, the possible negative effects on human health and the environment must be identified as soon as possible. In 2008, the Federal Council passed

the “Action Plan for Synthetic Nanomaterials” and defined a programme of work that favours a responsible approach to nanomaterials. The first report on the status of implementation of this programme was published in April 2012 (» FDHA/FDEA/DETEC 2012).

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sector, the EU passed its Ecodesign Directive<sup>1</sup> in 2009. This directive formulates requirements in relation to the more environmentally-friendly design of certain products and product groups, and is based accordingly on the best technologies available on the market. While priority was originally focused on the energy consumption of products, today, the directive also covers products that do not consume any energy themselves but influence energy consumption (e.g. windows, insulating materials and car tyres). Thus, since November 2012, car tyres in the EU must have a label that rates their fuel efficiency, grip grading and rolling noise.

The use of standardised ecological product labels (e.g. energy label, cantonal buildings energy performance certificate (Gebäudeenergieausweis der Kantone, GEAK) is also increasing constantly in Switzerland (» Chapter 3). Consumers need reliable information on the environmental impact of products so that they can make environmentally-based and resource-conserving decisions. Hence, the federal authorities support the development of mechanisms for the provision of relevant, technically sound and comprehensible information that takes the entire product life cycle and all of the relevant environmental issues into account. This includes quality standards and methods for the comprehensive assessment of the environmental impact of products (known as life cycle assessments) (» FOEN 2009a).

Information about energy consumption and other product information can facilitate environmentally-aware purchasing decisions. Companies that already take their ecological responsibility into account when designing the product-range go one step further. Part of their range

consists only of products that fulfil certain minimum standards – e.g. wood products from cotton that is organically grown and processed in an environmentally friendly way. •

### Internet links

[www.bafu.admin.ch/economy](http://www.bafu.admin.ch/economy)

[www.bafu.admin.ch/state-chemicals](http://www.bafu.admin.ch/state-chemicals)

[www.bag.admin.ch/nanotechnologie](http://www.bag.admin.ch/nanotechnologie)

[www.cleantech.admin.ch](http://www.cleantech.admin.ch)

[www.statistics.admin.ch](http://www.statistics.admin.ch) » Topics » National economy

[www.statistik.admin.ch](http://www.statistik.admin.ch) » Topics » Territory and environment  
» Environmental accounting (f, g)

### Data download

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<sup>1</sup> Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (recast).

# 3. Households and consumption

Throughout the world, growing prosperity and population increase are affecting both the demand for resources and environmental pollution. Food, living and mobility play a particularly prominent role in this regard in Switzerland. The federal authorities aim to contribute to a more sustainable approach to natural resources through the provision of better environmental product information.

## Context

The Swiss population has grown around by 70 % since the mid-20<sup>th</sup> century. The threshold of 8 million inhabitants was exceeded in 2012. At the same time, the number of persons per household has shown a steady decline, and the average per-capita living space has increased considerably (» FSO 2012c).

Per-capita consumer spending has also increased, and in 2009 exceeded the 1990 level by 12 % in real terms. Almost one quarter of consumer spending goes on accommodation and heating, 14 % on food, beverages and tobacco, and 9 % on transport (» FSO 2010a). Along with the growth in population and consumption, the volume of waste generated in Switzerland has also increased considerably in recent decades. In 2011, every Swiss resident produced an average of around 2 kg of waste per day. Half of this waste was collected separately and recycled (» G6).

The average distance travelled per person and year, both at home and abroad, is over 20,000 km. Leisure mobility accounts for the vast majority of the distances covered. On average, each Swiss household has over 1.2 passenger cars. Fuel consumption in the road transport sector has

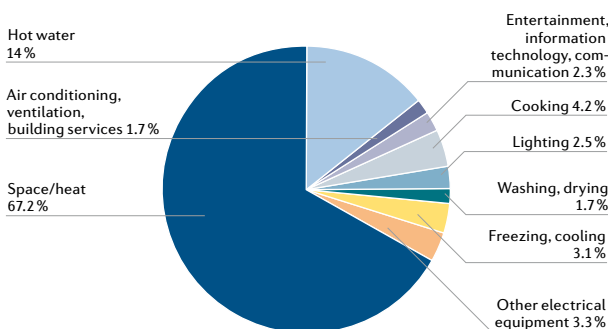
increased markedly since 1990, and a shift from petrol to diesel has also been observed (» Chapters 4 and 5).

Over 80 % of the energy consumption of private households (excluding mobility) is accounted for by heating, including hot water (» G3.1). Although the number of inhabitants and per-capita living space have risen, heating energy consumption has remained roughly constant over the past decade. Improvements in the energy standard of buildings and heating systems compensated for the increase in heated area. In terms of the energy sources used for heating, a shift can be observed from heating oil to natural gas and wood (» SFOE 2011a).

The consumption of goods generates environmental impacts not only domestically but also abroad. The proportion of raw materials, semi-finished products and finished products imported into Switzerland is increasing (» FSO 2012a). Hence, a holistic perspective must be adopted to obtain a comprehensive picture of the environmental impacts caused by Switzerland's consumption and production (» FOEN 2011a).

Together, the consumption domains of food, housing (including electricity and heat energy) and mobility are

**G3.1 Energy use by private households, 2011**

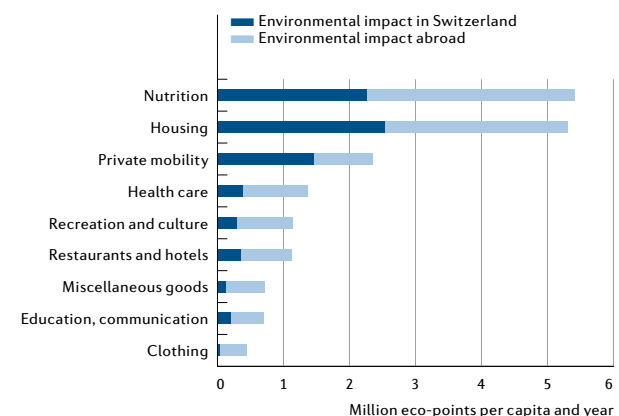


Source: SFOE

State

Trend

**G3.2 Environmental impact of different consumption sectors, 2005**



Source: FOEN

State

Trend

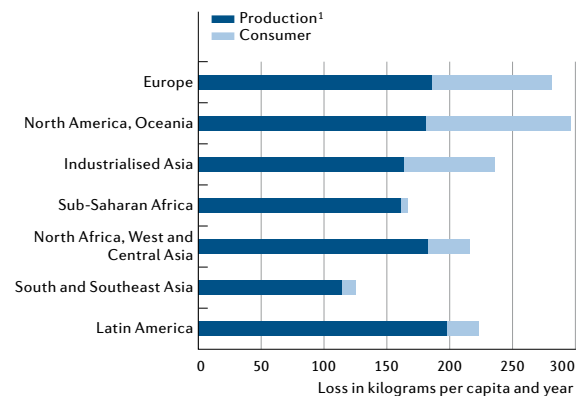
## Food waste – food losses and waste

According to a report compiled by the United Nations Food and Agriculture Organisation (FAO) one third of the food produced globally for human consumption is lost (» FAO 2011). Food losses and waste arise at all stages of the food system – i.e. during production, storage, processing, transport, wholesale, retail and consumption. In the economically highly developed regions (Europe, USA, parts of Asia), however, food waste arises mainly at consumption level, particularly in private households and in the catering trade (» G3.3).

This situation is problematic, first, on account of the scarcity of food in many developing countries, and, second, because it is associated with major – and in part avoidable – environmental impacts. In Switzerland, the federal authorities aim to develop concrete solutions for the reduction of food waste in cooperation with the affected actors,

and to raise consumer awareness of the phenomenon.

**G3.3 Global food losses and food waste, 2007**



<sup>1</sup> From agricultural production to wholesale and retail trade.

Source: FAO

State Trend

responsible for two thirds of the total environmental impact caused. Around 60% of the environmental impacts caused by Swiss businesses and households arise abroad (» G3.2). Mobility is the only consumption domain that causes greater environmental impacts at home than abroad.

Private individuals and professional purchasers working for companies or state authorities can influence environmental impacts considerably through their consumption behaviour. However, they often face a bewildering choice of offers which, in addition to varying in terms of environmental friendliness, also differ strongly in relation to their price, quality, functionality, appearance, etc.

To be able to act in an ecologically responsible way, consumers need relevant, reliable and easily understandable information (» FOEN 2012b). This requirement is far from being fulfilled in all cases at present. In many cases, the information provided often relates only to selected characteristics such as energy consumption or production type. Other aspects – e.g. information about the materials used, the impacts on sensitive ecosystems in the country of production and the environmental impacts arising from the product disposal – are ignored.

### Impacts

In the consumption domains of housing and mobility, air pollutants and greenhouse gases arise from the extraction, processing and use of fossil heating and motor fuels. Residential buildings and transport infrastructure involve the

sealing of soil and require a lot of material for their construction and maintenance. Moreover, transport is a considerable source of noise.

The importance of the resource consumption and environmental impacts generated by the construction and operation of buildings and by transport was already recognised years ago and is the object of numerous environmental protection measures (» Chapter 4 and 5). The awareness of the influence that nutritional habits can have on resource consumption and environmental impacts is only increasing gradually.

Meat and milk products are important foodstuffs in Switzerland. Producing the imports of feed for Swiss livestock alone requires a cultivation area almost as big as Switzerland's open arable area (» Vision Agriculture 2010). The consumption of products like coffee, cocoa and palm oil, which are not produced in Switzerland, also has comparatively high environmental impacts. In some cases, the production and processing of such goods requires a lot of energy, water, fertiliser and plant protection products, and the demand for ever-increasing arable areas threatens tropical rain forests.

### Measures

When it approved the Green Economy Action Plan in March 2013, the Federal Council commissioned the administration to cooperate with the private sector in developing measures for improving the information provided on the envi- »

› environmental impact of products (» FOEN 2013a; Chapter 2). Two recommendations are foremost with respect to the requirements for environmental product information: relevance and a holistic approach. Information is relevant if it enables the consumer to select ecologically advantageous products and avoid problematic ones. Adopting a holistic approach means that all important environmental impacts throughout the life cycle of a product – from raw materials extraction to waste disposal or recycling – are included in the assessment.

Because the variety of products involved is so extensive, it must now be clarified with the stakeholders (retailers, producers, environmental and consumer protection organisations) how scientifically sound environmental information can be provided for goods with a high environmental impact at an acceptable cost. A further challenge consists in processing the information in such a way that it will be noted and understood by potential buyers, and will provide useful indicators to producers and retailers for the assessment and optimisation of their product ranges.

The public sector already provides information for raising public awareness and decision-making support on the reduction of environmental impacts, for example in the form of teaching materials (» FOEN 2008, 2012c). The federal authorities introduced a mandatory energy label for passenger vehicles in 2002. It was completely updated in 2011 and, in addition to fuel consumption, now also contains information about CO<sub>2</sub> emissions and energy efficiency in relation to the kerb weight. Trade is also obliged to indicate the energy consumption of various electrical household and office devices and for lamps.<sup>1</sup> With the cantonal buildings energy performance certificate (Gebäudeenergieausweis der Kantone, GEAK), a mechanism was created in 2010 which shows buyers, tenants and property owners how much energy a residential building requires for standard use in relation to heating, hot water, light and other electrical loads, and the areas in which potential for improvement exists.<sup>2</sup>

Information alone is not enough, however, to promote environmentally friendly behaviour. The fact that a combination of information and financial incentives and attractive infrastructure can be very successful is demonstrated, for example, by the separate collection of waste. The Environmental Protection Act stipulates that the cost of the disposal of household waste must be borne by the polluter. A refuse bag fee (pay per bag disposal) is charged by most Swiss communes today and a dense network of collection points for recyclables exists. In addition, advance disposal fees are also levied to finance the appropriate disposal of waste that can be given special treatment or recycled (e.g. glass, electronic devices and batteries). Switzerland has this approach to thank for the high response rates for different recyclables. As a result of the introduction and development of separate waste collection,

the per-capita volume of waste that must be incinerated declined before stabilising at this lower level (» G6).

The public service is also an important consumer. Public authorities spend around CHF 32 billion annually on the construction of infrastructure and buildings, the procurement of vehicles, equipment, work wear, office material, etc., and the acquisition of third-party services. Approximately one fifth of expenditure arises at federal level and the cantons and communes each account for two fifths. The federal authorities aim to act as a model here by creating a demand for goods and services and buildings that are economical, environmentally friendly and non toxic throughout their entire life cycles, and are also produced in a socially responsible way. The necessary tools and training are provided to those responsible for procurement. The implementation of sustainable public procurement will be documented at federal level in future with the help of a monitoring instrument designed for the purpose. •

#### Internet links

[www.statistics.admin.ch](http://www.statistics.admin.ch) » Topics » Population

[www.statistics.admin.ch](http://www.statistics.admin.ch) » Topics » National economy

[www.bafu.admin.ch/state-wastemanagement](http://www.bafu.admin.ch/state-wastemanagement)

[www.bafu.admin.ch/products](http://www.bafu.admin.ch/products)

[www.labelinfo.ch](http://www.labelinfo.ch) (f, g)

[www.kompass-nachhaltigkeit.ch](http://www.kompass-nachhaltigkeit.ch) (f, g)

#### Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

<sup>1</sup> [www.energieetikette.ch](http://www.energieetikette.ch)

<sup>2</sup> [www.geak.ch](http://www.geak.ch)



# 4. Energy

Swiss energy policy is in the midst of radical change. The planned closure of Switzerland's nuclear power stations has given a new impetus to the promotion of energy efficiency and renewable energy sources. The interests of environmental and landscape protection must be taken into account in the necessary development of renewable energy sources.

## Context

Switzerland's energy consumption is strongly influenced by the weather and economic development in the short term. From a longer-term perspective, it is increasing as a result of the rise in population, per-capita living space and the motor vehicle stock, in particular. Technical advances, political measures for the reduction of energy consumption and improvement of energy efficiency, and the shift towards less energy-intensive industry sectors are dampening consumption.

Irrespective of the weather-related variations in the demand for heating, final energy consumption in Switzerland increased by 0.9 % per year between 2000 and 2010. While electricity, natural gas and diesel consumption increased considerably from 2000, there was a strong decline in the consumption of heating oil and petrol (» SFOE 2011b). Overall, around two thirds of Switzerland's energy needs are currently covered by fossil fuels.

Between 2000 and 2011, the share of final energy consumption accounted for by renewable energies (hydropower, wood, sun, biogas, ambient heat and biogenic fuels) grew from 16 % to 19 %. At four fifths, the biggest contribution here is made by hydropower and wood. If electricity is considered in isolation, renewable energies accounted for 49.5 % of consumption in 2011; this contribution originated almost exclusively from hydropower. In the case of heat generation, 16.6 % of the energy consumed came from renewable sources, a good half of which in the form of wood. Renewable energies (biogenic fuels, biogas) play a minor role when it comes to meeting the demand for motor fuels (» SFOE 2012b; G4.1).

The severe earthquake in Japan in March 2011 and the resulting disaster at the Fukushima nuclear power plant prompted a rethink in Swiss energy policy. In May 2011, the Federal Council decided to refrain from constructing new nuclear power plants and to implement a gradual withdrawal from nuclear power. This decision was supported by Parliament with the referral of numerous parliamentary procedural requests in summer and autumn 2011.

## Impacts

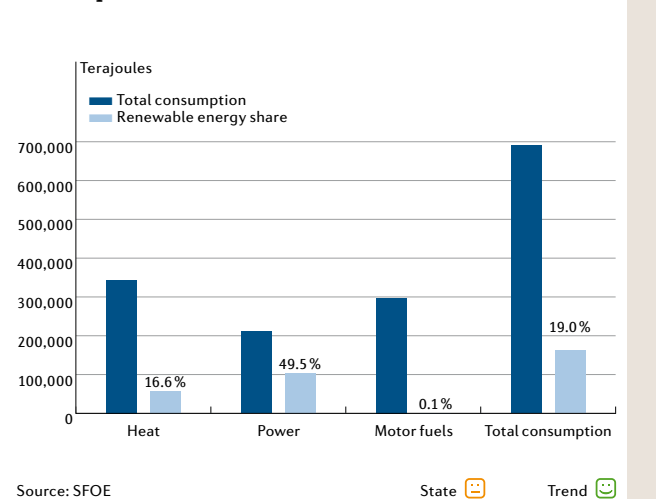
The extraction and use of fossil energy carriers has a particularly strong impact on the environment. Air pollutants

and greenhouse gases are emitted through the combustion of these fuels. Moreover, considerable environmental risks are associated with the extraction and transport of fossil heating and motor fuels.

The use of renewable energy sources also has impacts on the environment and landscape, including water, and can give rise to conflicts of interest. For example, small hydropower projects located on natural stretches of water, which are valuable from an ecological and landscape perspective, and wind power plants located in landscape protection areas and close to settlement areas – for noise protection reasons in this instance – come into conflict with environmental law. Regulations for the protection of waters must be taken into account in the development and optimised operation of existing large hydropower plants. Air pollution control and the numerous services provided by the forest must be taken into account in relation to the use of wood energy. Moreover, wood should be primarily used as a raw material or construction material and only secondarily as fuel.

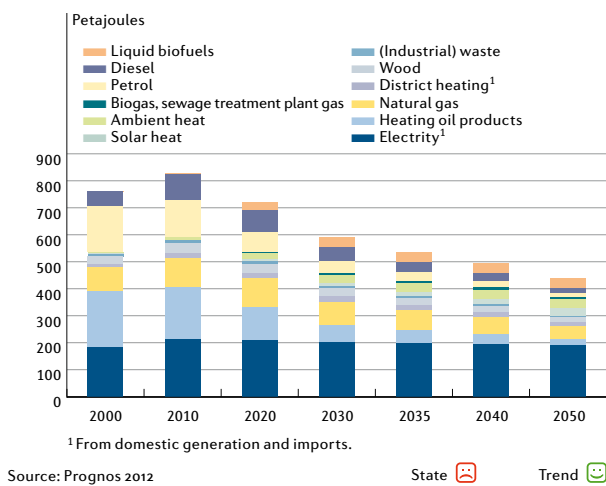
Another potential area of conflict between energy supply and environmental protection is the development of »

**G4.1 Renewable energy share of final energy consumption, 2011**



#### G.4.2 Final energy demand by energy carrier

Development according to Energy Strategy 2050



transmission systems for electricity. In addition to their negative impacts on the landscape, overhead power lines are also associated with electromog impacts. However, radiation impacts must also be taken into consideration when cables are buried.

Finally, with the gradual withdrawal from nuclear power, the problem of the long-term storage of radioactive waste remains an ongoing one. At the end of 2011, the Federal Council decided to have six possible sites examined in detail for this purpose. The search for sites should be completed in around 10 years' time.

### Measures

In its Energy Strategy 2050, which was launched in 2011, the Federal Council proposes to rely on an energy supply that consistently exploits the savings potential that exists in the use of electricity and heating and motor fuels, further promotes the development of new energy sources and reduces the country's considerable dependency on fossil energy carriers (» SFOE 2012c). The development of the electricity supply network is also necessary to guarantee a secure electricity supply for Switzerland with the withdrawal from nuclear power.

If the trend in energy consumption remains unchanged, the demand for electricity will increase constantly in the decades to come and by 2050 it will exceed the 2010 level by almost one third. At the same time, a replacement must be found for the contribution made by nuclear power to the electricity supply up to now. It is intended to meet future demand by increasing the supply from existing hydropower plants, by expanding the use of renewable energies and through greater energy efficiency. Until these measures take effect, electricity demand will have to be covered temporarily by imports of electricity generated from renewable energy sources. If unavoidable, as a transitional solution, electricity will also be generated from fossil energy carriers (new co-generation plants or larger fossil-thermal power plants). To ensure that Switzerland's

climate policy objectives are not compromised, any additional CO<sub>2</sub> emissions generated must be completely compensated for.

According to the Federal Council's new strategy, considerable scope exists for increasing efficiency and promoting renewable energy sources in meeting the future demand for energy in the areas of heat generation and mobility. The exploitation of this scope will involve a marked change in Switzerland's energy supply structure (» G.4.2).

The package of measures associated with the Energy Strategy 2050 complements and extends various other measures and programmes that already make important contributions to the fulfilment of Switzerland's energy policy objectives today:

- The SwissEnergy programme and the federal authorities' constantly tightened efficiency requirements shall be continued.
- The "competitive tenders" mechanism has been implemented since 2010. With its help, the federal authorities support projects and programmes in industry, services and households that achieve electricity savings potential as cheaply as possible.
- The cost-covering remuneration for feed-in to the electricity grid (CRF) was introduced in 2009 to ensure a continuous increase in the contribution of eco-electricity in the years to come.
- Other important elements of federal energy and climate policy include the federal and cantonal buildings programme, the voluntary CO<sub>2</sub> reduction targets adopted by companies, the cantonal energy regulations (» Chapter 8) and the CO<sub>2</sub> emissions regulations for passenger vehicles (» Chapter 5).

In the course of the further substantiation of the package of measures, care will be taken to ensure that environmental law provisions and the limited potential for the sustainable use of renewable energies from the perspective of environmental protection will be respected. Hence, among other things, suitable locations must be designated by spatial planning (» Swiss Academies 2012). This will create the necessary legal certainty for investments in electricity generation.

#### Internet links

[www.statistik.admin.ch](http://www.statistik.admin.ch) » Themen » Energie (f, g)

[www.bafu.admin.ch/energy](http://www.bafu.admin.ch/energy) (f, g)

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# 5. Transport and mobility

The increase in traffic is one of the key challenges facing environmental policy. The mode of transport used is not the only important factor here. Spatial planning can contribute to reducing the overall environmental impact of increasing traffic volumes.

## Context

Domestic traffic volumes and the cross-border transportation of people and goods are increasing constantly. In addition to population growth and rising prosperity, the main reasons for this development include the progressive spatial separation of functions like living, work and shopping, and an increasingly specialised and globalised economy (» G5.1).

According to the 2010 microcensus on mobility and transport (» FSO/ARE 2012), in 2010, Switzerland's residential population covered a distance of around 13,600 km per capita within the country's borders. This was supplemented by a further 6,900 km travelled abroad (in particular air kilometres). Over half of this total distance of 20,500 km was accounted for by holiday and leisure travel. Most of the per-capita distances travelled domestically each year are also due to leisure traffic. Work and shopping are the second and third most common reasons for the distances travelled (» G11.3).

At 421,000, the number of newly registered motorised road vehicles reached a peak in 2011 (» FSO 2012d). Four out of five Swiss households have at least one passenger vehicle at their disposal. The increase in the number of vehicles contrasts with the downward trend in mileage<sup>1</sup> per vehicle: the space required for vehicles is increasing while the use made of them declines.

Between 2000 and 2010, the extension of services and low price of public transport – due to subsidies – prompted an increase of approximately 52 % in rail transport<sup>2</sup> in Switzerland. This is over five times higher than the corresponding rise in private motorised transport (+ 9%). Despite this, however, the car remains by far the dominant mode of transport (» FSO 2012e).

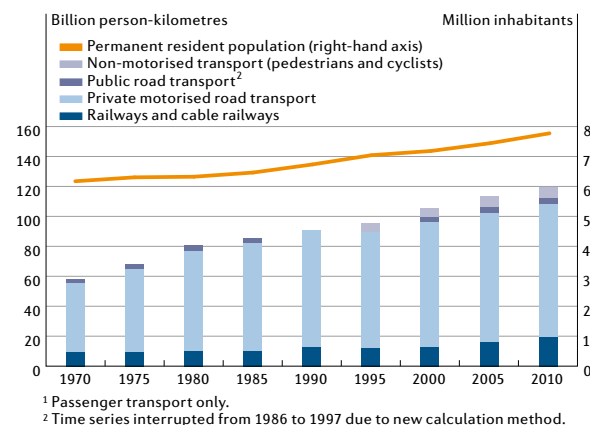
The impact of choice of transport mode on environmental pollution is considerable: a journey in a passenger vehicle occupied by one person in Switzerland generates around four times more CO<sub>2</sub> emissions than a journey in an intercity bus with average occupation, and around 20 times more than a journey in a regional train with average occupation.<sup>3</sup> Although a further decrease in CO<sub>2</sub> emis-

sions from newly registered passenger cars has been observed since 2007, at 155 g per km in 2011, they were still higher in Switzerland than in all of the EU states apart from Latvia and Estonia (» DETEC 2012a; EEA 2012; G8.2).

The vehicle-kilometres travelled by freight transport on Switzerland's roads increased by 12 % between 2000 and 2010 (average for light and heavy freight vehicles). The increase in the volume of goods transported, in particular on transit routes, was particularly strong due to the gradual increase in the authorised total weight of freight vehicles. Between 1984 and 2011, the market share of rail in transalpine freight transport decreased from 86 % to 64 % (» DETEC 2012b). According to the target for the modal shift from rail to road in transalpine freight transport, only 650,000 heavy goods vehicles should be allowed to cross the Alps annually. It will not be possible to reach this target under current conditions.

The rapid rise in commercial air traffic in the 1980s and 1990s was followed by a considerable slump between 2001 and 2004 (terror attacks in New York, grounding of Swissair). In 2011, around 450,000 take-offs and landings by regular and charter services were recorded in Switzerland. Due to the improved occupancy of aeroplanes, passenger numbers were a good 20 % higher than in 2000. Hence, the long-term trend for the increasing use of aeroplanes continued. »

## G5.1 Population and transport development<sup>1</sup>



Source: FSO

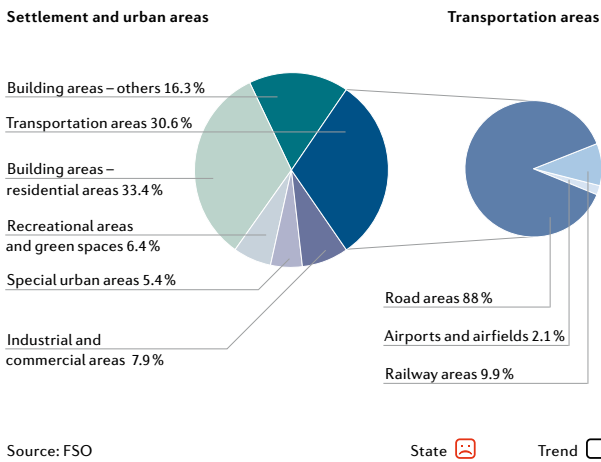
State

Trend

<sup>1</sup> This is expressed in vehicle-kilometres and represents the total of all kilometres travelled by individual vehicles in a year.

<sup>2</sup> This is expressed in person-kilometres and corresponds to the total number of kilometres covered by the transported persons annually.

<sup>3</sup> [www.mobitool.ch](http://www.mobitool.ch) » Tools » Interaktiver Vergleich von Verkehrsmitteln (f, g).

**G5.2 Land use by transport infrastructure, 2007**  
 25 cantons (excl. Graubünden)


volume increases, transport-related environmental problems will remain prominent.

To optimise cooperation in the context of spatial planning and achieve better coordination of transport and settlement development, the federal authorities together with the cantons, cities and communes developed the Spatial Strategy for Switzerland (Raumkonzept Schweiz) (» DETEC/CCG/DPPE/SVC/ASC 2012). This recommends that, in future, areas that already have good public transport links should be developed. Compact agglomerations, condensed settlements and the creation of centres in rural areas offer the best conditions for achieving more environmentally friendly mobility.

To improve the situation in areas subject to high traffic volumes, since 2007, public transport and non-motorised transport are being given targeted promotion through agglomeration programmes. The services provided for rail passenger and freight transport will be developed from 2013 through the Future Development of Railway Infrastructure (Zukünftige Entwicklung der Bahninfrastruktur, ZEB) project.

The main focus of efforts to reduce the noise pollution caused by road and rail transport is on measures that reduce the generation of noise at source, i.e. measures involving vehicles, roads, transport regimes and adapted driving practices. Switzerland is also committed at international level to the reduction of noise emission limits for road transport vehicles and the fitting of rail freight cars – a considerable source of noise in rail transport – with low-noise brakes.

The SFOE's SwissEnergy programme and the revised CO<sub>2</sub> Act provide a range of measures for reducing energy consumption and CO<sub>2</sub> emissions generated by transport. In particular, from 2015 – as is already the case in the EU – new passenger cars may not emit more than 130 g CO<sub>2</sub> per km. This target is being implemented gradually from 2012. Between 2012 and 2020, this measure is expected to yield an average annual reduction in CO<sub>2</sub> emissions of 1 million tonnes and annual fuel cost savings of around CHF 770 million.

**Internet links**

[www.statistics.admin.ch](http://www.statistics.admin.ch) » Topics » Mobility and transport

[www.bafu.admin.ch/transports](http://www.bafu.admin.ch/transports) (f, g)

[www.bav.admin.ch](http://www.bav.admin.ch)

**Data download**

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

**Impacts**

Transport requires almost as much space as living. The area occupied by road, rail and air traffic infrastructure corresponds to around one third of settlement area (» G5.2). It contributes to the sealing of the soil and causes landscape fragmentation (» Chapter 11).

In 2011, around one third of Switzerland's energy sales and 38 % of all of the country's CO<sub>2</sub> emissions were generated by transport. While the CO<sub>2</sub> emissions from households, industry and services were around 20 % below the 1990 level, an increase of 11 % was observed for transport between 1990 and 2011 (» Chapter 8).

Road transport is responsible for around 60 % of nitrogen oxide emissions (NO<sub>x</sub>) and makes a major contribution to particulate emission pollution. Thanks to technical improvements in exhaust gas treatment, both NO<sub>x</sub> and particulate matter emissions have declined considerably since 1990. Nevertheless, the legal limit values are still regularly exceeded, particularly in urban areas and along motorways (» Chapter 7).

The increase in transport volume also means an increase in noise pollution. Road transport is by far the main cause of noise. Around one sixth of the Swiss population is exposed to a level of traffic noise that exceeds the legally authorised limit. This gives rise to major costs in terms of health problems and losses in property values (» Chapter 16).

**Measures**

In most cases, private motorised transport has a greater impact on the environment than public transport. Thanks to its considerable investment in the public transport network, Switzerland has created favourable conditions for an energy- and space-saving, and less polluting mobility system. Since 1980, it has succeeded in considerably increasing the attractiveness of public transport and non-motorised transport (cycling, walking) as an alternative to transport by car. However, as long as the overall transport

# 6. Agriculture

The agriculture sector made progress in various areas of environmental concern in the 1990s. Since then, however, little success has been achieved in overcoming continuing deficits. The aim of the Agricultural Policy for 2014–2017 is to overcome this stagnation and continue to develop agriculture in the direction of food production that is adapted to local circumstances and conserves resources.

## Context

Although agricultural area declined by almost 2 % between 2000 and 2011, over one third of the country's territory is used for agriculture and Alpine grazing. Two thirds of the former agricultural land was converted into settlement area and one third became forest (» SFO 2010b).

At global level, agriculture faces the task of providing more food for more people and, at the same time, conserving natural resources, optimising energy consumption and adapting to climate change. In 2009, Swiss agriculture produced food to the value of approximately CHF 10.3 billion and covered 63 % of the country's food requirements (gross self-sufficiency). To do this it imported production resources, such as nitrogen and phosphorous fertilisers and plant protection products, and around 800,000 tonnes of animal feed annually (» FOAG 2011).

## Impacts

The production and consumption of food cause around 30 % of the environmental impacts generated by the Swiss population (» FOEN 2011a). Hence, after living and mobility, food is the consumption domain with the highest environmental impact (» Chapter 3). Excessive meat consumption, unseasonal products and food waste have a particularly marked effect on this environmental impact.

Agriculture uses around 60 % more nitrogen than necessary to balance out the nutrients that are removed

from the soil through harvesting. Some of this nitrogen escapes from liquid and solid manure in the form of ammonia which damages sensitive ecosystems. In the form of nitrate, nitrogen from arable land pollutes waters and as nitrous oxide it affects the climate. The excess nitrogen from agriculture declined by one fifth in the course of the 1990s, however, it has remained at a constantly high level since then (» FOAG 2012; G6.1). In the European context, the Netherlands and Belgium are the only countries in which the ammonia emissions per hectare of agricultural land are higher than in Switzerland. The use of phosphorous here considerably exceeds the nutrient requirement of crops. Hence, instead of the optimal value of 1.0, the ratio between input and output ranges between 0.5 and 0.6 (» FOAG 2010).

In addition to nitrate, the groundwater and surface waters also contain traces of plant protection products. Although greater use is now made of more efficient products, the sales volumes have remained at a constantly high level for over 10 years.

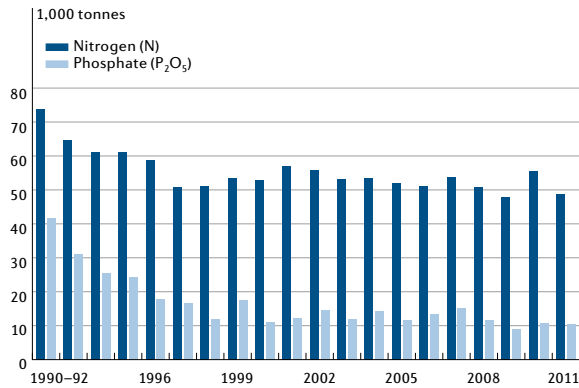
The mechanisation and intensification of agriculture resulted in the disappearance of numerous habitats of crucial importance for biodiversity like wetlands, hedges and low-nutrient meadows, and valuable structures like dry stone walls, especially in areas particularly favourable to agriculture. Traditional, ecologically valuable forms of farming also declined at the same time. Thanks to meas- »

## Environmentally friendly consumption – environmentally friendly agriculture

Through its approval of Article 104 of the Federal Constitution in 1996, the Swiss population established a political basis for sustainable agriculture. Today, around 5,600 (10 %) farms follow the guidelines for organic farming and 20,000 those of IP Suisse, the association for environmentally friendly agriculture. These farms make targeted use of the agricultural policy direct payments incentives for additional ecologi-

cal services and obtain higher market prices for their products. If all farms were to fulfil the criteria of these labels, Swiss agriculture would have considerably fewer environmental deficits. Hence, the Swiss population has the possibility of supporting environmentally friendly agricultural operations, not only as voters but also through the daily purchasing of Swiss label products, and in this way also of strengthening the

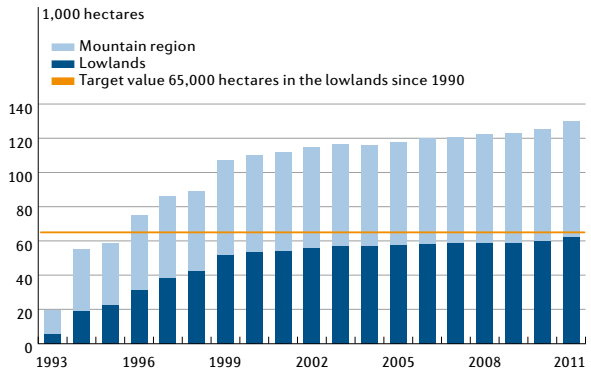
greening of Swiss agriculture. In addition, the purchasing of seasonal products, the avoidance of food waste and selection of milk and meat products that are produced using hay, grass or silage (instead of concentrate) are also crucial to the reduction of environmental impacts through the consumption of foodstuffs.

**G6.1 Development of mineral fertiliser consumption**


Source: SBV/Agricura

State 😞

Trend 😊

**G6.2 Development of the ecological compensation areas<sup>1</sup>**

<sup>1</sup> Excluding standard fruit trees; data prior to 1999 only concern ecological compensation areas entitled to subsidies.

Source: FOAG

State 😊

Trend 😊

ures in agriculture, it was possible to stem the biodiversity losses over the course of the 1990s. However, the biodiversity in cultivated lands has stagnated at a low level since then.

**Measures**

With its Environmental Targets for Agriculture (Umweltziele Landwirtschaft), the federal authorities defined the extent to which agriculture must contribute to different general environmental objectives, in particular relating to biodiversity, air pollution (ammonia, nitrogen oxides), water pollution (nitrate, phosphorous, plant protection products, veterinary drugs) and soil pollution (» FOEN/FOAG 2008).

Since 1998, farmers can claim direct payments if they present proof of ecological performance (PEP). This requires, among other things, the designation of a minimal proportion of ecological compensation areas and the balanced use of fertilisers. There was a considerable increase in ecological compensation areas in the 1990s, however they have only increased slightly since 2000 (» G6.2).

In accordance with the Ecological Quality Ordinance (ÖQV)<sup>1</sup> farmers receive payments for ecological compensation areas which make a particularly valuable contribution to biodiversity. These areas account for almost half of the total compensation area. The Swiss Biodiversity Strategy, which was passed by the Federal Council in 2012, aims to increase the number of ecological compensation areas and improve their quality and interconnectivity (» Chapter 12).

To promote a more sustainable approach to the use of fertilisers, plant protection products and soil resources, the cantons implement projects from the resources programme (Nachhaltige Ressourcennutzung, Ressourcenprogramm) with the help of federal financial support. For example, the

use of trailing hoses is promoted to reduce ammonia emissions and arable land is being converted into permanent pastures in the zone of contribution of drinking-water catchments, a measure that reduces nitrate leaching.

In accordance with the Agricultural Policy for 2014–2017, the federal authorities will focus the direct payments for agriculture on seven of the objectives enshrined in the Federal Constitution: agriculture shall contribute to keeping cultural landscapes free from development, securing the food supply and promoting both biodiversity and landscape diversity (» Federal Council 2012). Through its services it shall facilitate the existence of wide-ranging cultural landscapes and forms of production that are both environmentally friendly and respectful of animal welfare. The use of natural resources shall be made more efficient and the development of agriculture towards the fulfilment of these objectives shall be carried out in a socially acceptable way. By improving the focus of direct payments on the constitutional objectives, the federal authorities are aiming to improve the efficiency of resource allocation and promote production that is suited to particular locations. The production of food and animal feed, in particular, shall be increased and, at the same time, environmental impacts shall be reduced and services for biodiversity and the landscape enhanced.

**Internet links**

[www.statistics.admin.ch](http://www.statistics.admin.ch) » Topics » Agriculture, forestry

[www.bafu.admin.ch/agriculture](http://www.bafu.admin.ch/agriculture) (f, g)

[www.foag.admin.ch](http://www.foag.admin.ch)

**Data download**

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

<sup>1</sup> 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

Switzerland's air quality has improved considerably over the past 25 years. However, particulate matter, ozone, nitrogen oxides and ammonia still have negative impacts on health, ecosystems, sensitive materials and the climate. Improvements must be made primarily through the consistent use of the best available technologies.

## Context

Clean air is vital to the lives of humans, animals and plants. Air is polluted by harmful gases and fine suspended particles. These pollutants are transported away from the location at which they are released by the wind. They can change along the way – for example, under the influence of sunlight or by reacting with each other – and eventually cause damage to the environment and health in sometimes distant locations. Today, the most severe impacts arise from nitrogen compounds (nitrogen oxides and ammonia), particulate matter and ozone.

The nitrogen oxides (NO<sub>x</sub>) in question are combustion exhaust gases (NO<sub>2</sub> und NO), the main source of which is the transport sector (» G7.1). Despite the simultaneous increase in transport volumes, emissions of nitrogen oxides declined by around 50 % from the 1990s and less nitrogen dioxide (NO<sub>2</sub>) was measured in the air. Nevertheless, air quality standards are still exceeded, in particular in city centres and along main roads (» G8).

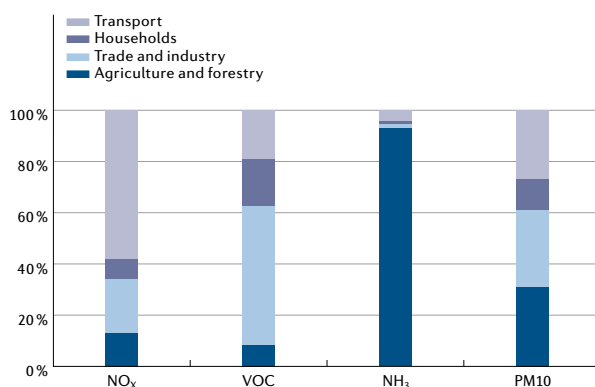
93 % of ammonia (NH<sub>3</sub>) originates from livestock farming. It escapes from barns and through the storage and spreading of farm manure. Between 1990 and 2000, ammonia emissions fell by around 10 %, but have shown little

or no decline since then. 55 % of near-natural ecosystems suffer from a level of nitrogen deposition that exceeds the critical loads.

Particulate matter is formed during different processes. Some of it originates from combustion, e.g. in diesel engines and wood-fired heating systems. Some is produced by the mechanical friction of brakes and road surfaces and by the stirring up of dust. Finally, around half of the measured particles form in the air from gaseous precursor pollutants like sulphur dioxide, nitrogen oxides and ammonia, and volatile organic compounds (VOCs). Particulate matter contamination has declined since 1990, however 30 % to 40 % of the population are still exposed to levels that exceed the legal limit (» G7.2). Urban populations are mainly affected by this, particularly those living in high-density terraced housing on or near busy roads.

Ground-level ozone arises from nitrogen dioxide, VOCs and other precursors in the presence of intensive solar radiation. VOCs arise from the evaporation of solvents and motor fuels. The main causes of ozone pollution, which is also known as “summer smog”, are trade and industry and road traffic. Ozone levels vary widely, depending on the weather. A particularly high number of readings that »

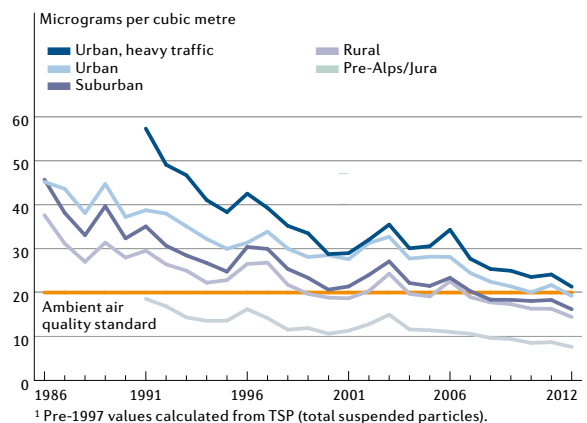
**G7.1 Air pollutant emissions by main sources, 2010**



Source: FOEN

State  Trend

**G7.2 Annual mean values for particulate matter (PM10)<sup>1</sup>**



Source: FOEN

State  Trend

› exceeded the limit values were recorded at measuring stations during the heat wave summer of 2003. Such extreme peaks were less common in recent years.

The values for 9 other important air pollutants, for which legally-prescribed ambient limit values exist, are below the limits today throughout Switzerland. Huge improvements have been attained in the case of sulphur dioxide, for example (› FOEN 2012d).

### Impacts

Between 3,000 and 4,000 people die prematurely in Switzerland every year due to the consequences of air pollution; 300 of them are affected by lung cancer (› ARE 2008). Every year, bad air quality causes 39,000 episodes of chronic bronchitis in children and 1000 in adults. The number of person days, on which people in Switzerland are restricted in their activities due to air pollution is approximately 2 million. The greatest risk to health is posed by particulate matter and ozone pollution, which increase the risk of respiratory and cardiovascular diseases. The carcinogenic soot emitted by diesel engines and wood combustion is particularly toxic. The health costs associated with air pollution are estimated at around CHF 5.1 billion per year.

Nitrogen compounds from the air cause extensive overfertilisation of the soil. As well as Alpine pastures, mires, dry meadows and pastures are particularly sensitive to this. Animal and plant species that are adapted to survive in nutrient-poor conditions are being lost from such habitats. In forests, the trees become unstable because their root growth is impaired, among other things. Together with other pollutants, nitrogen compounds cause acid rain which damages Alpine mountain lakes and forest soil. Nitrate from acidified forest soil can reach the groundwater. High ozone values damage plants and cause harvest losses of up to 15%.

Buildings, cultural monuments and other materials subject to the effects of weathering are corroded, bleached or damaged by acidic air pollutants. Soot particles and ground-level ozone also contribute to climate change.

### Measures

The Environmental Protection Act (EPA)<sup>1</sup> obliges the federal authorities and cantons to protect human beings, animals and plants from air pollutants that are harmful or cause nuisance. The measures for achieving this objective are defined in the Ordinance on Air Pollution Control (OAPC),<sup>2</sup> the Air Pollution Control Strategy and various international conventions. Polluters must, first, limit the emission of pollutants insofar as this is technically possible and economically feasible. If damaging or disturbing impacts persist or may still be expected, the authorities may then define stricter limits to be applied.

The federal authorities have enacted various regulations that limit the emission of pollutants by heating sys-

tems, industrial installations, motor vehicles and construction machines, and prescribe quality standards for the heating and motor fuels used. In relation to road vehicles, Switzerland has complied with the European Union's (EU) emission standards since 1995. Hence, the Euro 5 standard is currently applicable for new motor vehicles; the requirements in relation to particulate matter emissions were tightened considerably for this standard. From September 2014, it will be replaced by the Euro 6 standard. For off-road machines (building sites), stricter requirements apply in Switzerland than in the EU, depending on the type of machine – and insofar as necessitated by the protection of employees, local residents and passers-by. To reduce ammonia emissions, the federal authorities stipulate that installations for the storage and treatment of farm manure be designed and operated in a way that generates the lowest possible emissions, e.g. with permanently effective covering. In addition among other measures, the use of trailing hoses for the spreading of manure is promoted by the Sustainable Resource Use programme (Nachhaltige Ressourcennutzung, Ressourcenprogramm).

The federal authorities impose an incentive tax on volatile organic compounds (VOC) of CHF 3 per kilo. This increases the economic viability of VOC-free alternatives. The proceeds from the tax are returned to the population through their health insurance premiums. The federal authorities also avail of an economic incentive mechanism with the mileage-related heavy vehicle tax (MRHVT): trucks with lower emissions benefit from a lower tax rate and trucks that have been retrofitted with particle filters qualify for a discount.

The quality of the air in Switzerland is constantly monitored and analysed: at national level with the help of the National Air Pollution Monitoring Network (NABEL) and by the cantonal and communal measurement networks at regional and local levels. Switzerland also belongs to an international network for the measurement of air pollutants.

### Internet links

[www.bafu.admin.ch/state-air](http://www.bafu.admin.ch/state-air)

[www.cerclair.ch](http://www.cerclair.ch) (f, i, g)

### Maps

[map.bafu.admin.ch](http://map.bafu.admin.ch) » Air

### Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

<sup>1</sup> Federal Act of 7 October 1983 on the Protection of the Environment (Umweltschutzgesetz, USG), SR 814.01.

<sup>2</sup> Ordinance on Air Pollution Control of 16 December 1985 (Luftreinhalte-Verordnung, LRV), SR 814.318.142.1.



# 8. Climate change

Rising average temperatures are evidence of the progressive change in the global climate. Despite international agreements, greenhouse gas emissions continue to increase throughout the world. The need for action in Switzerland is also considerable, particularly in relation to transport. Emissions have risen sharply in this sector since 1990.

## Context

In 2011, greenhouse gases totalling around 50 million tonnes of CO<sub>2</sub> equivalents<sup>1</sup> were emitted into the atmosphere in Switzerland (» FOEN 2012a). This volume has scarcely changed since 1990 (» G11). The main source of greenhouse gases in Switzerland in recent years was transport (33 %), followed by households and industry (19 and 21 %). Agriculture accounted for around 12 % of the total emissions.

If the emissions generated abroad by Switzerland are also taken into consideration, a continuous increase in emissions may be observed between 1993 and 2008. Because the population also grew in this period, the total per-capita emissions remain around 12 to 13 tonnes of CO<sub>2</sub> equivalents. Switzerland's per-capita emissions are therefore slightly higher than the European average (» FOEN 2011a).

At 85 %, CO<sub>2</sub> accounts for the largest proportion of domestic greenhouse gas emissions. The trend for CO<sub>2</sub> emissions is mainly influenced by population and economic growth, technological progress and the proportion of energy consumption accounted for by the various fossil fuel carriers used (oil, gas, petrol, diesel, electricity, etc.) (» Chapter 4).

Under the Kyoto Protocol, Switzerland committed to reducing its greenhouse gas emissions by an average of 8 % for the period 2008 to 2012 as compared with 1990 levels.

The corresponding target value in the CO<sub>2</sub> Act, which implements the Kyoto Protocol requirement at national level, is a 10 % reduction in CO<sub>2</sub> emissions for the same period. Due to the development of emissions from motor fuels (+12 % since 1990), Switzerland can only meet its targets through the purchase of emissions certificates from climate protection projects abroad and by taking into account the carbon sink effect of forest.

## Impacts

The increase in temperatures in recent decades is a well-documented reality both for Switzerland and the rest of the world (» G10). 2011 was this country's hottest year since records began. According to the latest scenarios for climate change in Switzerland, average temperatures will increase further in all parts of the country and in all seasons over

the course of the 21<sup>st</sup> century (» CH2011 2011). According to different emissions scenarios, the expected temperature increase by the end of this century is between 3.5 and 6 °C above the temperature when records began in Switzerland (1864). More frequent and intensive heat waves may also be expected.

The volume of precipitation in summer should generally decrease by the end of the century. More of the precipitation will fall in the form of rain instead of snow, and hence increase the risk of flooding (» Chapter 14). It is not yet possible to make any definitive statements about the development of extreme precipitation events, however.

The observed increase in temperature is leaving clear traces in the Alpine region. The melting of the glaciers in the Alps has accelerated dramatically since the 1980s. Glacier melt can exacerbate natural hazards. The Inventory of Dangerous Glaciers in Switzerland (Inventar gefährlicher Gletscher in der Schweiz)<sup>2</sup> lists 53 glaciers that could cause damage to human life, animals and property in the next 10 to 20 years. One such example is the Lower Grindelwald Glacier: to prevent flooding, the meltwater lake that forms on the tip of the glacier has been regulated using a drainage tunnel since 2010.

The location of the zero degree line is also rising due to the increase in average temperatures (» G8.1). This is causing the warming and gradual thawing of the permanently frozen subsoil (permafrost) in the mountains. The rockslide that occurred on 27 December 2011 on Pizzo Cengalo in the Bregaglia Valley (canton of Graubünden) may have resulted from this trend (» FOEN 2013b).

The impacts of climate change on agriculture and forestry, winter tourism, hydropower production and human health are emerging insidiously and will probably only become clearly identifiable in the course of the decades to come.

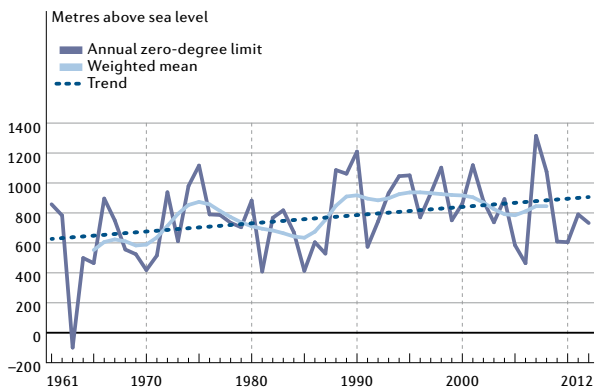
## Measures

Up to 2012, the CO<sub>2</sub> Act<sup>3</sup> of 8 October 1999 formed the legal basis for Switzerland's climate policy objectives and measures. For the ensuing period, Parliament passed the fully revised CO<sub>2</sub> Act in 2011. The aim of this act is to reduce the »

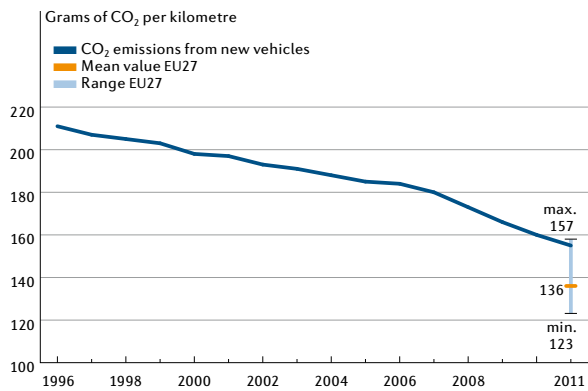
<sup>1</sup> The global climate-warming potential of the different greenhouse gases varies. It is expressed as a multiple of the climate-warming potential of CO<sub>2</sub> (as CO<sub>2</sub> equivalents, CO<sub>2</sub>eq).

<sup>2</sup> <http://glaciology.ethz.ch/inventar/inventar.html> (g)

<sup>3</sup> Federal Act of 8 October 1999 on the Reduction of CO<sub>2</sub> Emissions (CO<sub>2</sub>-Gesetz), SR 641.71.

**G8.1** Rise of the zero-degree limit in winter since 1961


Source: METEOSWISS

State Trend 
**G8.2** CO<sub>2</sub> emissions from newly registered passenger cars in Switzerland


Sources: auto-schweiz; EEA

State Trend 

- › greenhouse gas emissions generated in Switzerland by at least 20 % by 2020 compared to 1990.

The most important measures contained in the revised CO<sub>2</sub> Act are:

- The CO<sub>2</sub> levy on heating fuels introduced in 2008 is retained. Companies can continue to be exempted from the CO<sub>2</sub> levy by undertaking to comply with agreed emissions reduction targets.
- The emissions trading system for energy-intensive business shall be continued and harmonised with the EU emissions trading system.
- The federal and cantonal buildings programme, which was established in 2010, will be continued. As was the case up to now, one third of the proceeds from the CO<sub>2</sub> levy on heating fuels will be earmarked for the financing of the buildings programme. The maximum contribution is being increased from the current CHF 200 million to CHF 300 million per year.
- The cantons shall ensure that the energy consumption of buildings decreases by enacting minimum requirements for new buildings and renovation projects.
- The obligation for vehicle importers to reduce the emissions of new passenger vehicles put on the road up to 2015 to an average of 130 g CO<sub>2</sub> per km, which was introduced on 1 May 2012, is adopted in the completely revised CO<sub>2</sub> Act. It is intended that this measure will further the trend for lower-emissions passenger vehicles (› G8.2).
- The former “climate cent” mechanism will be replaced by a compensation obligation for the importers of fossil motor fuels. They must compensate for a part of the transport-related CO<sub>2</sub> emissions through climate protection projects in Switzerland.
- The operators of fossil-thermal power plants (gas-fired combined power plants) must compensate for the CO<sub>2</sub> emissions generated by their plants by investing in CO<sub>2</sub>-reducing projects. At least half of the compensation sum must be spent in Switzerland.

The revised CO<sub>2</sub> Act also contains new provisions on adaptation to the impacts of climate change in Switzerland. The federal authorities shall coordinate adaptation measures and ensure the development of associated planning documents. The first part of the national adaptation strategy was passed by the Federal Council in March 2012 (› DETEC 2012C). It shall be substantiated in the form of a national action plan by the end of 2013.

#### Internet links

[www.bafu.admin.ch/state-climate](http://www.bafu.admin.ch/state-climate)

[www.bafu.admin.ch/climate-policy-switzerland](http://www.bafu.admin.ch/climate-policy-switzerland) (f, i, g)

[www.meteoswiss.ch/climate](http://www.meteoswiss.ch/climate)

[www.climate-change.ch](http://www.climate-change.ch) (g)

[www.ch2011.ch](http://www.ch2011.ch)

#### Maps

[map.bafu.admin.ch](http://map.bafu.admin.ch) » Natural Hazards

#### Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

# 9. Water

Water quality in Switzerland is generally good. However, the contamination of groundwater by nitrate and plant protection products is excessive in some cases and micropollutants pose a challenge for wastewater treatment. The poor ecological state of many streams, rivers and lakeshores is being improved through rehabilitation projects.

## Context

Switzerland has over 1422 km<sup>2</sup> of lake area and around 65,300 km of watercourses. Around 150 billion m<sup>3</sup> of groundwater is stored underground. The federal and cantonal authorities monitor the state and development of these surface and underground waters. Water quality in Switzerland is generally good. However, the current concentrations of phosphorous in some of the lakes on the Central Plateau are too high. This leads to excessive algal growth and the associated oxygen depletion. Groundwater quality is mainly impaired by nitrate and by residues of plant protection products and chlorinated hydrocarbons.

In 2011, the nitrate concentrations recorded at 16 % of the monitoring sites of the National Groundwater Monitoring NAQUA exceeded the legally required maximum of 25 mg/l (» FOEN 2013c). In areas in which arable farming is the main form of land use, the readings exceeded the required maximum value at 45 % of the monitoring sites (» M9.1; G12). Nitrate leaches into the groundwater, e.g. when too much manure is spread or soil is left without plant cover for a long period of time.

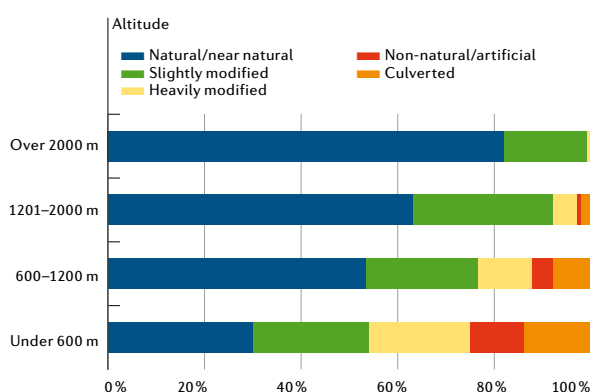
In 2011, active substances from plant protection products (herbicides, fungicides, insecticides) at concentrations exceeding the prescribed maximum value of 0.1 µg/l were detected in 2 % of groundwater monitoring sites. Concen-

trations of degradation products from these substances in excess of 0.1 µg/l were found in over 20 % of the monitoring sites. In surface waters, the most serious cases of contamination by plant protection products are generally transient and arise in small streams. However, measurements indicate that these contaminations may at times occur in concentrations that are harmful to aquatic organisms. They are due to the incorrect handling of substances (e.g. improper cleaning of spraying devices or disposal of residues), their illegal application (e.g. use of herbicides along paths and roads) and wind transport from treated crops, surface flooding and leaching. Agriculture is by far the main contamination source along with the maintenance of private gardens, forecourts and public parks, and outdoor sport facilities.

In addition to plant protection products, biocidal products, components from personal care and cleaning products, motor fuels, lubricants and heating fuels, drugs, and other substances (known as micropollutants) reach waters via the drainage system, wastewater treatment plants and indirectly through the spreading of manure and subsequent rainfall.

Switzerland's public sewage pipes cover a distance of around 49,000 km and private pipes cover a similar distance. Around 97 % of the population is connected to one »

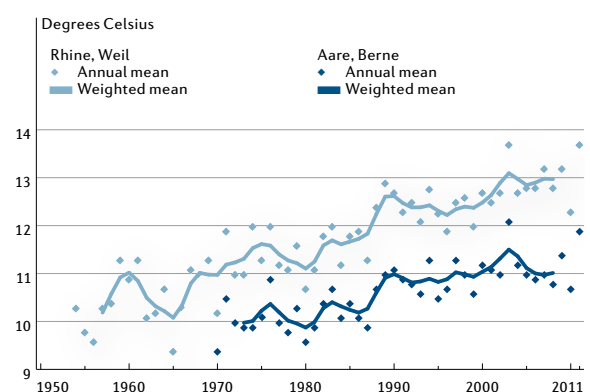
**G9.1** Ecomorphological state of watercourses at different altitudes, 2009



Source: FOEN

State Trend

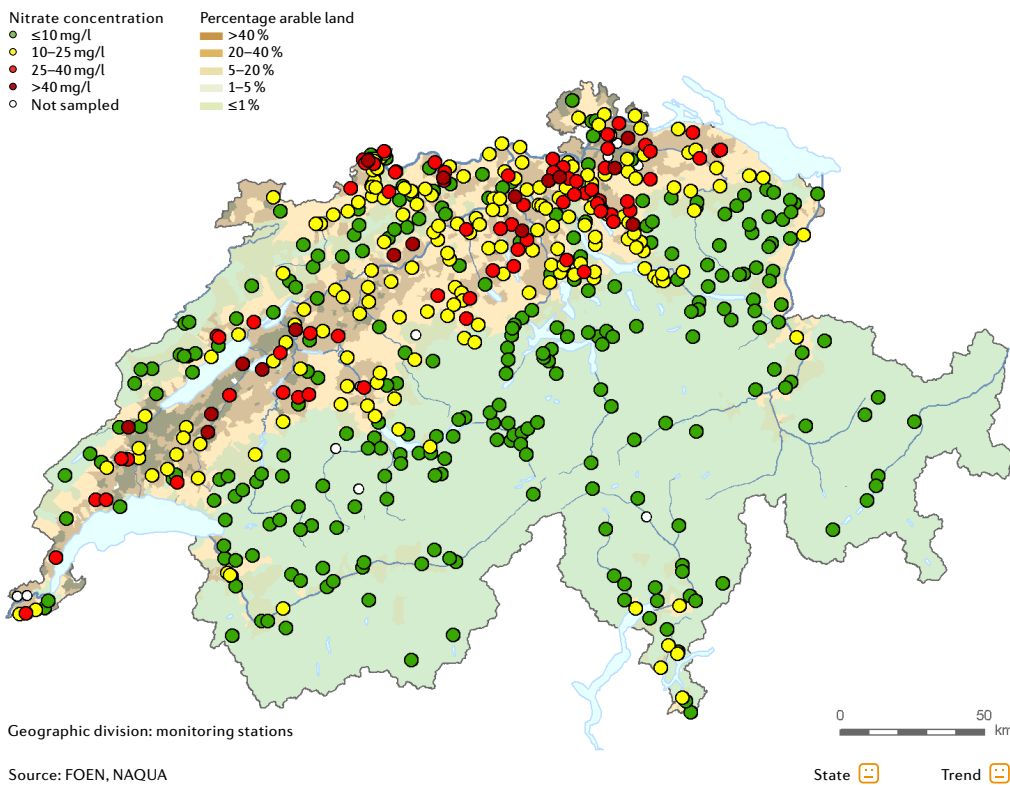
**G9.2** Water temperature of the Rhine and Aare



Source: FOEN

State Trend

## M9.1 Nitrate concentration in groundwater, 2011



› or more central wastewater treatment plants (WTPs). Thanks to technical modernisation and the amalgamation of smaller WTPs to form larger, more powerful plants, the performance of these plants has been improved while the associated costs have remained constant.

Switzerland's watercourses underwent enormous changes from the 19<sup>th</sup> century to meet the needs of flood protection, energy production and land reclamation for agriculture and settlements. As a result, the ecomorphological state of one quarter of the country's watercourses is poor (» G9.1) and their flow regimes, bed load budgets and fish migration are impaired (» FOEN 2009b).

Climate change and the discharge of heated water from cooling and wastewater treatment plants have caused a rise in the temperature of many watercourses. For example, the Rhine near Basel is now 2 °C warmer than it was in the 1960s (» G9.2). The results of a research project (» FOEN 2012e) indicate that, in future, due to the effects of climate change, watercourses are likely to contain more water in winter, while the runoff in areas without glaciers is likely to decline in summer. In locations with glaciers, summer runoff will tend to increase up to the mid-21<sup>st</sup> century due to the meltwater and a decline may be expected thereafter.

### Impacts

The demands made on water and surface waters in Switzerland are very wide-ranging: they provide an indispensable basis for the survival of animals and plants. They are inten-

sively engineered for the protection of agricultural areas and settlements. And they are used for energy production, recreation and leisure, and for drinking and industrial water.

Switzerland meets 80 % of its drinking water requirement from groundwater (including springs) and 20 % from lakes. Thanks to its high quality, approximately half of the groundwater can be fed directly into the drinking-water network without treatment. Even in low concentrations, foreign substances in the groundwater can generate high economic costs for drinking-water treatment. Despite population growth, Switzerland's water consumption has declined considerably since 1975. The demand for agricultural irrigation is expected to rise, however, due to climate change.

Even in very small concentrations, micropollutants have negative impacts on ecosystems. This is particularly true of biologically active substances. These include herbicides, fungicides, insecticides, medicines and hormone-like substances that impair the fertility or development of aquatic organisms.

Hydraulic engineering structures and a lack of space limit the ecological functions of many watercourses considerably and impair their biodiversity. Fish migration is hampered by artificial obstacles. Banks lined with concrete or which are very steep prevent interaction with neighbouring habitats. The natural dynamics also suffer due to hydraulic engineering structures, insufficient residual flows and the operation of hydropower plants with strong

variations between water surges and low flow (hydropeaking). Constrained watercourses with little space have less capacity for accommodating flood peaks, and greater damage must be expected when dikes are flooded. River straightening and hydraulic engineering structures also reduce the recreational value and landscape quality of many watercourses.

As a result of warming, watercourses can reach temperatures in summer at which the survival of certain organisms is threatened due to the lack of oxygen and proliferation of diseases. More frequent drought periods can result in shortages in the water supply in some locations and exacerbate the conflicts between different uses (e.g. irrigation and ecological residual flow management).

### Measures

When the nitrate concentration in the groundwater used to supply drinking water exceeds the prescribed maximum value of 25 mg/l, the cantons must identify the causes and develop rehabilitation projects. The most important measure here is the conversion of arable land to permanent pastureland. Around half of the rehabilitation projects that have been underway for longer periods have been very successful. Near-natural management methods, for example organic farming, reduce the inputs of pollutants into surface waters, and ecological compensation areas act as buffer strips in the vicinity of waters.

The risks relating to the contamination of waters are identified and limited by regulations applied during the process for the licensing of plant protection products.

Today's WTPs are effective in removing nutrients like nitrogen and phosphorus from the water but not micro-pollutants. Hence, the federal authorities are working with partners from the cantons, industry, research and wastewater management to develop a package of measures for the upgrade of medium and large WTPs by addition of an extra treatment stage. The efficiency of wastewater treatment shall also be further increased through greater regional cooperation and the joining of smaller WTPs.

The revised Waters Protection Act requires the rehabilitation of rivers and lakes so that their natural functions can be re-established and they can provide greater benefit to society (» G13). In rehabilitation projects, for example, banks are restored to a near-natural state and greater space is provided for the natural flow dynamics. The federal authorities are contributing to the effectiveness of these measures. The negative impacts of hydropower production (hydropeaking, impaired bed load budget, fish migration obstacles) must be eliminated by 2030. The annual budget of CHF 50 million for these measures is covered by a surcharge on the transmission costs of high voltage networks. Integrated watershed management guarantees that watercourses and water bodies and their wide-ranging functions are considered holistically and the measures implemented are not piecemeal due to sectoral and administrative boundaries (» WA21 2011).

Switzerland's decision to phase out nuclear power necessitates the development of renewable energy sources

(» Chapter 4). Hydropower can contribute to this requirement. The aim of developing hydropower production and at the same time conserving and restoring near-natural habitats and landscapes poses a major challenge. The federal authorities recommend that the cantons develop strategies for the management of hydropower production. Natural watercourses and water bodies that are valuable from an ecological and landscape perspective shall be protected in this way (» FOEN/SFOE/ARE 2011).

In view of the expected changes in the climate, the measures contained in Switzerland's strategy for adaptation to climate change include ensuring that sufficient space is provided for waters so that the increased flood risk can be alleviated. The cooperation between different regions and beyond the national borders shall be improved to prevent potential conflicts of interest in the area of water use.

### Internet links

[www.bafu.admin.ch/state-water](http://www.bafu.admin.ch/state-water)

[www.svgw.ch](http://www.svgw.ch) (f, i, g)

### Maps

[map.bafu.admin.ch](http://map.bafu.admin.ch) » Waters

### Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

# 10. Soil

Soil is a limited, non-renewable resource. Fertile soil can be protected through high-density settlement development, brownfield reclamation and measures that limit the input of pollutants. However, almost 1 m<sup>2</sup> of productive agricultural land continues to be lost per second in Switzerland. The quantitative protection of soil should be intensified.

## Context

Soil fulfils basic economic and ecological functions: it stores and filters water, decomposes pollutants, supplies nutrients, biomass, geothermal heat and mineral raw materials (gravel, limestone, granite), and is the basis of biodiversity.

For decades, almost 1 m<sup>2</sup> of productive agricultural land has been lost per second in Switzerland and mainly replaced by settlement area (» FSO 2001). In the mid-1990s, settlement area – primarily buildings, including their grounds, transport areas, and green spaces and recreational areas – accounted for 6.8 % of the national territory. Since then, this value has risen to around 7.4 % (» FOEN 2011b). In 2007, over 60 % of the settlement area was covered with buildings and infrastructure and, therefore, sealed (» FSO 2010c; G10.1). The almost 10,000 km<sup>2</sup> of agricultural area in the Central Plateau and in the valleys in the mountain region is under particular pressure in this context. Even the most productive soils (arable land) are not exempt from the pressure of settlement development.

Switzerland has no soil that is completely free from pollutants. The level of pollution in around 90 % of soil that is not built on is low; it is average in 9 % of this land and

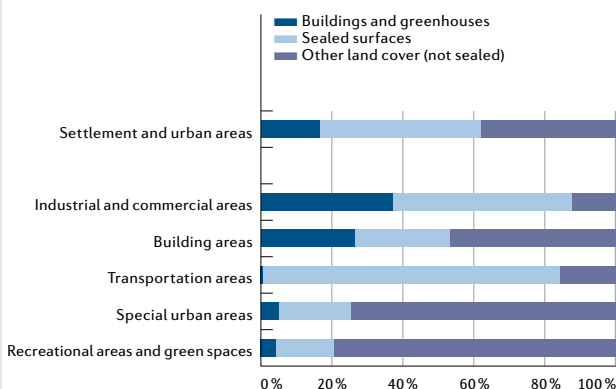
high in 1 % (» G14). Local concentrations of pollutants mainly arise in settlement areas, typically near garages and petrol stations, metal-processing plants and shooting ranges.

Today, around 38,000 polluted sites are registered throughout Switzerland, most of them in the industrialised Central Plateau. Around 60 % of all polluted sites are industrial sites and 40 % are landfill sites. Over 6,000 have been surveyed up to now and their remediation requirements have been assessed. In the case of 3,000 of these sites, no further measures are required. It is expected that approximately 10 % of all polluted sites qualify as contaminated sites. This means that, sooner or later, they will pose a threat to human life and the environment, and hence require remediation (» G10.2).

## Impacts

Soil that is built on is stripped almost entirely of its ecological functions. However, this is not the only way in which the functionality of soil is impaired. Traffic and incinerator exhaust fumes, fertilisers and plant protection products used in agriculture and horticulture, and pollutants from old industrial areas and waste deposits accumulate in the soil. They disrupt the natural material cycles

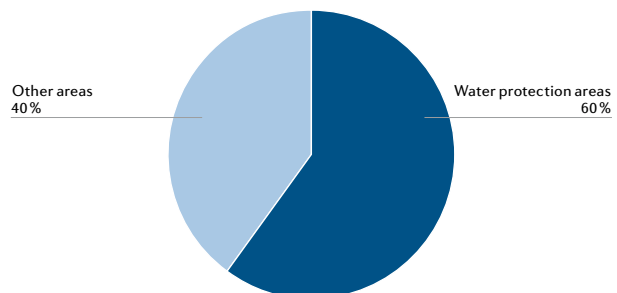
**G10.1 Degree of soil sealing in settlement areas, 2007**  
25 cantons (excl. Graubünden)



Source: FSO

State Trend

**G10.2 Polluted sites in water protection areas, 2012**



Source: FOEN

State Trend

there and pose a threat to humans and animals when they enter the groundwater or food chain. The use of unsuitable methods in agriculture and forestry causes the compaction of the soil. The absorption of water is reduced as a result and the risk of erosion and flooding increases.

Excessively intensive agricultural use can contribute to the impoverishment of the flora and fauna and also influences the organisms under the earth's surface: studies have shown that the fields and meadows on organic farms have the richest soil life. For example, between 50 % and 80 % more earthworms are found in organically farmed soil than in conventionally farmed soil (» FOEN 2011b). This also has a positive effect on the soil fertility.

The impairment of soil life is not immediately detectable and negative impacts only arise after a period of time. Whereas air and waters can recover in a matter of weeks or a few years after the removal of a pollution source, soil often takes centuries to recover.

## Measures

Important provisions for the protection of soil are found in the Federal Constitution and in 9 legislative acts and 16 ordinances. The federal authorities support the improvement of soil protection in different sectors. However, success has been limited in this area up to now as the interests of unrestricted land use often outweigh those of soil protection at cantonal and communal levels, or because awareness of the ecological services provided by soil is lacking.

The economic management of soil poses a key challenge. With the Sectoral Plan for Crop Rotation Areas (Sachplan Fruchtfolgeflächen), the cantons are obliged to conserve a certain minimum area of high-quality arable land (» Chapter 6). Appropriate measures for strengthening the protection of productive agricultural land shall be coordinated with each other in the agricultural, forest, environmental and spatial planning legislation (» FDEA 2012).

The demand for more development zones can be reduced if optimum use is made of areas already zoned for development. This requires densification measures, which include, for example, the better use of industrial areas. Due to the structural transformation of industry, hundreds of industrial sites are only partly used, or not at all and are now brownfields. The federal authorities, in cooperation with the cantons and communes, established the Swiss Brownfield Platform (Industriebrachen-Plattform Schweiz)<sup>1</sup> with a view to exploiting the enormous development potential presented by industrial wastelands. Owners can advertise available sites on this platform and potential investors can obtain information about the size, location, access, eventual infrastructure and current use of sites.

To avoid major interventions in the landscape and protect raw materials found under the ground in Switzerland, the availability of which is limited (gravel, limestone, granite), the federal authorities issue regulations on the recycling of excavation material and building rubble and

residues from waste incineration. When old buildings have to make way for new ones, a large proportion of the demolished material can be recycled in this way. Thanks to these federal rules, between 80 % and 90 % of concrete demolition material is reprocessed in recycling plants today.

A broad range of measures (ban on leaded petrol, ban on use of sewage sludge as a fertiliser, restriction on the cadmium content of fertilisers and copper content of plant protection products, etc.) has resulted in a noticeable reduction in the inputs of pollutants into the soil over the past 20 years. The federal authorities also support measures that raise the public's awareness of the need to refrain from using pesticides and herbicides and from making extensive use of fertilisers in gardens and green areas.

When pollutant contamination arises in a delimitable area, the sites in question must be recorded in a register in accordance with the Contaminated Sites Ordinance (CSO)<sup>2</sup> and investigated to establish whether they are causing disturbing or harmful impacts on the environment. The analysis of all of the approximately 15,000 sites requiring investigation should be completed by 2015. Contaminated sites that pose an acute threat should be remediated by 2017. The remediation work on all of the other sites shall be initiated by 2025 at the latest. Over 700 contaminated sites have already been remediated.

The federal authorities provide up to CHF 40 million annually for dealing with contaminated sites. This fund is financed through a charge levied on waste deposits.<sup>3</sup> It is estimated that the cost of remediating all of the contaminated sites in Switzerland will total around CHF 5 billion.

## Internet links

[www.bafu.admin.ch/state-soils](http://www.bafu.admin.ch/state-soils)

[www.bafu.admin.ch/state-contaminatedsites](http://www.bafu.admin.ch/state-contaminatedsites)

[www.statistik.admin.ch](http://www.statistik.admin.ch) » Themen » Raum, Umwelt  
» Bodennutzung, -bedeckung (f, g)

[www.are.admin.ch/landwirtschaft](http://www.are.admin.ch/landwirtschaft) (f, g, i)

[www.blw.admin.ch/kulturland](http://www.blw.admin.ch/kulturland) (f, g, i)

## Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

<sup>1</sup> [www.areale.ch](http://www.areale.ch) (f, g)

<sup>2</sup> Ordinance of 26 August 1998 on the Remediation of Contaminated Sites (Altlasten-Verordnung, AltIV), SR 814.680.

<sup>3</sup> 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.

# 11. Landscape

Landscape fragmentation and urban sprawl have continued to increase in Switzerland in recent decades and the quality of the country's landscape has deteriorated as a result. The rehabilitation of watercourses shows that this development can be reversed. Better landscape quality has a positive impact on human well-being, identity and the attractiveness of locations.

## Context

Landscape encompasses all spaces as experienced and perceived by humans. It provides habitats for humans, animals and plants. It is the result of millennia of geological and biological processes and also mirrors the social, cultural and economic development of a region. A landscape changes according to how it is used, the rise and fall in its population, and the prevailing lifestyles and consumption habits.

Between 1950 and 2012, the population of Switzerland increased by 3 million to a total of 8 million people. Along with the economy, consumption also increased and is claiming ever more space. Hence, the average living space per person increased from 34 to 44 m<sup>2</sup> between 1980 and 2000. The growth in the population and mobility is also making ever-increasing demands on transport infrastructure. Since the 1980s, the fragmentation of the landscape has also accelerated due to infrastructure development and the expansion of settlement areas (» G11.1).

At 37 % and 31 % respectively, productive agricultural land and forest account for the largest proportion of Swiss territory. Settlements and infrastructure account for around 7 %. Since the 1990s, this share has been increasing by around 21 km<sup>2</sup> annually. Conversely, the area used for

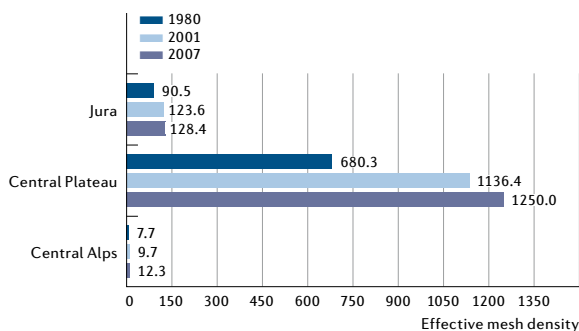
agricultural purposes shrank by 2.3 % (330 km<sup>2</sup>) between 1996 and 2009.

The fragmentation of the landscape has increased sharply since the 1950s (» G15). Due to settlement growth, tourism, structural change in agriculture and the development of infrastructure networks, the number of individual structures and facilities has increased. Hence, there are hardly any locations in Switzerland in which areas of a quarter of a km<sup>2</sup> or more are completely free of buildings or facilities (» G11.2). Largely untouched areas with natural dynamics (forest wilderness, high Alpine areas, alluvial sites) are only found in 25 % of Swiss territory. And even these areas bear the impact of human activities.

## Impacts

The character of a landscape is manifested in its particular features and uniqueness, and in the natural and cultural-historical associations it evokes. Both of these factors are important preconditions for enabling people to identify with a landscape. Characteristic landscapes fascinate and attract tourists. Both distinctiveness and associations with the past are considerably more pronounced in rural areas than in settlement landscapes (» FOEN 2010).

### G11.1 Landscape fragmentation<sup>1</sup>



<sup>1</sup> Roads (from motorways to driveways), railway lines, settlements, mountains over 2,100 m, and lakes and rivers were taken into account as fragmenting elements.

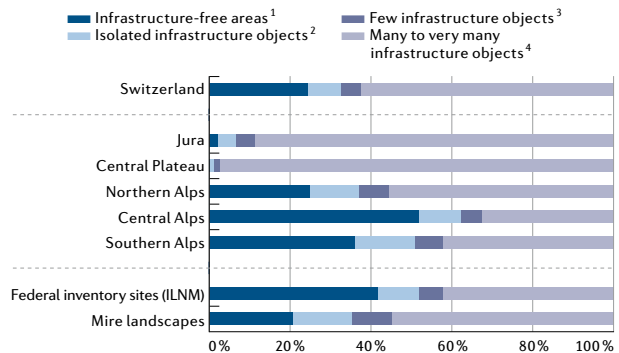
The higher the effective mesh density (number of meshes per 1,000 km<sup>2</sup>), the more fragmented the landscape.

Source: FOEN

State

Trend

### G11.2 Percentage of infrastructure-free areas, 2009



<sup>1</sup> That is, with no buildings, transport infrastructure, power lines, etc.

<sup>2</sup> 0.1–5 % of the 0.25 km<sup>2</sup> reference areas with infrastructure.

<sup>3</sup> 5.1–10 % of the 0.25 km<sup>2</sup> reference areas with infrastructure.

<sup>4</sup> Over 10 % of the 0.25 km<sup>2</sup> reference areas with infrastructure.

Source: FOEN

State

Trend



## Leisure and tourism

With 145,000 employees (full-time equivalent) and gross value added of CHF 14.5 billion (data for 2009), tourism is an important sector of the Swiss economy. From the perspective of tourists, the country's attractive landscapes are the "Swiss brand's" greatest asset (» Schweiz Tourismus 2009). The country's 66,000 kilometre-long network of paths alone hosted around 2.4 million hikers in one year. These visitors spent around CHF 1.6 billion for their travel to and from their destinations, mountain railways, board and accommodation, and equipment (» FEDRO 2011).

Tourism and leisure activities also have negative impacts on the environment, for example due to noise and air pollutants. In 2010, around 40 % of all of the distances travelled in Switzerland<sup>1</sup> were accounted for by leisure traffic. Two thirds of these distances were covered by car (» FSO/ARE 2012; G11.3).

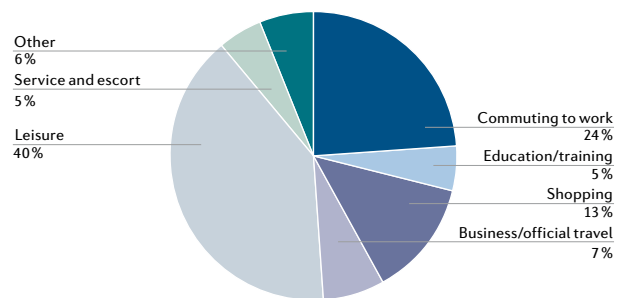
<sup>1</sup> The distances travelled by foreigners in Switzerland are not included in this figure.

People practising outdoor sports and leisure activities can startle wild animals. Fleeing from such unnecessary disturbances causes the animals to lose energy and threatens their survival.

Many landscapes are modified and impaired by ski lifts, piste levelling, artificial snow installations and tourism buildings.

### G11.3 Reasons for travel, 2010

Share of daily distance within the national territory



Sources: FSO; ARE

State  Trend

Due to developments in recent decades, the landscape in Switzerland is under threat in relation to its substance and, therefore, as a capital for sustainable development: it is being fragmented, sealed and consumed by urban sprawl. This is evidenced in a loss of landscape diversity and uniqueness – in particular in settlement areas. The character of the landscape is fading and the potential it offers in terms of experience is being reduced. As a result of its degradation, the positive effects on well-being and health, among other things, are being lost (» FOEN 2013d). The landscape offers fewer possibilities for identification and its attractiveness as an economic location and tourism destination is suffering.

High levels of construction activity, which often takes little account of regional characteristics, have contributed to the loss of character and uniqueness of landscapes. Typical local and regional features, which play an important role in identity, are becoming less common. In agricultural areas too, interchangeable landscapes have emerged that are mostly lacking in distinctive structures and character due to the removal of elements like hedges, walls and individual trees to make space for rational farming methods, and to the loss of land-use diversity. In contrast, farmland in marginal yield areas and Alpine pastures has declined steadily in area since the 1980s and fallen into disuse. The abandonment of farming, in particular areas farmed on a small-scale, can result in the loss

of cultural landscape diversity, aesthetic quality and biodiversity. (» Chapter 12).

Energy use can also have a strong influence on the landscape. For example, hydropower production impairs the ecological functions and recreational value of surface waters. Wind energy installations disfigure the landscape and cause it to lose residential and recreational quality. The same applies to overhead power lines.

In recent times, a trend towards the intensification of land use (densification) has emerged within settlements. The resulting landscape qualities depend largely on the design of such projects and the active development of open spaces (» NRP54 2012).

## Measures

The federal authorities and cantons support the conservation and upgrading of landscape quality, that is its diversity, uniqueness and beauty, and the preservation of the character of managed landscapes (» FOEN 2011c). Greater account shall be taken of landscape services – functions of the landscape that benefit humans – the provision of which shall be guaranteed in the long term. In accordance with the Nature and Cultural Heritage Protection Act (NCHA),<sup>1</sup> the federal authorities are obliged to protect the landscape in its spatially relevant activities (national roads, military »

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

› installations, etc.) and, therefore, to set a good example in this regard. In the case of construction projects subject to licensing (e.g. cable cars), the federal authorities examine the impacts of their operation on the landscape. They can impose restrictions or make suggestions for improvements, for example on routing or construction, so that installations are better integrated in the landscape.

In addition, the collective good landscape shall be taken into account in a targeted way in spatially relevant sectoral policies. These policies shall be better coordinated with each other. This will increase the awareness of landscape qualities in particular. The central coordinating mechanism for this process is the Landscape Strategy for Switzerland (Landschaftskonzept Schweiz), in which the federal authorities defined binding targets in relation to its activities in the areas of nature and landscape protection. (› SAEFL/FOSP 1998) Other important mechanisms include the Swiss Biodiversity Strategy (› FOEN 2012f), the Forest Policy 2020 (› FOEN 2013f) and the Agricultural Policy for 2014–2017.

With regard to surface waters, the revised Waters Protection Act, which came into force in 2011, initiated the rehabilitation of some of the approximately 10,800 km of rivers and streams that are currently in a poor ecological state. Other mechanisms that have an impact on the landscape include the Spatial Strategy for Switzerland (Raumkonzept Schweiz), the partial revision of the Spatial Planning Act, the strategy for Adaptation to Climate Change in Switzerland and federal energy policy.

Through the recommendations on the planning of wind energy installations, the federal authorities in cooperation with the cantonal offices, non-governmental organisations and the electricity sector have created a basis for landscape-compatible planning (› SFOE/FOEN/ARE 2010). It is the task of the cantonal structure planners to designate areas in which potential exists for wind energy and, conversely, the areas in which landscape services take priority.

Landscapes that are particularly worthy of protection are recorded in the Federal Inventory of Landscapes and Natural Monuments of National Importance (ILNM) and in the Federal Inventory of Mire Landscapes of National Importance. Switzerland also bears international responsibility for areas included in the UNESCO list of World Heritage Sites and the UNESCO Biosphere Reserves. In addition, the Nature and Cultural Heritage Protection Act also provides for the establishment of new parks of national importance.

The ILNM, which lists 162 objects, includes unique landscapes, characteristic typical landscapes, landscape of particular recreational value and natural monuments. Because the National Council's Control Committee deemed this mechanism as insufficiently effective, the descriptions of all of the inventory's objects are being revised, refined and complemented with object-specific protection objectives. In addition, measures are being examined for the improved integration of the inventory in the spatially-relevant federal policy sectors and for increasing its acceptance. Finally, the ILNM objects shall be subject to more intensive monitoring in the context of environmental and spatial

monitoring, among other things with respect to the implementation of their specific protection objectives.

Switzerland has three categories of parks of national importance:

- **National parks** with core zones, in which large natural habitats are left to develop freely. At present two parks are on the candidate list: the Parc Adula and the Parco Nazionale del Locarnese. The existing Swiss National Park, in Graubünden, was founded in 1914 and is governed by a specific law.
- **Regional nature parks**, in which the quality of the natural environment and landscape are worthy of conservation and upgrading and in which sustainable use is also possible. Fourteen parks have already been given this designation.
- **Nature discovery parks**, which aim to provide undisturbed habitats for native flora and fauna in the vicinity of large towns and cities and hence enable the population to experience nature. Unhampered natural development is the priority in the core zones of these parks. •

#### Internet links

[www.bafu.admin.ch/state-landscape](http://www.bafu.admin.ch/state-landscape)

[www.bafu.admin.ch/tourism](http://www.bafu.admin.ch/tourism) (f, g)

[www.statistik.admin.ch](http://www.statistik.admin.ch) » Themen » Raum, Umwelt  
» Bodennutzung, -bedeckung (f, g)

[www.statistik.admin.ch](http://www.statistik.admin.ch) » Themen » Tourismus (f, g)

#### Maps

[map.bafu.admin.ch](http://map.bafu.admin.ch) » Biodiversity and Landscapes

#### Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

# 12. Biodiversity

The state of biodiversity in Switzerland is unsatisfactory. Over one third of surveyed species are threatened and the area covered by valuable habitats declined considerably over the past century. With the Swiss Biodiversity Strategy, the federal authorities set out the ways in which losses can be halted and ecosystem services conserved.

## Context

Biodiversity is the variety of life. It incorporates the diversity of habitats and ecosystems, the species diversity of fauna, flora, fungi and microorganisms, and their genetic diversity (varieties, breeds, subspecies). Thanks to its considerable variations in altitude, contrasting climates, varying soils and wide-ranging forms of land use, Switzerland is rich in biodiversity. A mosaic of forests, agricultural land, watercourses and water bodies, and settlements formed there over the centuries.

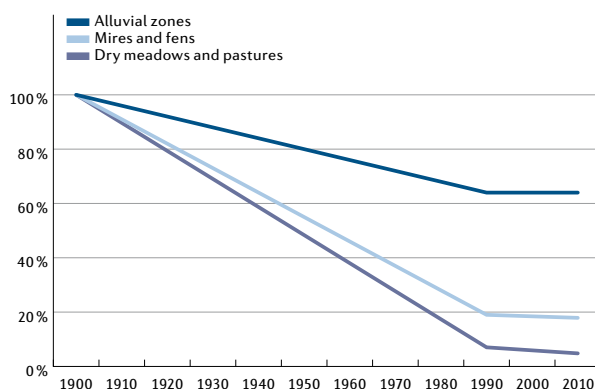
However, the past 100 years saw a considerable transformation in land use, and biodiversity has come under pressure due to the many changes in agriculture, forestry and energy production. This development has been further intensified by the impacts of settlement growth, mobility, inputs of substances, alien species, leisure activities, consumption and climate change.

Overall, the state of Switzerland's biodiversity is unsatisfactory. According to the Red Lists, 36% of all of the species of flora, fauna and fungi surveyed are threatened (» G16). Valuable habitats declined considerably into the 1990s (» Lachat et al. 2010; G12.1), and the quality of habitats continues to deteriorate (» G12.2). Genetic diversity is also suffering as landscape fragmentation is isolating animal and plant populations from each other.

In the course of the increase in agricultural production, biodiversity on agriculturally productive land suffered major losses from the mid-20<sup>th</sup> century – particularly in the Central Plateau and in the major Alpine Valleys. Land use was intensified, the use of fertilisers and plant protection products increased, wetlands were drained, plots standardised and farming mechanised. As a result, hedges, dry stone walls and other ecologically valuable microstructures were lost. In mountain meadows and pastures, species stocks are becoming increasingly uniform and encroaching forest is replacing biodiversity-rich meadows and pastureland (» Chapter 6).

Although the biodiversity in forests declined compared with its state in the early 20<sup>th</sup> century, it has improved considerably over the past 30 years. Natural regeneration has been increasingly dominant in forests since the 1980s. This promotes the growth of trees that are suited to local conditions and a high level of genetic diversity. The proportion of deadwood in forests has increased overall – this means that more habitats are available for many of the animals and fungi that live in forests. However, deficits still exist in some regions, in particular regarding the size and regional distribution of forest reserves. There is also a lack of well lit forests which only thrive when managed in a particular way (» Chapter 13).

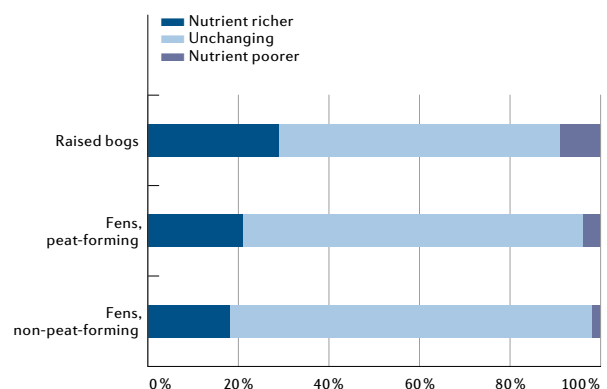
**G12.1 Habitats: alluvial zones, mires and fens, dry meadows and pastures**



Source: Lachat et al. 2010

State Trend

**G12.2 Development of nutrient supply to mires and fens<sup>1</sup>**



<sup>1</sup> Between 1997 and 2006.

Source: FOEN

State Trend

Watercourses in many locations have lost their natural dynamics due to flood protection structures and corrections. The ecological functions of a quarter of all stream and river courses are compromised by artificial obstacles, dams, and extreme surges and low flows (hydropeaking) downstream of hydropower plants (» Chapter 9).

Growing numbers of species that are not native to Switzerland are being introduced unintentionally to the country by people. Some, for example, the Asian Clam and the Japanese Knotweed, are invasive and proliferating extensively.

Many habitats in settlement areas have disappeared due to the sealing of surfaces and cracks in walls. Despite this, the biological diversity in villages and towns is often surprisingly high.

### Impacts

With their animals, plants, fungi and microorganisms, ecosystems provide vital services for humans and supply them with natural goods like food, clothing, building materials and medicines. There are many other examples of ecosystem services: springs and groundwater provide drinking water; mountain forests provide protection against avalanches, landslides, debris flows and floods; mires and wetlands absorb precipitation peaks; pathogens and invasive species are regulated and their proliferation stemmed; landscapes are made more diverse and attractive; a high level of genetic diversity enables animal and plant species to adapt to changing environmental conditions.

A deterioration in the state of biodiversity poses a threat to the sustainable provision of these ecosystem services. If ecosystem services have to be ensured using technical interventions, for example drinking-water treatment, avalanche protection structures and control of invasive species, the associated costs would be enormous. Other services, for example soil formation and oxygen production, cannot be reproduced technically.

Biodiversity loss is accompanied by a reduction in safety, because it diminishes the capacity of ecosystems to react to climate change, extreme events and other unpredictable developments while preserving their functions.

### Measures

The Swiss Biodiversity Strategy (SBS), which was passed by the Federal Council in 2012, defines ten strategic goals to be fulfilled by 2020 (» FOEN 2012f). These include the sustainable use of natural resources by all relevant sectors and the development of an ecological infrastructure of protected and interconnected areas. National priority species and genetic diversity shall be conserved and promoted (» FOEN 2011d). Other objectives concern the cutting back of financial incentives unfavourable to biodiversity, the recording of ecosystem services, the enhancement of knowledge about biodiversity, biodiversity in settlement areas, the international commitment to biodiversity and the monitoring of changes in biodiversity. The federal authorities will substantiate the goals of the SBS in an action plan

by mid-2014. The need for adaptations to the law will also be examined in this context.

The conservation and promotion of biodiversity is enshrined in various other federal instruments. For example, the Agriculture Policy for 2014–2017 contains provisions for the further development of the biodiversity-related payments. The Environmental Targets for Agriculture (Umweltziele Landwirtschaft) stipulate that agriculture shall make a major contribution to the conservation and promotion of biodiversity (» FOEN/FOAG 2008).

With the Forest Policy 2020, the federal authorities would like to ensure that the proportion of forest reserves will increase by around 5 % to 8 % by 2020, that priority habitats like forest edges and wooded pastures are promoted and that forest management in all forest areas is near-natural.

Following the coming into force of the revised Waters Protection Act in 2011, surface waters whose ecological functions are impaired can be rehabilitated with the support of the federal authorities.

The federal authorities monitor the state of biodiversity with the help of the Red Lists and Biodiversity Monitoring (BDM). The National Ecological Network project (Réseau écologique national, REN), provides the basis for the better integration of biodiversity into spatial planning processes.

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization, which was signed by Switzerland in May 2011, ensures that the benefits arising from the use of genetic resources are shared with the country of origin, for example the manufacture of medicines from plant-based active substances. It also regulates corresponding information and licensing obligations. The Nagoya Protocol is awaiting ratification by the Swiss Parliament. •

#### Internet links

[www.bafu.admin.ch/state-biodiversity](http://www.bafu.admin.ch/state-biodiversity)

[www.biodiversitymonitoring.ch](http://www.biodiversitymonitoring.ch)

[www.sib.admin.ch](http://www.sib.admin.ch)

[www.vogelwarte.ch](http://www.vogelwarte.ch)

#### Maps

[map.bafu.admin.ch](http://map.bafu.admin.ch) » Biodiversity and Landscapes

#### Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

# 13. Forest

Forests provide protection against natural hazards and produce wood. They are also habitats for animals and plants and attractive locations for recreation and leisure. Forest area in the Alpine region continues to expand. The services provided by forests are under threat from nitrogen inputs from traffic and agriculture, and from the effects of climate change. The federal authorities' responses to these challenges are contained in the Forest Policy 2020.

## Context

The Swiss forest fulfils a range of important functions. An average of 6.9 million m<sup>3</sup> of wood were harvested annually during the years 2007 to 2011. The tree trunks and roots provide protection in almost 50 % of forest area against avalanches, landslides, debris flows and floods (» FOEN 2013e). Forest is a habitat for half of all known animal and plant species in Switzerland, its soil acts as a water filter, it stores climate-damaging CO<sub>2</sub>, and it provides a recreational space for up to 240,000 people in periods of fine weather. These wide-ranging protective, welfare and harvesting functions are protected by the Federal Act on Forest (ForA).<sup>1</sup>

Forests cover 31.8 % of the territory of Switzerland. This area has been increasing since the 19<sup>th</sup> century. In the five-year period from 2007 to 2011, the increase totalled around 300 km<sup>2</sup> (» WSL 2012). Forest area is increasing in the Alpine region, in particular, where it is encroaching on abandoned agricultural land and Alpine pastures.

There has also been a further increase in standing volume since 2007, i.e. around 2 % throughout Switzerland.

However, there are considerable differences between the regions in this regard: whereas standing volume has increased markedly in the Alpine region, it actually declined in the Central Plateau. Between 2007 and 2011, 84 % of the natural wood increment throughout Switzerland was harvested or remained in the forest in the form of dead trees; the corresponding figure for the Central Plateau was 115 % (» G13.1). Wood harvesting is sustainable in the long term if the wood lost through harvesting and natural death does not exceed the increment.

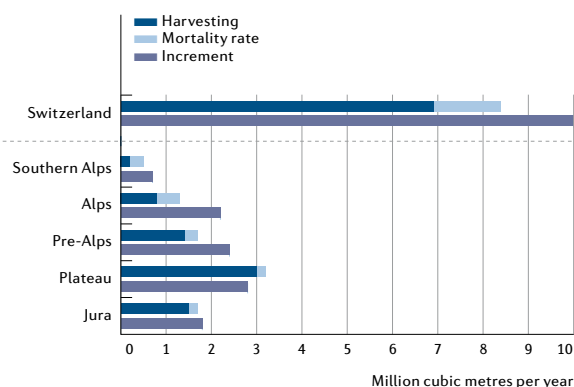
To provide effective protection against natural hazards, forests must be structured and regenerated in a targeted way. Regeneration in around one third of protective forests is critical or insufficient.

Fewer threatened species live in the forest than in other ecosystems (» Chapter 12). However, beetles, fungi and lichens, which rely on deadwood for their survival, are above average in terms of their representation on the Red Lists. Many light- and heat-loving reptiles, butterflies and orchids are also threatened.

The biomass that grows in forests removes more carbon from the atmosphere than is lost through harvesting »

<sup>1</sup> Federal Act of 4 October 1991 on Forest (Waldgesetz, WaG), SR 921.0.

**G13.1 Forest harvesting, mortality rate and increment**

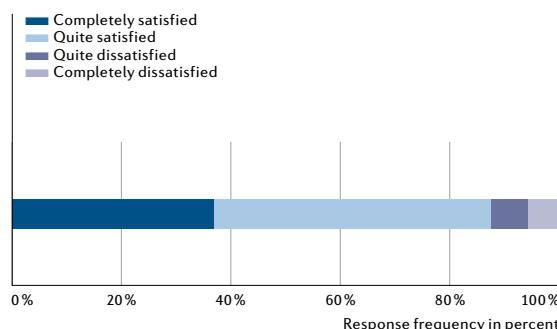


Modelled annual mean values for the years 2009 to 2011.

Source: WSL, NF14

State  Trend

**G13.2 Satisfaction with visits to the forest and recreation, 2010**



Sources: FOEN; WSL

State  Trend

› and natural decomposition. Hence, with the exception of the three years after Storm Lothar in December 1999, the Swiss forest acts as a CO<sub>2</sub> sink (» G18).

The Scots Pine trees that grow on the flat terrain and barren soils of the canton of Valais have failed to withstand the stress caused by the drought of recent years and are increasingly being superseded by Downy Oak. An examination of this change in tree species showed that this development is influenced by the higher summer and winter temperatures caused by climate change combined with biotic influences (» WSL 2006).

Forest is important as a recreational space for densely populated Switzerland. According to a survey, almost 94 % of the population regularly spends time in the forest (» FOEN 2012g). The recreational uses made of the forest are varied – walking, sport, “simply being there”, observing nature, picking mushrooms, etc. – and the level of satisfaction with visits to forests is high (» G13.2).

### Impacts

The Swiss forest is under chronic stress from inputs of air pollutants and is hence vulnerable to acute events like drought, storms, diseases and pests.

The Asian Long-horned Beetle has been detected on several occasions since autumn 2011. This introduced species destroys deciduous trees and is classified as a particularly dangerous pest in accordance with the Plant Protection Ordinance (PlantPO).<sup>2</sup>

Nitrogen inputs in 95 % of forest area exceed the critical limit. The main sources are agriculture and motorised transport. Nitrogen from the air makes trees grow faster in height without developing stronger roots to provide stability, and causes blackberry bushes to grow rampantly so that natural forest regeneration is hampered in many places. Moreover, pollution causes the acidification of forest soils. With time, their filter capacity can also be affected and this could eventually give rise to the need for technical drinking-water treatment.

When forests are not managed, many of them, particularly in the Alpine region, develop an unfavourable structure which causes a reduction in the protection they provide against natural hazards. At the same time, the potential for supplying Switzerland with construction timber and energy wood is not fully exploited.

In the absence of harvesting, open types of forest and the habitats they provide for light- and heat-loving species disappear. Conversely, the intensive management found in the Central Plateau in particular means that the later stages of natural forest development are a rarity there. In the absence of the old and dead wood associated with these stages, the specialist species which rely on this wood are lacking (» Chapter 12).

The rapidity with which climate change is progressing is putting a strain on the adaptive capacity of the forest ecosystems. Trees with their slow process of generational progression are particularly severely affected. Model cal-

culations prompt expectations that the tree line will climb in altitude. This will probably accelerate the encroaching of forest on Alpine pastures. The expected increase in summer heat waves will cause further desiccation of forest soil and promote forest fires.

### Measures

The expanse of forest in Switzerland is fundamentally protected by the ban on deforestation.<sup>3</sup> With the Forest Policy 2020,<sup>4</sup> however, the federal authorities would like to adopt a more flexible approach to the obligation to make compensation in kind for deforestation in certain cases, for example the protection of particularly valuable agricultural land and the rehabilitation of watercourses and water bodies (» FOEN 2013f). In March 2012, the Federal Assembly decided to change the Forest Act, which together with the revised Forest Ordinance will come into force in the course of 2013.

Various measures are being taken to ensure that a better use is made of the sustainably harvestable wood potential. This should boost demand and improve the conditions for the use of wood.

The federal authorities guarantee the service provided by protective forests by defining criteria applicable throughout Switzerland.

The federal authorities want to promote biodiversity with the Forest Policy 2020, among others by increasing the proportion of forest reserves from the current 5 % to 8 % by 2020, and by supporting the maintenance of priority habitats like forest edges and wooded pastures.

To ensure that forest can also continue to perform all of its functions in the face of climate change, the federal authorities support research programmes that investigate how storms, drought and forest fires affect the forest. In addition, together with the cantons, they finance maintenance measures which lead to stable forest stands that are suited to their locations.

### Internet links

[www.bafu.admin.ch/state-forest](http://www.bafu.admin.ch/state-forest)

[www.bafu.admin.ch/state-timber](http://www.bafu.admin.ch/state-timber)

[www.statistics.admin.ch](http://www.statistics.admin.ch) » Topics » Agriculture, forestry

[www.lfi.ch](http://www.lfi.ch)

### Maps

[map.bafu.admin.ch](http://map.bafu.admin.ch) » Forest

### Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

<sup>2</sup> Ordinance of 27 October 2010 on Plant Protection (Pflanzenschutzverordnung, PSV), SR 916.20.

<sup>3</sup> Federal Act of 4 October 1991 on Forest (Waldgesetz, WaG), SR 921.0, Artikel 5.

<sup>4</sup> Forest Policy 2020, approved by the Federal Council on 31 August 2011.

# 14. Natural hazards

Switzerland's settlement area is expanding continuously. This increases the risk of damage arising from natural hazards. Costly hazard protection structures and early warnings cannot always prevent such damage. Spatial-planning measures often offer the most effective means of avoiding damage.

## Context

As a densely populated country influenced by the Alps, Switzerland is particularly exposed to natural hazards like storms, floods, landslides, rockfall and avalanches. The vulnerability to damage caused by such events is also rising because the areas at risk from such hazards are being used more intensively. The concentration of material assets and vulnerable infrastructure is also increasing in these risk areas.

Due to climate change, parts of Switzerland will probably be more exposed to natural hazards than previously (» Chapter 8). Glacier retreat continues apace and at high altitudes snow will increasingly give way to rain. The seasonal water flow regimes of rivers will change as a result. Because the zero degree line is rising, the hitherto permanently frozen soil in the mountains (permafrost) is melting (» G8.1). In the case of intensive rainfall, loose material can start to move and the probability of rockfall and debris flows (rock avalanches and mud slides) increases; the volume of bed load in Alpine streams and rivers also rises. More frequent heat waves and droughts can also exacerbate the risk of forest fires and impair the vitality and regeneration capacity of protective forests. In the past, damage costs increased more slowly than would have been expected based on the increases in population, settlement area and density of material assets. The natural hazard protection measures taken in Switzerland in recent decades were probably a major contributory factor here.

## Impacts

Following a relatively long period without any major damage events, severe storms increased in frequency in Switzerland from the 1970s. These events claimed lives and, in some cases, caused damage to the tune of billions of Swiss francs (» G19). Between 1972 and 2011, the average annual inflation-adjusted cost of the damage caused by floods, landslides, debris flows and rock fall was CHF 340 million. It is not yet possible to say whether the observed increase in flood events is already a result of climate change (» G14.1).

2007, a year of storms that caused extensive damage, was followed by three years of spatially localised events and varying damage costs. The total cost of damage arising from storm events was also above average in 2011 (CHF 100–150 million). However, the situation that arose in 2011 presented a new development: heavy precipitation in combination

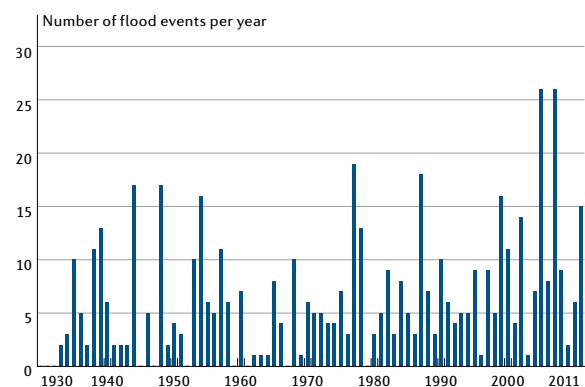
with rapid snow melt caused the water levels in numerous rivers in the Bernese Oberland, Central Switzerland and the canton of Valais to reach a maximum within a very short period of time. Several railway lines and roads were blocked as a result.

The protective measures adopted in recent years have proven effective. The flood relief tunnels in Thun and structural measures on the river Kander in Kandersteg (Bern) and on the river Lonza near Gampel/Steg (Valais) fulfilled expectations during the floods in autumn 2011. The national alerting system, which was introduced by the Federal Council in early 2011 and provides warnings of storms, floods, earthquakes and avalanches, has also proven effective. However, the storm of 2011 showed that, in future, better account must be taken of hazard situations along watercourses, for which the cantons are responsible.

## Measures

The risk posed by natural hazards can be alleviated through spatial planning measures, hazard protection structures, protective forest maintenance, emergency strategies, and early alerting and warning. However, it is not possible to avoid damage entirely. The current focus of action in dealing with natural hazards includes the remediation of old hazard protection structures, the improvement of the »

**G14.1 Annual floods in Switzerland**



Source: FOEN

State

Trend

## Earthquakes

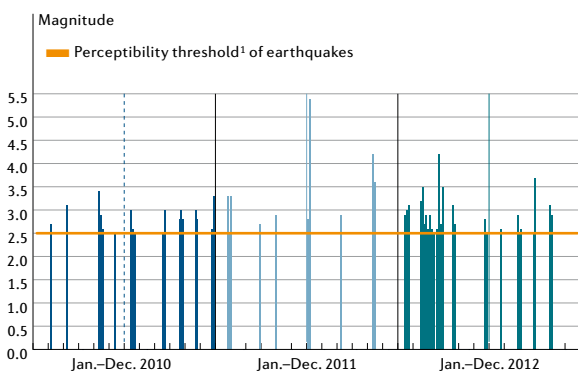
In the international context, the risk posed by earthquakes in Switzerland is moderate to average (» SED 2006). Earthquakes that do not cause major damage are frequently registered (» G14.2). A regional earthquake with a magnitude of

6 that causes some damage may be expected every 100 years, and a destructive, national earthquake with a magnitude of 7 may be expected around every 1000 years. The earthquake risk is elevated in the canton of Valais, the Basel re-

gion, central Switzerland, the Engadin and in the Rhine Valley of St. Gallen. Viewed from a long-term perspective, the damage costs that may be expected from earthquakes and floods in Switzerland are comparable.

To test the functioning of international cooperation in the event of an earthquake, civil management bodies and military staff organisations from Switzerland, the German federal state of Baden-Württemberg and the French regions of Bas-Rhin and Haut-Rhin carried out a comprehensive earthquake exercise in 2012 entitled SEISMO 12. This was based on an event corresponding to the severe earthquake in Basel on 18 October 1356. According to a damage simulation, such an event today could be expected to claim the lives of approximately 6,000 victims, cause serious injury to 18,000 persons and make 160,000 buildings uninhabitable in the long-term.

### G14.2 Earthquakes felt by people in Switzerland, 2010–2012



<sup>1</sup> Earthquakes with a magnitude of >2.5 are not always perceptible; it depends where they occur.

Source: SED

State

Trend

- › cooperation between the federal, cantonal and communal authorities during hazard events (development and upgrading of alert and alarm systems), and the raising of public awareness about natural hazards (» FOEN 2011e).

Taking natural hazards into account in spatial planning is of particular importance. The cantons are responsible for identifying the areas that face considerable threats from floods, avalanches, landslides and rockfall. The results of their surveys are documented in hazard maps. In early 2012 around 80 % of the necessary hazard maps had been completed. They will be available for the entire country by the end of 2013. The identified risks must be incorporated into the cantonal structure plans and the communal land-use plans (» G20). The further increase in damage from hazard events can be prevented through the designation of hazard zones, the formulation of building regulations and the definition of property protection measures.

Numerous structural measures for protection against natural hazards, some of which were constructed as far back as the 19<sup>th</sup> century, no longer meet today's requirements. The federal authorities support the cantons in the erection of new flood protection structures and the remediation of existing ones. In addition to numerous projects on smaller watercourses, major remediation projects are currently underway on the Rhone, Linth and Alpine Rhine.

The remaining risks must be curtailed through comprehensive emergency planning (hazard event preparation and management). The extent of the damage caused by major hazard events can be reduced by up to 20 % with

the help of better forecasting methods and timely and appropriate alerting and warning. As part of the "Optimisation of Warning and Alerting in the Event of Natural Hazards" (OWARNA) project, the cooperation between the participating federal offices is being improved and the procedure to be followed during hazard events harmonised (» Swiss Confederation 2010). The natural hazards website [www.naturgefahren.ch](http://www.naturgefahren.ch) will be developed into the central federal information platform for natural hazards by 2014.

#### Internet links

[www.bafu.admin.ch/state-naturalhazards](http://www.bafu.admin.ch/state-naturalhazards)

[www.bafu.admin.ch/state-earthquakes](http://www.bafu.admin.ch/state-earthquakes)

[www.naturgefahren.ch](http://www.naturgefahren.ch) (f, g, i)

#### Maps

[map.bafu.admin.ch](http://map.bafu.admin.ch) » Natural Hazards

#### Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)



# 15. Risk of major chemical and biological accidents

Approximately 2,600 establishments, 12,000 road and rail km and almost 2,500 km of high-pressure gas and oil pipelines could potentially cause a major accident in Switzerland. To limit the serious associated risks to human life and the environment, the owners of such installations are obliged to take appropriate measures.

## Context

Major accidents are significant operational failures in technical installations which present considerable hazard potential that can have impacts beyond the site of the installation in question. These hazards arise through the handling of chemical substances and dangerous microorganisms (e.g. pathogens). Nuclear accidents are the responsibility of the Swiss Federal Nuclear Safety Inspectorate (ENSI), which provides information about radioactivity in the proximity of nuclear power plants in its annual radiological protection reports.<sup>1</sup>

In 2009, approximately 2,600 installations in Switzerland were subject to the Major Accidents Ordinance (MAO)<sup>2</sup> because they handle volumes of hazardous chemicals that exceed a certain threshold (» G21). Hazardous goods are transported on 4,000 km of railway and 7,850 km of road in Switzerland. Due to the explosion and fire risks<sup>3</sup> they pose, 2,200 km of gas high-pressure pipelines and 250 km of oil pipelines are also subject to the Major Accidents Ordinance, since 2013. »

<sup>2</sup> Ordinance of 27 February 1991 on Protection against Major Accidents (Störfallverordnung, StFV), SR 814.012.

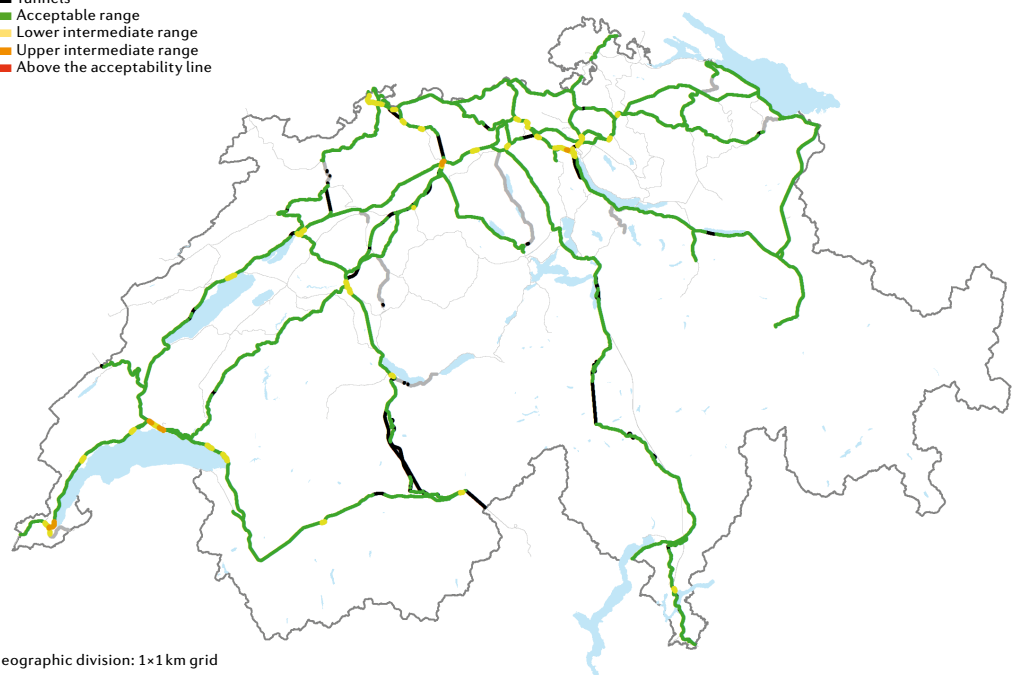
<sup>3</sup> Risk: Product of the probability of occurrence of an event and its consequence (extent of the possible damage to the population or environment).

<sup>1</sup> [www.ensi.ch/en/category/dokumente/jahresberichte](http://www.ensi.ch/en/category/dokumente/jahresberichte)

### M15.1 Risks to persons posed by the transport of hazardous goods by rail, 2011

Risks to persons for all representative substances

- Total risks not estimated / <100,000 t/year hazardous goods transported
- Tunnels
- Acceptable range
- Lower intermediate range
- Upper intermediate range
- Above the acceptability line



Geographic division: 1×1 km grid

Source: BAFU

State

Trend

### › Impacts

Casualties, injuries and serious human and animal health problems must be expected in the event of major accidents involving explosive or toxic substances (flammable gases, corrosive liquids, etc.) and pathogenic organisms (e. g. tuberculosis, anthrax and bird flu pathogens).

In 1986, a major fire occurred in a chemicals warehouse in Schweizerhalle (Basel-Landschaft). The contaminated fire-fighting water triggered large-scale fish death in the river Rhine. Since then sporadic major chemical accidents have occurred in Switzerland with less serious consequences. In contrast, there have been no major accidents involving organisms.

### Measures

The owners of installations that constitute a potential chemical or biological hazard have a personal responsibility to take measures to reduce the associated risks. Such measures include, for example, the installation of retention basins for liquid spills, sensors for measuring leaks and the better coordination of operational and communal fire-fighting services.

The authority responsible for implementing the legislation can require that installation owners submit a risk report. This facilitates the better evaluation of the associated risks and detailed monitoring of the extent to which the safety measures are being implemented. In 2009, 259 establishments or units were obliged to submit a risk report. In the case of transport installations, the operators carry out screenings for the network-wide estimate of the risks. For the railway lines, the proportion of sections with a tolerable risk is 68 km (risks to persons in the intermediate range), which corresponds to around 2 % of the Swiss standard-gauge rail network (» FOT/SBB/BLS/FOEN 2011; M15.1). The screenings are still under development for the roads and pipelines.

The coordination of spatial planning and major accidents prevention is becoming more important due to the increase in settlement density in Switzerland. For this reason, a new article (coordination with structural and land-use planning) was introduced to the Major Accidents Ordinance at the beginning of 2013 and a corresponding planning guide was published by the federal authorities (» ARE/FOEN/FOT 2009). The implementation of this article and the planning guide can result, for example, in owners placing their hazardous goods stores in more secure parts of their premises or in the erection of façades in neighbouring buildings that provide greater protection against heat radiation and poisonous gases. •

### Internet links

[www.bafu.admin.ch/state-majoraccidents](http://www.bafu.admin.ch/state-majoraccidents)

[www.bafu.admin.ch/state-biosafety](http://www.bafu.admin.ch/state-biosafety)

### Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

# 16. Noise

Around 1.3 million people in Switzerland are exposed to excessive levels of noise. Road traffic is the main source of this noise. The losses in rental income and health costs generated by noise total over CHF 1.2 billion per year. The federal authorities promote the reduction of noise at source using incentive mechanisms.

## Context

Quiet is a valuable good that is essential for the well-being and good health of the population. The economic importance of quiet is evident, for example, from the housing market and from an area's tourist attractions. Based on the limit values stipulated in the Noise Abatement Ordinance (NAO),<sup>1</sup> 1.3 million people in Switzerland are exposed to excessive traffic noise by day and 930,000 by night (» FOEN 2009c).

Traffic is the biggest source of noise in Switzerland. During the day, 1.2 million people are exposed to excessive road traffic noise and 70,000 to excessive railway noise. The corresponding figures for night time are 700,000 for road noise and 140,000 for railway noise (» G22). The volume of traffic on the roads and railways has increased considerably over the past 20 years (» Chapter 5). Although engines have become quieter, their weight has increased and the tyres in use now tend to be wider. Tyre rolling noise has also increased as a result. The higher the speed at which a vehicle travels the more the tyre rolling noise dominates the engine noise. These developments combined have resulted in an increase in noise.

Excessive noise from air traffic affects 65,000 people during the day and 95,000 at night. Since 1990, the number

of noise-intensive take-offs and landings by regular and charter services has increased by almost one third at Switzerland's three airports of Zürich-Kloten, Geneva-Cointrin and Basel-Mulhouse.

## Impacts

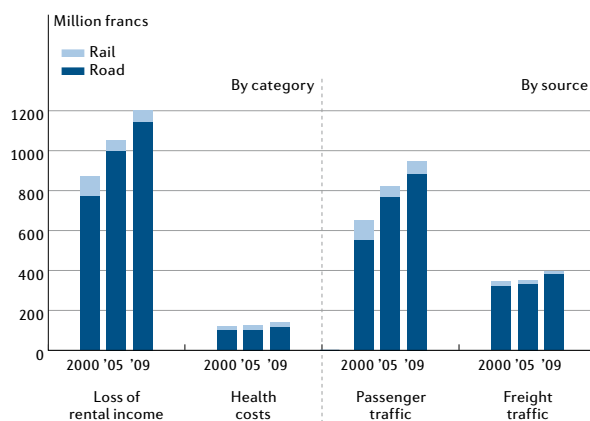
Noise disturbs people and can make them ill. The possible impacts are stress, sleep disturbance, increased blood pressure, cardiovascular problems, an increased risk of cardiac arrest and social disorders like aggression. The sick, young and elderly are at particular risk from the various health problems associated with noise.

The Swiss population loses around 47,000 years of life annually, which, in the absence of traffic noise, could have been lived out in good health. This figure was calculated using a method developed by the World Health Organisation (WHO). Most years are lost due to sleep disturbances caused by traffic noise (» FOEN 2011f). Compared with the consequences of other environmental impacts, the loss of life years due to noise takes fourth place after household accidents, the long-term consequences of particulate matter and traffic accidents (» EUA 2010a).

As the biggest source of noise, traffic generates noise-related health costs of around CHF 140 million annually. In addition, rental income losses caused by traffic noise »

<sup>1</sup> Ordinance on Noise Abatement of 15 December 1986 (Lärmschutzverordnung, LSV), SR 814.41.

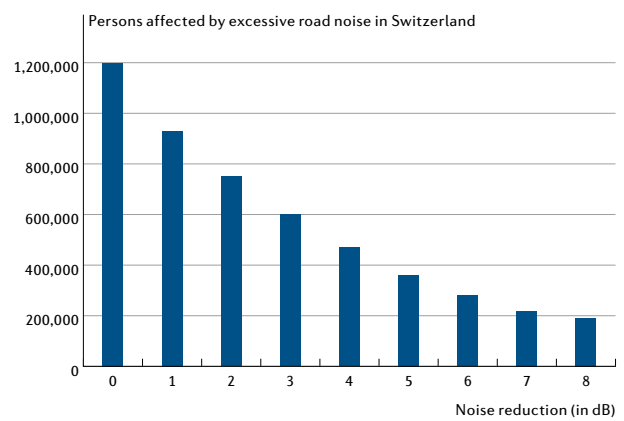
**G16.1 External costs of traffic noise**



Source: ARE

State  Trend

**G16.2 Effect of noise reduction on the number of persons affected**



Source: FOEN

State  Trend

› total over CHF 1.2 billion per year. This sum rose by over 35 % between 2000 and 2009 (» ARE 2012; G16.1).

The social mix valued by many people is under threat in noise-polluted city and village areas, and active neighbourhood life is in danger of being lost as a result: those who can afford it move to a quieter area and the economically weaker and less affluent sectors of the population are left behind. The move to quieter residential areas often results in increased traffic in those areas, and this, in turn, leads to more noise. Hence, previously quiet settings are also becoming noisy.

### Measures

The aim of the Environmental Protection Act (EPA)<sup>2</sup> and Noise Abatement Ordinance (NAO) is to protect the population against harmful and disturbing noise.

Irrespective of the existing noise pollution, noise must be limited as much at source as is technically feasible and economically viable. If noise exposure limits are exceeded, the owner of a noisy installation must take additional measures.

In the case of road traffic, noise can be reduced by between 6 and 8 decibels<sup>3</sup> through low noise road surfaces,<sup>4</sup> quieter tyres, adapted driving technique and, if necessary, the restriction of the authorised maximum speed. The implementation of this package of measures would mean that the noise levels affecting the majority of the Swiss people who are currently exposed to excessive levels of road noise would be below the legal limits (» G16.2). Hence, the fight against road noise must continue to be focused on these measures and promote their simultaneous implementation.

Low-noise rail freight cars with composite brake blocks generate ten times less noise than those with grey cast iron brakes. Most Swiss freight cars have been fitted with these brakes as part of the railway noise reduction measures. Noise barriers are also being installed. There are problems with international railway freight transport as, for reasons of cost, the rolling stock is not being consistently upgraded. Noise pollution should, however, decline further in future thanks to railway noise-reduction measures.

Various economic incentive systems have been introduced to promote measures that contain noise at source. For example, airlines that fly noisy aeroplanes into Swiss airports pay higher landing charges than they would for quieter aircraft. Railway companies receive a bonus when they use low-noise freight cars.

This principle could also be applied to properties using the “compensation payment” model. If a tenant generates noise levels exceeding the authorised noise exposure limits, property owners currently have the option of suing the polluter for loss of value. However, the necessity of going to court is a major stumbling block and compensation is only paid in a few cases. Hence, the federal authorities are examining a new approach whereby the noise polluter

would owe compensation to the property owner for the noise suffered. Instead of having to make a one-off compensation payment, the polluter would make an annual payment similar to a mortgage payment. This “noise mortgage” could be paid off in part or in full by the polluter by reducing the level of noise generated.

Measures that improve the market opportunities of low-noise devices or components also work on reducing noise at source. Since 1 November 2012, the manufacturers of car tyres within the EU area must declare the tyre noise class on a label. The federal authorities have launched an information campaign to get dealers and customers in Switzerland to take noise into account when purchasing tyres.

If the noise exposure limits cannot be complied with through direct measures at the source of noise, attempts must be made to prevent the propagation of noise, for example through noise barriers. If the noise from roads, railway lines and other public infrastructure cannot be reduced – either at source or in its propagation – to below the exposure limit through the exhaustion of all proportionate options, soundproof windows are considered as the last resort. However, this is merely a substitute measure as these windows only provide protection to people inside buildings.

Since the mid-1980s approximately CHF 1.7 billion has been spent on noise reduction on roads and around CHF 800 million on railways since 2000. A further CHF 2.5 billion has been allocated for the completion of the road noise reduction measures, of which around 45 % is provided by the federal authorities. •

### Internet links

[www.bafu.admin.ch/state-noise](http://www.bafu.admin.ch/state-noise)

### Maps

[map.bafu.admin.ch](http://map.bafu.admin.ch) » Noise

### Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

<sup>2</sup> Federal Act of 7 October 1983 on the Environment (Umweltschutzgesetz, USG), SR 814.01.

<sup>3</sup> Physical unit for measurement of sound, abbreviated as dB. For more information see: [www.bafu.admin.ch/laerm](http://www.bafu.admin.ch/laerm) (f, g).

<sup>4</sup> For more information visit: [www.leisestrassen.ch](http://www.leisestrassen.ch) (f, g).

# 17. Electromog

Electromog from the operation of transmitters, mobile telephones and power lines is pervasive in everyday life. While uncertainty persists regarding its long-term effects on human health, in the short and medium term, harmful impacts have not been observed for exposure levels below the applicable limit values.

## Context

Non-ionising radiation, which is referred to colloquially as electromog, arises wherever electricity is generated, transported and used, and where information is transmitted via radio technology.

Since the 1990s, the number of mobile radio devices in Switzerland has increased to over 10 million (» G23). Up to the end of 2011, mobile radio antennae for the operation of mobile communication networks had been erected at over 15,500 locations. Wireless computer networks (WLAN) and cordless telephones are also based on radio connections and hence generate non-ionising radiation. Electromog is also produced by high-voltage power lines, transformer stations and household electrical appliances.

## Impacts

The effects of electromog on organisms depend, among other things, on the intensity and frequency of the radiation. In the laboratory, biological effects can already be measured after short periods of low-intensity exposure, however, there is no clear indication of a health risk. Very little is known about the effects on the human body of weak but constant exposure to electromog.

To provide a better assessment of the potential risks posed by electromog, a national research programme

(» NRP57 2011) was carried out in Switzerland from 2007 to 2011. In one of the programme's projects, test subjects in the Basel region wore measuring devices for one week which recorded the radiation exposure from typical telecommunication applications in the area.

For people who use mobile telephones, the highest short-term exposure to electromog arises through their own telephone calls. The exposure not caused by the subjects themselves mainly arises from mobile and cordless telephones in their surroundings, and only to a small extent from mobile communication antennae (» G17.1). Although the average total exposure is considerably below the applicable limit values, there are enormous variances between persons and from one location to the next. It was not possible to establish a link between radiation exposure and any health effect during the study period of one year.

## Measures

With the Ordinance on Protection against Non-Ionising Radiation (NIRO)<sup>1</sup> the federal authorities specified limit values for radiation exposure from transmitters, high-voltage power lines and other infrastructure. In locations where people regularly spend longer periods of time, for example houses, offices and schools, the particularly strict installation limit values must be observed. In this way, the federal authorities implement the precautionary principle enshrined in the Environmental Protection Act (EPA).<sup>2</sup> This stipulates that environmental impacts shall be limited insofar as is possible using state-of-the-art technology and is economically viable.

## Internet links

[www.bafu.admin.ch/state-electromog](http://www.bafu.admin.ch/state-electromog)

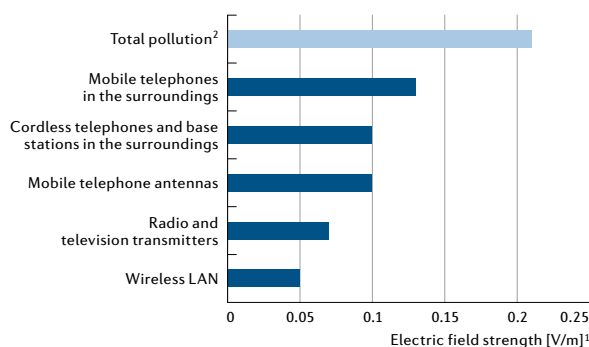
[www.bag.admin.ch/emf](http://www.bag.admin.ch/emf)

## Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

### G17.1 Electromog pollution in the Basle region, 2011

Average pollution from telecommunication and broadcasting applications<sup>1</sup>



<sup>1</sup> Excluding own telephone calls.

<sup>2</sup> The total pollution corresponds to the root of the sum of the squared individual contributions.

Source: NRP57

State

Trend

<sup>1</sup> Ordinance of 23 December 1999 on Protection against Non-Ionising Radiation (Verordnung über den Schutz vor nichtionisierender Strahlung, NISV), SR 814.710.

<sup>2</sup> Federal Act of the 7 October 1983 on the Protection of the Environment (Umweltschutzgesetz, USG), SR 814.01.

# 18. Health

A near-natural, sustainably used biosphere contributes to the fulfilment of vital requirements like eating, drinking and breathing, and also supports physical and psychological well-being. Contaminants in the air and water, and pollution from noise and chemicals can impair human health and lead to environmental diseases and premature death.

According to the estimates of the World Health Organization (WHO), between 15 % and 20 % of deaths in Europe are attributable to harmful environmental impacts. The most important sources here include particulate matter and noise pollution. However, in concrete individual cases, it is difficult to establish a direct link between environmental pollution and the state of a person's health. In many cases, several factors are at work that only give rise to a harmful effect in combination. Moreover, everyone is not affected by such impacts to the same extent. The risk groups include, in particular, vulnerable people like children, the sick, the elderly and pregnant women (» EEA 2010b).

Air pollution control, noise abatement, waters protection and the management of chemicals are environmental policy sectors aimed at protecting health. The conservation of biodiversity and attractive, varied landscapes is also very important for the quality of life in urban areas and recreational spaces.

Since the 1970s, great progress has been made in Switzerland in relation to the protection of health against environmental impacts. Although the population and economy have grown considerably and resource consumption has also increased sharply, thanks to emission-reducing measures, the concentrations of pollutants like volatile organic compounds (VOCs), nitrogen oxides and sulphur dioxide in the air and the pollutant load in surface waters have declined markedly. However, despite technological advances, the impacts caused by other contaminants like particulate matter and ozone, and stress factors like noise remain too high.

## Effects of environmental impacts

The main aim of the Environmental Protection Act (EPA)<sup>1</sup> – the provision of protection against harmful or disturbing environmental impacts – is far from being attained in all respects. The following action fields merit particular attention:

**Air pollution:** The limit values for particulate matter (particularly in urban areas) and ozone (in the case of intensive sunshine, summer smog) are still widely exceeded. This causes respiratory and cardiovascular diseases and premature deaths (» Chapter 7).

**Noise:** One sixth of the population is exposed to excessive levels of noise. The possible consequences include stress, sleep disturbances, raised blood pressure, cardiovascular problems, increased risk of cardiac arrest and social disorders like aggression (» Chapter 16).

**Water quality:** The nitrate concentration in the groundwater recorded at many monitoring stations is too high. In some cases, groundwater contains substances from the degradation of plant protection products and other micro-pollutants which can damage the health of ecosystems, even in small concentrations (» Chapter 9). In contrast, the problems affecting human health were largely resolved during the last century.

**Climate change:** Heat waves pose a risk to the health of elderly people and young children. Increasing temperatures promote the proliferation of new pathogens (e.g. the chikungunya and dengue viruses) and of plants with high allergy potential. (» Chapter 8).

**Electrosmog:** Although the impacts of non-ionising radiation on organisms are quantifiable, the consequences for health have yet to be identified. The level of knowledge about the long-term consequences of radiation exposure is very limited (» Chapter 17).

**Hazardous substances:** Small quantities of various persistent organic substances are detectable in humans and the environment. Little is known about the consequences of chronic or combined contamination. Significant gaps also exist in the knowledge about the risks associated with nanomaterials (» Chapter 2).

**Loss of landscape quality and diversity:** Soil-sealing, landscape fragmentation, noise and intensive land use reduce the recreational value and experiential potential offered by landscapes (» Chapter 11).

## Quality of living space influences well-being

A new understanding of the links between the environment and health has become accepted in expert circles since 2000: human well-being is strongly influenced by the quality of the living, working and leisure environments. Individual environmental impacts considered in isolation do not have a decisive influence on human health but the simultaneous exposure to different pollutants and stress factors does (» EEA 2010b). This perspective highlights the importance of factors like clean air, quiet, aesthetic land-

<sup>1</sup> Federal Act of the 7 October 1983 on the Protection of the Environment (Umweltschutzgesetz, USG), SR 814.01.

## Chemicals that pose a risk to the environment and health

The persistent organic pollutants (POPs) group is an example of toxic substances that are resistant to degradation, accumulate in the bodies of humans and animals, and can also be transported over long distances. In some cases, their use was severely restricted or banned from the 1970s. Despite this, traces of these substances are still found in humans today.

Since 1987, the WHO has been coordinating measurement campaigns for monitoring the contamination of maternal milk with selected POPs. The results for Switzerland show that the levels of dioxin-like polychlorinated biphenyls (PCBs), dioxins and furans declined by 50% between 2002 and 2009. This can be explained by the effect of the international agreements on protection against POPs<sup>2</sup> (» FOEN 2011h; G18.1). To prevent such risk substances – e.g. from contaminated sites and buildings cons-

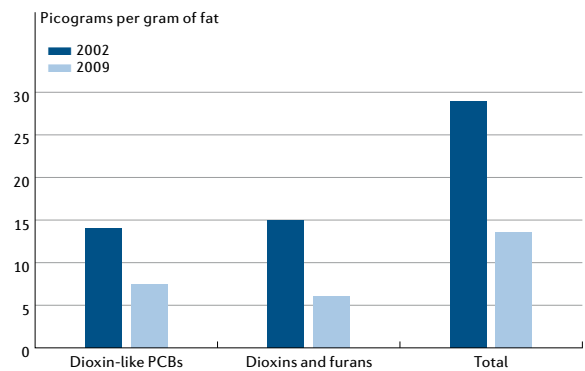
tructed in Switzerland before 1975 – from reaching the environment, and hence also the human food chain, further efforts are required to ensure their environmentally friendly disposal.

Little is known about the long-term negative impacts of many chemical substances from industrial chemicals, plant protection products, biocides and

pharmaceutical products that reach the environment and organisms. Because the number of chemical substances introduced into the market throughout the world is constantly increasing, the monitoring of their impacts on humans and nature is becoming a matter of growing importance.

<sup>2</sup> In particular the Stockholm Convention on Persistent Organic Pollutants (<http://chm.pops.int>) and the Aarhus Protocol on POPs of 1998 to the UNECE Convention on Long-Range Transboundary Air Pollution.

### G18.1 Contamination of breast milk in Switzerland by selected POPs<sup>1</sup>



<sup>1</sup> Persistent Organic Pollutants, POPs.

Source: FOEN

State

Trend

scape qualities and the possibility of movement and relaxation in the open air for human well-being (» FOEN 2011g).

The federal authorities have developed mechanisms to enable the measurement of changes in such ecosystem services with the help of indicators and for the definition of objectives for the conservation of ecosystems and landscapes – including in the interest of health. They have documented the state and development of the landscape in Switzerland and the perception of landscape change by the population (» FOEN 2010; 2013d). Areas of major importance in relation to health include, in particular, urban green and open spaces and recreational areas in the proximity of large settlements.

The interaction between the health of humans and animals is a further dimension that has been attracting greater attention since the emergence of SARS (severe acute respiratory syndrome) and bird flu. Almost two thirds of all infectious diseases that pose a threat to humans can be transmitted by animals. The risk of the transmission and proliferation of new diseases grows with the decrease in natural animal habitats, intensive livestock breeding and the increasing mobility of humans, animals and products (» FVO 2011).

#### Internet links

[www.bag.admin.ch/radiation](http://www.bag.admin.ch/radiation)

[www.bag.admin.ch/chemikalien](http://www.bag.admin.ch/chemikalien) (f, i, g)

[www.obsan.admin.ch](http://www.obsan.admin.ch)

[www.statistik.admin.ch](http://www.statistik.admin.ch) » Themen » Gesundheit (f, g)

[www.meteoschweiz.ch/gesundheit](http://www.meteoschweiz.ch/gesundheit) (f, i, g)

#### Data download

[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

## III. Switzerland in the international context

Switzerland is connected with the entire world in a variety of ways: ecological, economic, social and political systems interact constantly. The focus in the third part of this environmental report is the global perspective on various environmental problems. The report refers to so-called global megatrends which involve developments with world-wide consequences. Increasing urbanisation and economic growth are two examples of developments that have major impacts on the state of the environment.

In addition to economic, social and technological megatrends, three important ecological developments can be observed:

- progressive overuse of natural resources;
- increasing pollutant contamination of the environment;
- growing impacts of climate change.

These three developments and their consequences for Switzerland are discussed in this section of the report. The role of Switzerland in international environmental policy is also related to these urgent environmental problems.



# 19. Global megatrends and Switzerland's commitment

The pressure on important natural resources is rising throughout the world and, simultaneous to this, biodiversity is in decline. The improper management of chemicals and waste, and emissions of particulate matter and ground-level ozone cause extensive impacts on the environment and health. Climate change is also developing into a central challenge at global level.

## Progressive overuse of natural resources

The use of natural resources has increased steadily with the global economic growth and increasing prosperity of recent decades. This diminishes the capacity of ecosystems to provide services (e.g. clean air, drinking water, food, etc.). The rise in the global population by 2 billion people to an expected 9 billion by 2050 and the further increase in the standard of living pose enormous challenges in the context of conserving and renewing vital natural resources. If we do not succeed in doing this, serious consequences could arise, in particular for the poorest sectors of the population, and the development prospects for future generations will be diminished (» OECD 2012; UNEP 2012).

**Water** The global demand for water resources continues to increase (» G19.1) and the per-capita availability of freshwater is declining. Polluted water is the main cause of environment-related diseases and deaths. According to United Nations' estimates, by 2025, 1.8 billion people will live in countries or regions affected by water shortages.

The use of transboundary waters harbours potential for conflict between neighbouring countries and communities, and can trigger migratory movements. Climate change will have a particularly strong impact on the quality and availability of water and will further intensify the water crisis.

The quantitative decline and poor quality of surface waters and groundwater affects ecosystems and their services. The destruction of ecosystems like wetlands and forests poses a threat to the hydrological cycle.

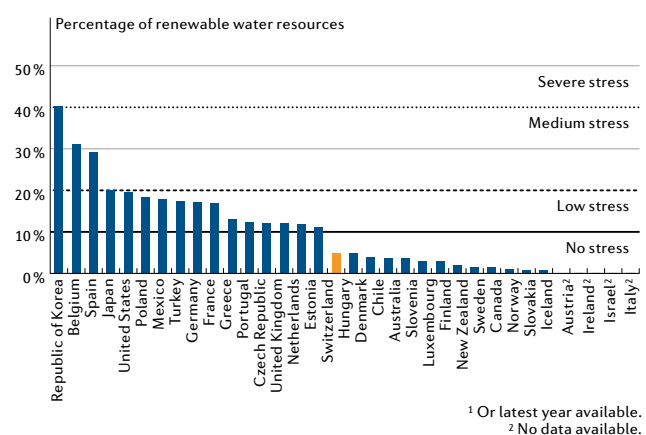
If the water required for the manufacture of imported products is taken into account, approximately 80 % of the water consumed in Switzerland comes from abroad. Hence, more sustainable water management beyond the country's borders is also in the interest of Switzerland. Therefore, it is committed to ensuring that water management does not come to a halt at national borders. Catchment areas should be considered holistically and the different sectors (energy, agriculture, fishing, etc.) must coordinate their activities. Other points of interest for Switzerland in the international

context include the adaptation of water management to water shortages and drought, the alleviation of increased flood risks as a result of climate change, the sustainable use of groundwater, and the suitable design and management of water from an ecological, landscape and recreational perspective.

Switzerland makes its extensive knowledge of water management available at international level. It advocates the establishment of a "water forum" under the umbrella of the UN, and has expressed its support for the extension of the European UNECE Water Convention to a global convention in 2013.

**Forests** Forest loss impairs biodiversity, increases the risk of natural disasters and contributes to climate change. Deforestation in tropical forests continues at a rapid rate and accounts for around 25 % of global CO<sub>2</sub> emissions. Due to the growth of forest area in moderate climate zones, the reduction in global forest area since the 1990s, from over 80,000 to approximately 50,000 km<sup>2</sup> annually, is slowing »

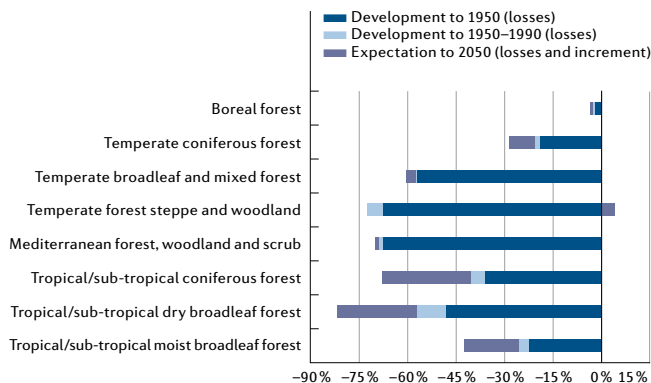
**G19.1 Water stress (OECD countries), 2009<sup>1</sup>**



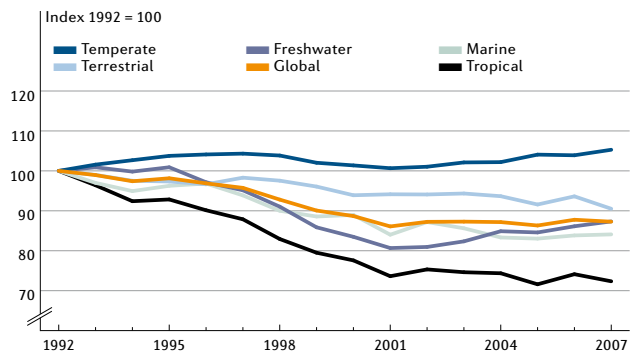
Source: OECD

**G19.2 Conversion of global forest ecosystems 1950–2050**

Fraction of area converted



Source: MEA 2005

**G19.3 Living Planet Index<sup>1</sup>**

<sup>1</sup> The Living Planet Index reflects changes in the health of the earth's ecosystems. It is based on monitoring almost 8,000 populations of over 2,500 vertebrate species.

Sources: WWF; ZSL

down (» G19.2). It is expected, however, that forest losses will continue to exceed expansion in the decades to come. The main reason for the overexploitation of forests is the inadequate state supervision of forest harvesting in many countries (» EUA 2010b).

Forests produce wide-ranging goods and provide services in the areas of water management (regulation and improvement of water quality), energy (firewood), agriculture (agroforestry), soil conservation, biodiversity and climate.

For various reasons, Switzerland has an interest in the clear international regulation of the management of forest as a resource. It is important for Switzerland to be able to import wood that is sustainably and legally produced. Access to local genetic forest resources is also important for Swiss pharmaceutical research.

Switzerland supports the establishment of a forest convention in the context of the United Nations. This would contribute to the conservation of global forest area, its sustainable management and would hence guarantee the economic, social and ecological services provided by forests.

**Biodiversity** Population growth and rising prosperity are putting more and more pressure on natural resources. Comprehensive changes in land use (e.g. deforestation to obtain agricultural land and settlement area) result in a loss of biological diversity. The majority of all surveyed animal and plant species are affected by decline – in terms of both their range and frequency. According to the International Union for Conservation of Nature (IUCN), around 20,000 of the surveyed species are threatened with extinction.

Ecosystems like tropical forests, oceans and inland waters, which provide habitats for many threatened species, are undergoing enormous changes (» G19.3). For example, as a result of unsuitable agricultural methods and a lack of water treatment, huge volumes of phosphorous reach the oceans. This can give rise to algal bloom and have a negative impact on species diversity. The huge masses of

plastic debris that float around in the world's seas (known as plastic islands) are also a cause for concern as little is known about their impacts on marine fauna.

Switzerland is concerned about the conservation of global biodiversity for numerous reasons. From an ecological perspective, biodiversity is central to the functioning of ecosystems and their capacity for adaptation. From an economic perspective, as an importing country, Switzerland is dependent on the services provided by biodiversity for agriculture, industry and research (» Chapter 12). Finally, it has an ethical obligation to participate in the global efforts to conserve biodiversity. The least developed countries, in particular, are often highly dependent on intact ecosystems.

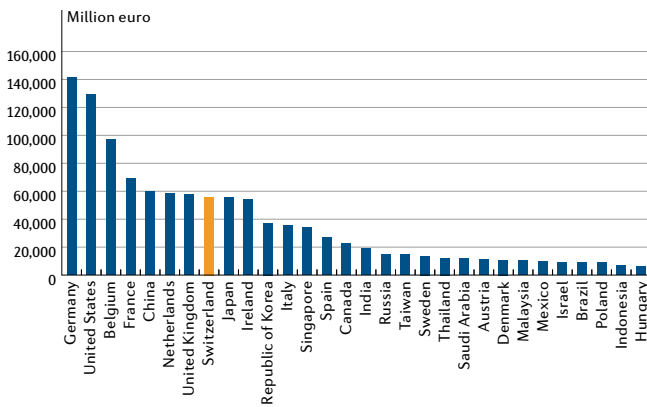
Switzerland supports the implementation of effective regulations for the protection and use of biodiversity. At national level, in 2012, it undertook to fulfil ten strategic goals defined in its Swiss Biodiversity Strategy (SBS). In addition, Switzerland is also a signatory of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization. The ratification of this protocol should facilitate the access to genetic resources and ensure that the benefits arising from their use are distributed in a balanced and fair way so that global biodiversity can be conserved. Switzerland supports the implementation of the strategic plan which was passed as part of the Convention on Biological Diversity<sup>1</sup> (CBD) in 2010 by providing financial support and expertise.

**Increasing contamination of the environment by pollutants**

The earth's natural regulating mechanisms are contaminated by an ever-increasing number of pollutants. Little is known at present about their effects on ecosystems and human health. The interactions between substances and

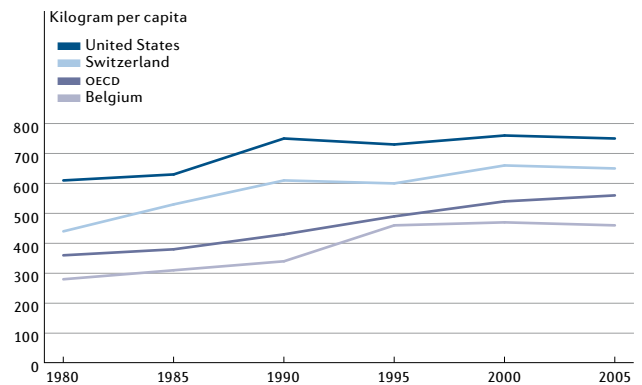
<sup>1</sup> Convention of 5 June 1992 on Biological Diversity (with Annexes), SR 0.451.43.

**G19.4 Sales of chemicals (30 most important countries), 2010**



Source: scienceindustries

**G19.5 Per capita municipal waste in industrialised countries**



Source: OECD

their accumulation in ecosystems and organisms, in particular, is still largely unresearched. Only a small proportion of these substances can be monitored in the long term.

**Chemicals and waste** Chemicals play a central role in human prosperity, however they also pose risks and dangers to the environment and human health. A large number of hazardous chemicals are conveyed throughout the world through the air, water, food chain, the trade in products and in the form of waste. At present, approximately 70,000 to 100,000 chemical substances are traded, almost 5,000 of them in volumes exceeding 1 million tonnes per year. The trade in chemicals is still dominated by the industrialised countries (» G19.4). The involvement of developing and newly-industrialised countries in their production is increasing rapidly, however, and their contribution should reach around 40% by 2030. Hence, the effective protection of humans and the environment and the fair distribution of the opportunities and risks require intensified international cooperation.

Switzerland is an important location for the chemicals industry and research. The safe use of chemicals throughout their entire life cycle and the protection against the harmful effects of chemicals and waste are, therefore, important concerns. For this reason Switzerland supports the extension of the international agreements and processes that exist in these areas (the Basel,<sup>2</sup> Rotterdam,<sup>3</sup> and Stockholm<sup>4</sup> Conventions, Montreal Protocol,<sup>5</sup> Strategic Approach to International Chemicals Management, SAICM) to other hazardous substances. In addition it advocates

<sup>2</sup> Basel Convention of 22 March 1989 on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (with annexes), SR 0.814.05.

<sup>3</sup> 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.

<sup>4</sup> Stockholm Convention on Persistent Organic Pollutants (POP Convention) (with annexes), SR 0.814.03.

<sup>5</sup> Montreal Protocol on Substances that Deplete the Ozone Layer of 16 September 1987 (with annexes), SR 0.814.021.

the establishment of complementary rules on heavy metals and the handling of nanomaterials.

Action is also required in the area of waste. The per capita volume of household waste generated in numerous industrialised countries remains at a high level (» G19.5). Switzerland would like to develop existing agreements in the direction of sustainable resource and materials management. A focus area for action here is partnership initiatives for the recycling of electronic and electrical waste. Switzerland is also committed to the formulation of rules that would prohibit the export of hazardous waste to countries that are unable to manage this waste safely.

**Air** Large volumes of waste gases and particulate matter are released through the combustion of wood and of motor and heating fuels. The pall of smog over cities and smoke plumes over rural areas can assume vast dimensions. This form of environmental pollution may be expected to increase particularly strongly in the developing countries undergoing rapid economic growth. Long-range transboundary air pollution can result in damage to human health and ecosystems in regions located at a considerable distance from the emission of the pollutants.

Thanks to technical advances and legislative measures, it should be possible to observe a downward trend in nitrogen oxide and carbon monoxide emissions. In contrast, an increase in ground-level ozone may be expected in various parts of the world – particularly in economically less developed areas. The consequences of increased ozone concentrations are also still observable in the industrialised countries. For example, it is estimated that ground-level ozone is reducing agricultural yields in Europe and North America by between 10% and 20%. It has been proven that periods with elevated ozone values cause a rise in respiratory and cardiovascular diseases and can result in greater mortality. Around 500,000 premature deaths per year are currently associated with particulate matter in Europe. If preventive measures are not taken, a further »

› considerable increase in premature deaths caused by particulate matter is expected up to 2050, particularly in developing and newly industrialised countries (» G19.6).

Switzerland is also affected by the health-damaging emissions produced by other countries. Hence, it has a considerable interest in the adoption of a pan-European coordinated approach to air pollution control. To enable the reduction of excessive air pollution from particulate matter and ozone, all European countries must commit to binding obligations. The same applies for the nitrogen compounds from agriculture (in particular ammonia) which promote the formation of particulate matter and impair ecosystems.

Switzerland advocates the inclusion of particulate matter and short-lived climate-active substances like soot in the 1999 Göteborg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.<sup>6</sup> Moreover, it supports the application of new emission limits for sulphur compounds, nitrogen oxides, ammonia, volatile organic compounds (VOC) and particulate matter in the signatory states for 2020.

### Intensifying impacts of climate change

Despite binding agreements (Climate Convention<sup>7</sup>, Kyoto Protocol<sup>8</sup>), the international community of states has not yet succeeded in stemming the global rise in greenhouse gas emissions. Emissions are expected to rise in the economically emerging, newly industrialised countries, in particular (China, India, Brazil, etc.), if effective climate policy measures are not implemented (» G19.7). Under these conditions the global mean temperature will quickly reach and exceed the critical threshold of +2 °C as com-

pared with the preindustrial level (» G19.8). In the long term this would involve far-reaching consequences for the food and water supply, human health, and terrestrial and aquatic ecosystems.

The initial impacts of climate change can already be observed throughout the world today: the melting of glaciers is accelerating, the availability of water declining, sea levels are rising, species habitats are shifting, and the habitat quality of sensitive ecosystems is deteriorating. While arable farming yields should rise in the medium term (to 2030), a decline in production is expected in the long term. With progressive climate change, more frequent and intensive heat waves, storms, floods and periods of drought must also be expected.

Switzerland may be particularly severely affected by climate change: according to the latest climate change scenarios, if the global temperature increases by 2 °C, this could mean a 3 to 4 °C rise for Switzerland (» CH2011 2011). An even higher increase in the global temperature would mean even greater warming for this country (up to +6 °C). Correspondingly, greater impacts could also be expected as compared with other countries (» Chapters 8 and 14).

The changes triggered by climate change affect numerous sectors of the economy: tourism, agriculture and forestry, water management (electricity production), etc. They increase the probability of damage from extreme hazard events and introduce new health risks. Impacts abroad could also have perceptible consequences for Switzerland due to its strong international integration. In this context Switzerland has the possibility of making its technical expertise, innovativeness and experience available in dealing with natural hazards at international level.

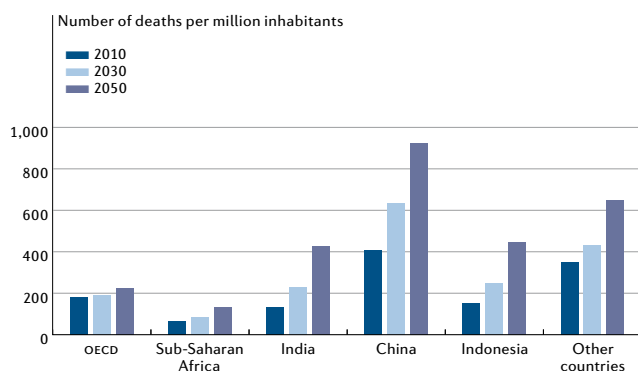
According to the International Energy Agency (IEA) the measures taken up to 2020 will prove crucial in determining whether it will be possible to limit the rise in global average temperatures to 2 °C (» IEA 2010). Switzerland advocates legally binding and ambitious emissions reduction targets, particularly for industrialised states and for all

<sup>6</sup> Protocol of 30 November 1999 to the 1979 Convention on Long-Range Transboundary Air Pollution To Abate Acidification, Eutrophication and Ground-Level Ozone (Göteborg Protocol), SR 0.814.327.

<sup>7</sup> United Nations Framework Convention on Climate Change of 9 May 1992 (with annexes), SR 0.814.01.

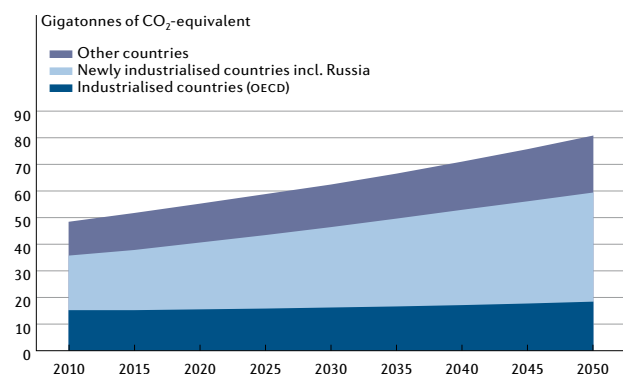
<sup>8</sup> Kyoto Protocol to the United Nations Framework Convention on Climate Change of 11 December 1997 (with annexes), SR 0.814.011.

#### G19.6 Premature deaths from exposure to particulate matter, 2010–2050 (OECD baseline)



Source: OECD

#### G19.7 Greenhouse gas emissions by region, 2010–2050 (OECD baseline)



Source: OECD

## The 2012 Rio conference and the international environmental system

Rio+20, the follow-up conference to the 1992 United Nations Conference on Environment and Development which was held in Rio de Janeiro, took place in June 2012, 20 years after the initial event. Its main objective was to renew the international political commitment to sustainable development.

Despite sporadic progress, many environmental problems have become more pressing in recent years and decades. The contradictions and unexploited synergies between the numerous environmental conventions and organisations were an important factor behind the failure of the international community to react more decisively to this situation. Switzerland is actively involved in the debate surrounding the reform of

the international institutions and agreements concerned with environmental protection.

It was decided in Rio to open up the Governing Council of the United Nations Environment Programme (UNEP) to all Member States of the United Nations, a measure that will result in the strengthening of this body. It was also decided that the UNEP would formulate environmental strategies for the UN system in future, a measure that will enable better coordination of the different priorities and activities of the actors involved. In contrast, it was not possible to upgrade the role of the UNEP in relation to the numerous environmental conventions. The Rio+20 concluding document encourages the countries to implement

the "green economy" as a part of their sustainability policies. In addition, a 10-year Programme on Sustainable Consumption and Production was passed. Switzerland played an important role in the development of this programme. A process was also initiated in Rio for the development of sustainable development goals. Such goals are important for demonstrating the action required to each country, and for making sustainable development quantifiable and comparable.

other countries that make a major contribution to the global emissions of greenhouse gases. However, it should be taken into account that a large proportion of the emissions generated by newly industrialised and developing countries arise in the manufacture of products that are exported to and consumed by industrialised countries. Accordingly, these countries' greenhouse gas emissions are caused not only by the increase in the domestic standard of living but also by the growing volume of international trade. The volume of emissions associated with exports to industrialised countries has more than quadrupled since 1990 (» UNEP 2012; G19.9).

Switzerland is committed to the application of the polluter-pays principle in the provision of funding for climate

change avoidance and adaptation measures in developing countries.

### Internet links

[www.eea.europa.eu](http://www.eea.europa.eu)

[epp.eurostat.ec.europa.eu](http://epp.eurostat.ec.europa.eu)

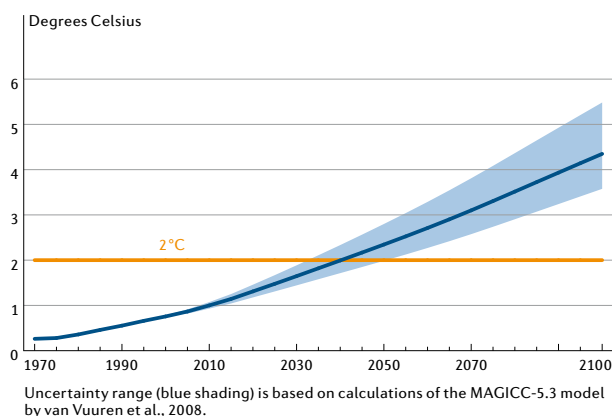
[www.unep.org](http://www.unep.org)

[www.oecd.org](http://www.oecd.org)

### Data download

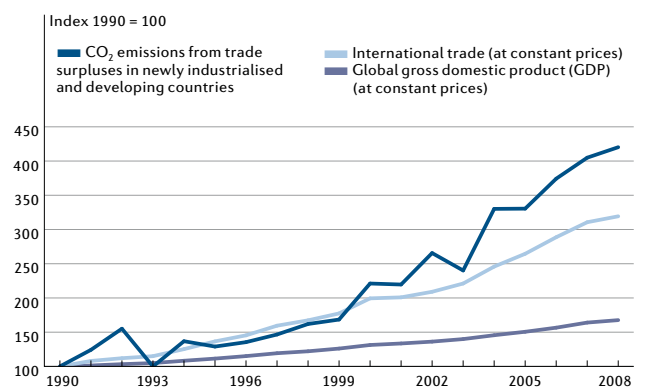
[www.bafu.admin.ch/environmental-report-2013](http://www.bafu.admin.ch/environmental-report-2013)

**G19.8 Global temperature increase, 1970–2100 (OECD baseline)**



Source: OECD

**G19.9 Displacement of CO<sub>2</sub> emissions in newly industrialised and developing countries**



Source: Peters et al. 2011





# IV. Annexes

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# Acronyms

ARE	Federal Office for Spatial Development (since 2000)	FOSP	Federal Office for Spatial Planning (ARE since 2000)
ART	Agroscope Reckenholz-Tänikon Research Station	FOT	Federal Office of Transport
ASC	Swiss Association of Communes	FSO	Federal Statistical Office
BDM	Swiss Biodiversity Monitoring Programme	FVO	Federal Veterinary Office
CCG	Conference of Cantonal Governments	GEAK	Cantonal building energy certificate
CRF	Foundation for the management of the Cost-covering Remuneration for Feed-in to the electricity grid	GEF	Global Environment Facility
DETEC	Department of the Environment, Transport, Energy and Communications	IEA	International Energy Agency
DPPE	Conference of Directors of Public Works, Spatial Planning and Environmental Protection	ILNM	Federal Inventory of Landscapes and Natural Monuments of National Importance
EEA	European Environment Agency	IUCN	International Union for Conservation of Nature and Natural Resources
EITI	Extractive Industry Transparency Initiative	LABES	Swiss Landscape Monitoring Network
ENSI	Swiss Federal Nuclear Safety Inspectorate	MEA	Millennium Ecosystem Assessment
ERKAS	Risk register established in accordance with the Major Accidents Ordinance	METEOSWISS	Federal Office of Meteorology and Climatology
EU	European Union	NABEL	National Air Pollution Monitoring Network
FAO	Food and Agriculture Organization of the United Nations	NABO	Swiss Soil Monitoring Network
FDEA	Federal Department of Economic Affairs	NADUF	National River Monitoring and Survey Programme
FDHA	Federal Department of Home Affairs	NAQUA	National Groundwater Monitoring Network
FEDRO	Federal Roads Office	NFI	Swiss National Forest Inventory
FFA	Federal Finance Administration	NRP	National Research Programmes
FIBL	Research Institute of Organic Agriculture	OECD	Organisation for Economic Co-operation and Development
FOAG	Federal Office for Agriculture	OFCOM	Federal Office of Communications
FOEN	Federal Office for the Environment (since 2006)	OPET	Federal Office for Professional Education and Technology
		SAEFL	Swiss Agency for the Environment, Forests and Landscape (FOEN since 2006)

SBB	Swiss Federal Railways
SBV	Swiss Farmers Union
SED	Swiss Seismological Service
SFOE	Swiss Federal Office of Energy
SLF	Institute for Snow and Avalanche Research
SNB	Swiss National Bank
SVC	Swiss Union of Cities
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHO	World Health Organisation
WSL	Swiss Federal Institute for Forest, Snow and Landscape Research
WTO	World Trade Organization
WWF	World Wide Fund for Nature
ZSL	Zoological Society of London

# Glossary

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

**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 ecological structures. Biodiversity encompasses 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** All of the earth's ecosystems, including organisms and their habitats. The biosphere includes all parts of the atmosphere, hydrosphere and lithosphere, in which organisms live.

**Building Programme** The Building Programme of the Confederation and Cantons promotes energy-saving renovation measures for buildings and investment in renewable energies, waste heat recovery and the optimisation of building services technology. The Building Programme makes a significant contribution to the fulfilment of Switzerland's climate objectives.

**Carbon sink** Through photosynthesis, trees remove CO<sub>2</sub> from the air, convert it and store it for extended periods in wood. The sink effect – the balance of carbon stored and released by biomass – is influenced by agricultural and forest management activities and can contribute to the off-setting of CO<sub>2</sub> emissions.

**CO<sub>2</sub>-equivalent** Unit describing the amount of global warming that may be caused by a given type and volume of greenhouse gas using the functionally equivalent amount or concentration of carbon dioxide (CO<sub>2</sub>) as a reference. To ensure better comparability, greenhouse gas emissions other than CO<sub>2</sub> (CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs and SF<sub>6</sub>) are converted into CO<sub>2</sub>-equivalents according to their global warming potential (GWP). One kilogram of CH<sub>4</sub> corresponds to 21 kg CO<sub>2</sub> and one kilogram of N<sub>2</sub>O is equivalent to 310 kg CO<sub>2</sub>.

**CO<sub>2</sub> sink** see Carbon sink

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

**Constant prices** Prices reflecting real values, i. e. adjusted for inflation through the application of a reference value. Synonyms: inflation-adjusted, real prices.

**Contaminated site** Polluted site created by a facility, accident or landfill that has been proven to cause harmful or noxious impacts on the environment, or one that risks causing such impacts in the future.

**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 economic growth exceeds the 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 decline and the economy grows nonetheless, decoupling is absolute. In this case, in the context of the specific field of material consumption, reference is also made to the dematerialisation of the economy.

**Ecodesign** Design approach based on the principles of sustainability. The aim is to achieve the maximum possible benefit for all actors involved (along the value-added chain) with minimum environmental pollution and socially fair conditions through the intelligent use of the available resources.

**Ecological footprint** The ecological footprint is the area on earth required to accommodate the lifestyle and living standard of a human being (with the continuation of today's production conditions) on a permanent basis. It includes the areas required for the production of clothing and food and for the provision of energy, e.g. including the disposal or recycling of the waste generated by an individual or for the binding of the carbon dioxide released through his or her activities.



**Economic sector** One of the three main subdivisions of the economy:

- Primary sector: agriculture, forestry and fishing
- Secondary sector: industry and construction
- Tertiary sector: services

**Eco-points** The “ecological scarcity method” expresses environmental pollution using the eco-point as a unit. This method for evaluating the environmental impact of products in life cycle assessments aggregates the individual impacts (e.g. climate change, air and water pollution and soil pollution) in a single parameter. It is based on legally defined targets for pollutant emissions and resource consumption, and measures the gaps between current emission values and these target values. The further the current status is from the target, the greater the number of points assigned to an emission.

**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.

**Ecosystem services** The term ecosystem service refers to the economic consideration of the benefits provided to humans by ecosystems. Examples of ecosystem services include the pollination of fruit blossoms, the provision of freshwater and drinking water through the natural filtration of precipitation, the reproduction of fish populations as a source of food, and the provision of fresh air and an attractive environment for leisure and recreation.

**Emission** The release of pollutants, noise, radiation and similar phenomena from natural or anthropogenic (man-made) sources, e.g. plants and installations.

**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 following 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 species** see Alien species

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

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

**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 so-called value added. GDP is calculated using either current prices or constant (i.e. real) prices for a given year. With constant prices, 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, micro-organism) whose genetic material has been modified in a way that does not occur in nature through crossbreeding or natural recombination.

**Green economy** A green economy is understood as an economy that takes the scarcity of finite resources and regenerative capacity of renewable resources into account, improves resource efficiency and increases the long-term competitiveness of the economy as a result.

**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 part of the heat radiation emanating from earth back again. An increase in the concentration of such greenhouse gases causes the earth's surface to heat up.

**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<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>). 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.

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

**Heating fuel** see Combustible

**Hydropeaking (surge and low flow)** Periodic change in the water regime of a water body or watercourse. Surge refers to the artificially increased discharge in a watercourse during the operation of hydroelectric turbines to satisfy peak demand. Surges are punctuated by phases of low flow during periods of low electricity demand, i.e. usually at night and weekends.

**Impact threshold** see limit value

**Invasive species** see Alien species

**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 Swiss society's footprint on the landscape. To date, two nationwide surveys have been published: the first (1979/85) was 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. Interim findings are published periodically on the FSO website ([www.statistik.admin.ch](http://www.statistik.admin.ch) » Themen » Raum, Umwelt » Bodennutzung, -bedeckung [f, g]).

**Life cycle process** The life cycle process of a product includes all stages in the "cradle to grave" cycle, i.e. from the harnessing of primary and secondary raw materials, to production, use and final disposal (waste disposal: waste treatment or recycling).

**Limit value** Threshold value applied when assessing exposure to harmful or noxious impacts of air pollution, noise, vibrations and radiation. It takes into account the impact of such exposure on particularly vulnerable groups, such as children, sick people, the elderly and pregnant women.

**Material cycle** In ecology, a material cycle refers to the periodic conversion of chemical compounds, in the process of which the original substance arises again following a series of chemical reactions. The term "material" refers here to a substance, a chemical element or a chemical compound, e.g. iron, dioxins.

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

**NMVOs (non-methane volatile organic compounds)**

A group of compounds including numerous organic substances used as solvents in paints, varnishes and adhesives, in cleaning agents and propellants in spray cans. NMVOs are precursors to the formation of ozone, summer smog and PM10.

**Noise exposure limits** The Noise Abatement Ordinance differentiates between three types of noise exposure limits:

- The impact threshold which constitutes the limit value, above which noise is regarded as harmful and a nuisance.
- The planning threshold is 5 dB (A) lower than the impact threshold and applies to new facilities; it is intended to prevent noise levels rising to the point at which they become a nuisance.
- The alert threshold is between 5 and 15 dB (A) higher than the impact threshold; remedial action is considered to be a matter of urgency if the alert threshold is exceeded.

**Particulate matter** see PM10

**Permafrost** Permanently frozen subsoil found in locations where the climate is comparatively cold, i.e. in high latitudes (polar regions) and at high altitudes.

**PIC (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.

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

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

**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. They 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 also cause hormonal imbalances and reproductive dysfunctions.

**Ratification** Confirmation of the signature at the bottom of a document, in which an agreement is concluded with another state. The deposition of the instrument of ratification generally constitutes the definitive validation of an international treaty.

**Recyclables** Materials that can be re-used following their initial use, transformed into other products or broken down into raw materials. In this way they are returned to the material cycle.

**Red Lists** Lists of endangered plant and animal species, the conservation of which requires urgent action. Red Lists are compiled for animals, ferns and flowering plants, mosses, lichens and fungi. The species are classed in different categories depending upon their degree of endangerment.

**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.

**Resource efficiency** Resource efficiency involves obtaining the maximum possible output (prosperity) through the minimum possible input of resources (including soil, energy, material, factors that could harm the environment, etc.).

**Smog** Term derived from the contraction of “smoke” and “fog” and referring to a mixture of air-polluting, gaseous, liquid and solid components that usually forms over urban areas under weather conditions characterised by restricted air exchange. When there is smog, sunlight appears diffuse and appears to shine through a cloud of fog.

**Species diversity** see Biological diversity

**Stratosphere** Layer of the earth’s atmosphere at an altitude of between around 15 and 50 km, the central area of which is characterised by an elevated concentration of ozone (ozone layer).

**Surge** see Hydropeaking (surge and low flow)

**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 the earth’s surface.

**VOC** see NMVOCs

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